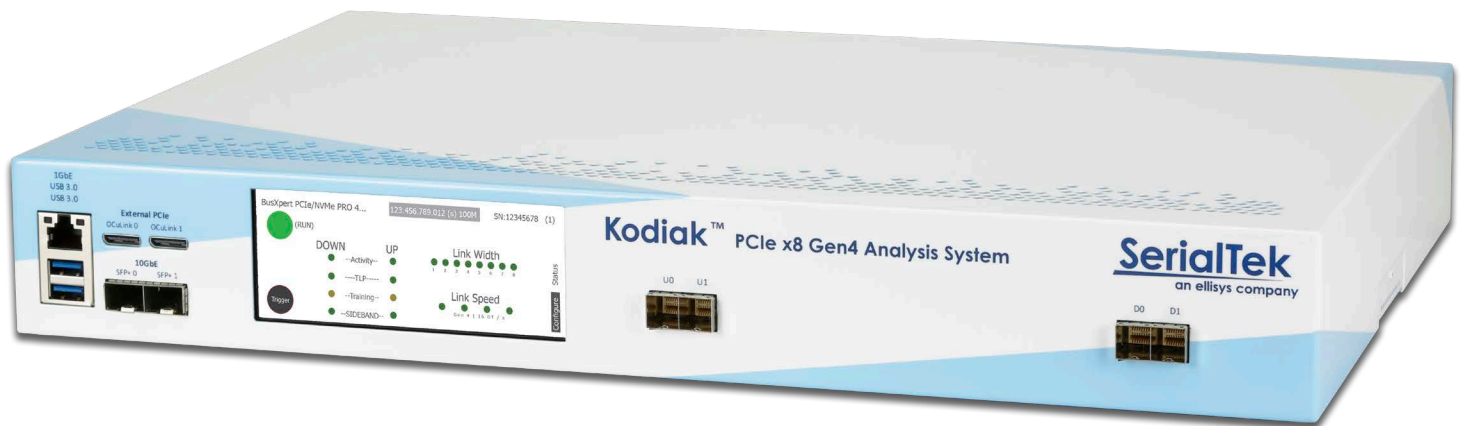


SerialTek

an ellisys company



Kodiak™

Next-Generation Gen4 PCIe®/NVMe™ Analyzer

Innovative ■ Cutting-Edge ■ Integrated

Sales Contact:



720.204.2140



sales@serialtek.com



www.serialtek.com/kodiak

PCIe/NVMe Analysis Platform with Embedded Hardware, Real-Time Protocol Processor™, Calibration-Free SI-Fi™ Probing and Automatic Equalization, Internal SSD Storage, Touchscreen LCD, and Standard PCIe Cabling.

State-of-the-Art Architecture

The Kodiak PCIe Gen4 Analysis System represents the state-of-the-art in protocol analyzer design. The Kodiak platform includes an array of high-performance innovations, made possible by an advanced design that breaks free from cumbersome legacy data upload practices in favor of ultra-responsive embedded data processing.

Interface responsiveness is markedly advanced, searches involving massive amounts of data are fast, and hardware filtering is flexible and powerful.

The Kodiak platform, with its field-proven BusXpert (TM) software application, is built to tackle the challenges presented by the complexities of rapidly advancing storage and datacenter I/O technologies.

Real-Time Protocol Processor

Kodiak employs an innovative system register processing concept called Real-Time Protocol Processor (RTPP™). This proprietary feature dynamically and automatically queries and saves PCI configuration space, host controller registers, and NVMe queues, whether the analyzer is actively recording or idle. This alleviates the need for time-consuming and highly impractical reboots, and provides the ability to precisely decode, trigger, and filter using current values.

Multiple Form Factor Support

SI-Fi™ interposer form factors include AIC (x4), M.2 (x4), U.2 (x4), and U.3 (x4). Additionally, U.2, U.3, single-port (1x4), and dual-port (2x2) analysis can be combined into one interposer unit, providing significant cost savings in enterprise environments where all form factors are required. SI-Fi™ interposers also support all relevant sidebands, including SMBus (e.g., NVMe-MI) from the host or from external / third-party injection or generation tools.

Flexible Trace Storage and Retrieval

Kodiak includes two 10GbE SFP+ ports and a GbE port to offload traces to a host computer or network and internal SSD trace storage of up to 2TB (with read-only access for other users). Direct attach storage choices include two USB 3.1 ports and two PCIe 3.0 OCuLink ports.

Transparency in Probe Design is Key

Driven by the need for ever-faster data transfers, PCI Express signaling has become exceptionally complex in design and difficult to monitor unobtrusively. Signal conditioning methods used for PCIe Gen1 and Gen2 now seem primitive compared to the complex approaches used for PCIe Gen3 and Gen4. Further challenges are presented by NVMe, which adds critical requirements like hot-plug and NVM Subsystem Reset (NSSR), where the PCIe signals are renegotiated. SerialTek's proprietary SI-Fi™ technology directly meets and overcomes these challenges with the features and capabilities needed to work efficiently.

With SerialTek's SI-Fi™ interposer technology, the transmitter threshold and pre-emphasis from one link partner reaches the receiver of the other link partner, so the link properly trains to optimum conditions, making the interposer as transparent as possible.

At the core of this technology is a highly specialized linear amplifier design where PCIe analog signals are received at a differential input and distributed to two separate phase-matched differential outputs with a nominal, idealized gain of 0dB. This approach results in easier set up of the analyzer and product under test and avoids a variety of limitations inherent to other probing approaches where link training sequences don't pass through the interposer.

SerialTek's SI-Fi™ interposer technology expands and enables coverage in critical test areas, including link training (LTSSM), Power Management, Hot Plug, Reset, and other situations where the physical link/lane characteristics may change.

No Need for Calibration

Competing PCIe Gen4 analyzers and interposers require tuning, or calibration, which leads to reliability issues as modern PCIe link training sequences can occur dynamically, not just at boot-up.

With SI-Fi™ technology and Kodiak's adaptive EQ capabilities, users can save hours in setup time. And if the link characteristics change (e.g., Hot Plug or NSSR), Kodiak can follow those changes dynamically, ultimately saving your test.

Powerful SerialTek Features

- No tuning (calibration) required
 - Kodiak's Rx automatically equalizes (EQs) the PCIe signals at all data rates
- Embedded trace processing architecture and fastest performance
- Real-Time Protocol Processor
 - Automatically captures PCI Config Space, Controller Registers, and NVMe Queues
 - No boot trace needed
 - Native NVMe triggers by device (BDF), Queues, and Packet/Event
 - Native NVMe filters by device (BDF), Controller Registers, Queues, and Packet/Event
- Deep Trace Buffers
 - 36GB, 72GB, 144GB
- Internal Trace Storage (SSD)
 - 512GB, 1TB, 2TB
 - Read-only access for non-primary users
- Direct Attach Storage
 - Two OCuLink (PCIe 3.0) ports
 - Two USB 3.1 ports
- Network and Direct Connectivity
 - Two 10GbE SFP+ (optical/copper)
 - One 1GbE RJ-45
- Single-port (1x4) and dual-port (2x2) analysis in one platform
- Real-time access to traces in memory (prior to downloading)
 - Users can review and analyze captured traces without downloading the trace
- Touchscreen LCD for analyzer setup and status

Interposers with SI-Fi™ Technology

- No tuning (calibration) required
 - Host and Device signals pass through the interposer, allowing for real-world PCIe link training and easier setup
- SI-Fi™ interposer probes expand coverage to enable testing in critical areas, including link training (LTSSM), Power Management, Hot Plug, Reset, and other situations where the physical link/lane characteristics may change
- AIC (x4), M.2 (x4), U.2 (x4), and U.3 (x4)
 - U.2, U.3, single-port (1x4), and dual-port (2x2) in one interposer
- Access to all sidebands, including SMBus

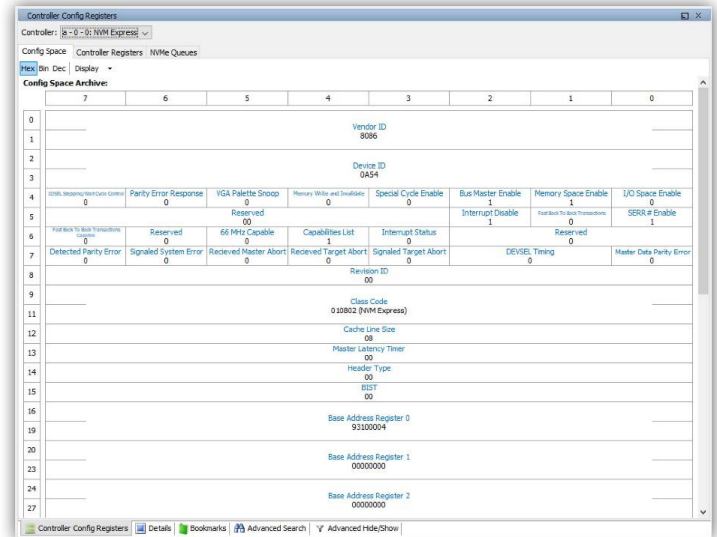
Real-Time Protocol Processor™

Automatically identifies & updates:

- PCIe configuration space
- Controller data structures (queue attributes, etc.)
- NVMe queue creation and deletion

Uses

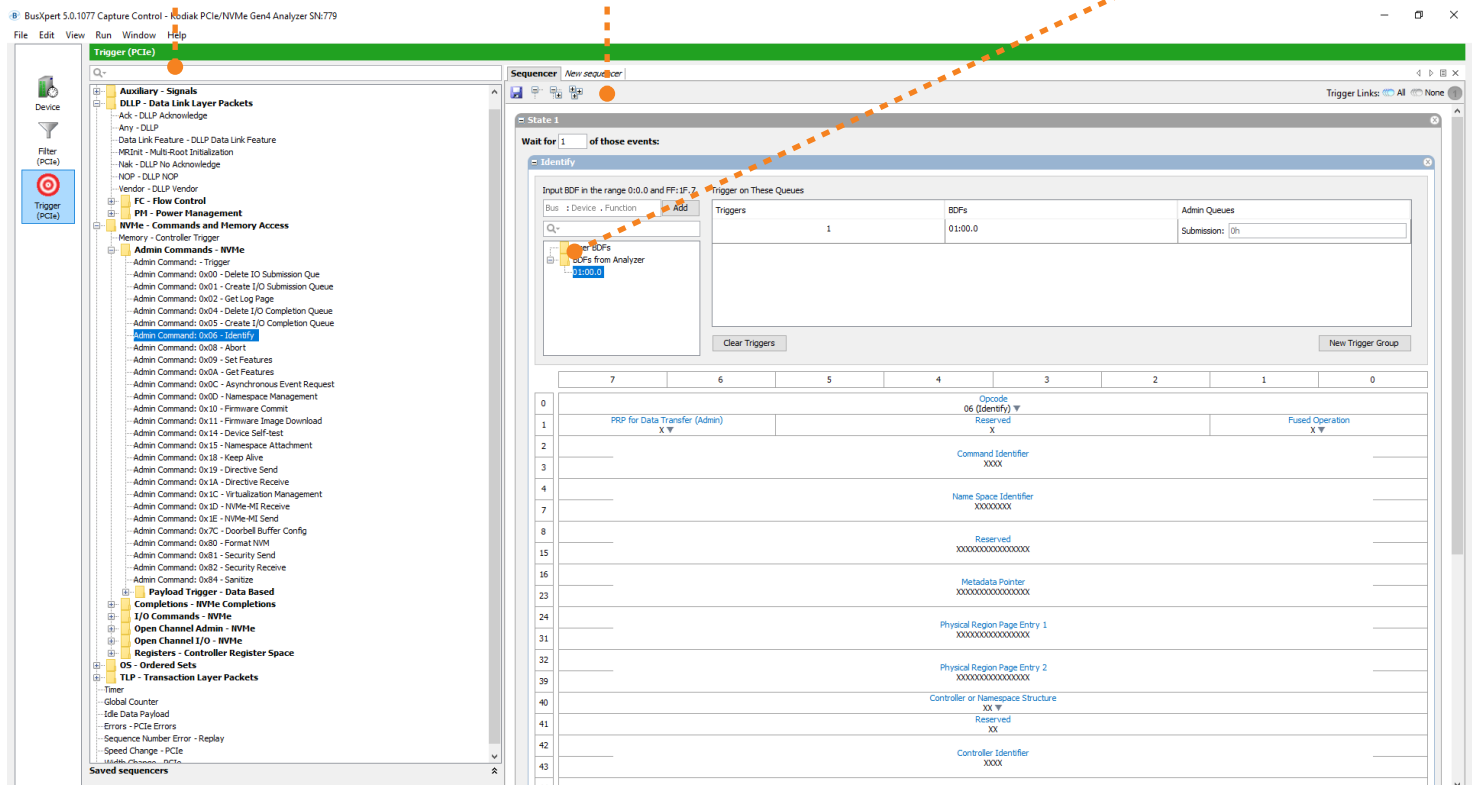
- Capture and decode PCIe and NVMe protocols without a boot trace
- Easy analyzer set up
- Correctly decode trace if any of the above attributes change
- Native NVMe triggering: by event (packet), device (BDF), and queue - eliminates false triggers
- Native NVMe Filtering: by device (BDF), controller registers, and queue



Create triggers easily with searchable drag/drop interface

Simple and advanced multi-state and multi-sequencer triggering

Real-time view of all available devices (BDFs) and NVMe queues



Protocol Views

Low-level and stack protocol elements are hierarchically and chronologically displayed in easily configurable views.

User-Configurable Views & Layouts

Easily modify protocol views by adding or removing columns or arranging the windows by dragging and dropping to desired area.

Fast & Advanced Search

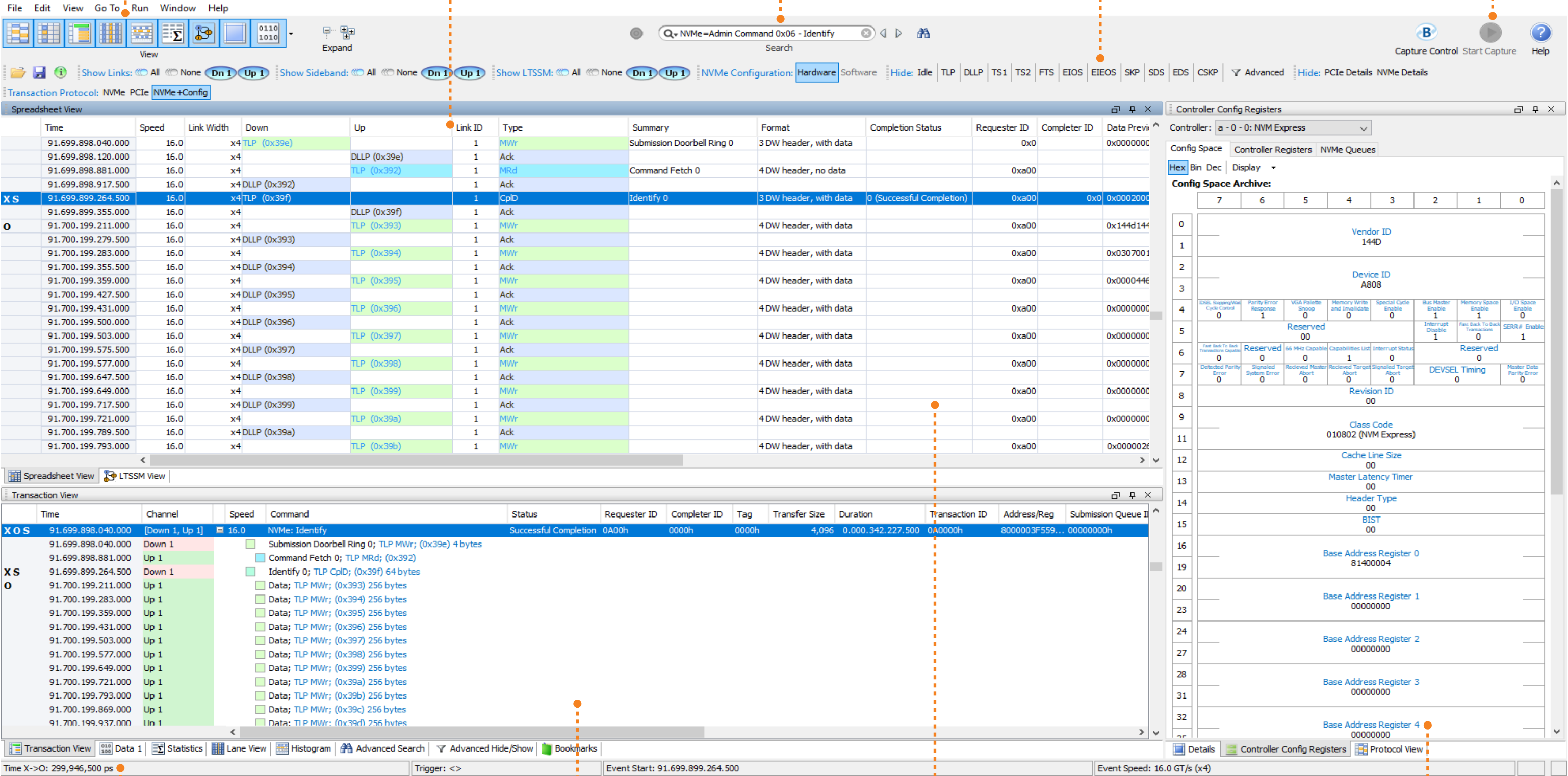
Quickly find events using a contextual search field. Includes multi-state search, multi-trace search, and copy/paste from the trace views.

Fast & Advanced Hide/Show

Quickly show/hide links, sidebands, LTSSM, and protocol events. Includes multi-state filtering and copy/paste from the trace views.

Setup and One-Click Record

Quick access allows for creating or modifying the capture settings, or starting a new capture with a single click.



Precision Timestamping

Every event is given a precise timestamp and synchronized across all views. Measuring is easily set via right-clicking the mouse.

Transaction View

All events are precisely timestamped and synchronized across all views. Easily measure between two points (X-O).

Spreadsheet View

Time-ordered, color-coded display of PCIe and NVMe protocol traffic, data, status, and precision timing measurements.

Real-Time Register Processor

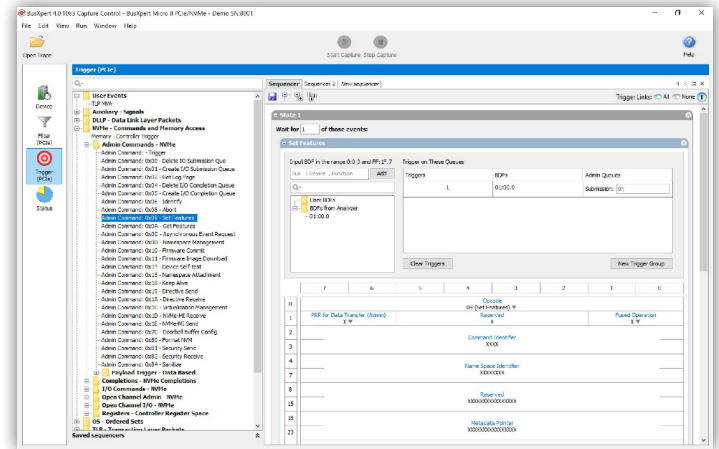
Automatically queries/saves PCI configuration space, controller registers, and NVMe queues, whether recording or idle.

BusXpert Software

Easy Configuration

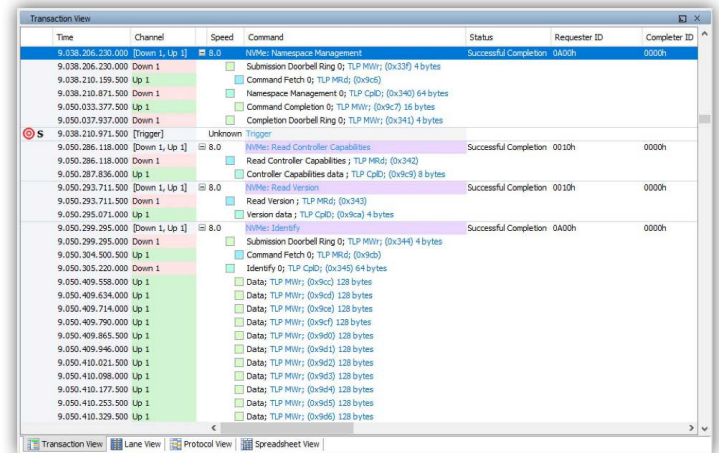
SerialTek's Java-based BusXpert software supports Microsoft and Linux OS's, is easy to configure, and has the most powerful trigger and filter capabilities in the market. Link speed, link width, lane polarity, and lane inversion are automatically detected or user configurable, and link speed and width changes are also triggerable. Simple (single-state) & advanced* (multi-state) trigger options are available. Triggering by event, device (BDF), NVMe queue(s), counters, and timers is standard.

*configuration-dependent



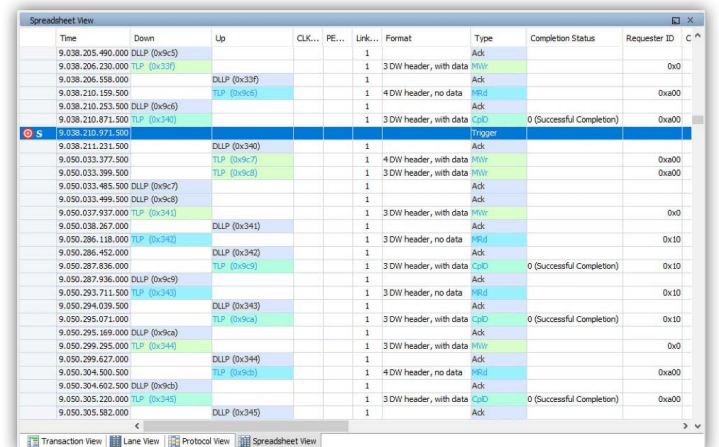
Transaction View

Transaction View is a hierarchical display ideal for viewing the combination of Request packets that deliver PCIe and NVMe commands and the associated completion packets returned from targets at the transaction level. Transaction view sorts transactions based on when the request/command was sent, and then all related packets are sorted by timestamp and displayed clearly with different colors, including red when errors are detected. Since PCIe and NVMe support multiple lanes, links, and open transactions, this view is ideal to easily analyze commands, completion status, setup, handshaking, and the data transferred each transaction. Columns contain data fields from the packets relevant to the transaction and are selectable by the user.



Spreadsheet View

Spreadsheet View is a chronological display of all PCIe and NVMe events sorted by timestamp, including ordered sets, DLLPs, TLPs, NVMe commands, link status, sideband signals/protocols (e.g., SMBus, MCTP, NVMe-MI), and more. Spreadsheet view displays data in rows and columns, where the row represents a packet and the columns represent values for the data fields and other relevant information such as speed or link width.



Lane View

Lane View is commonly used for debugging lane configuration, lane inversion, reversal, and swizzling. When greater than x1, PCIe uses lane striping, where one byte of a DLLP or TLP are sent down each lane and every lane is used. Lane View is a low-level display of every byte for every packet and their striping. During link negotiation, it is easy to follow ordered sets (e.g., TS1, TS2) and find link training issues.

Time	Dn 1 Sym	Dn 1 Lane 0	Dn 1 Lane 1	Up 1 Sym	Up 1 Lane 0	Up 1 Lane 1
9.038.210.905.500	2	Data	Data			
9.038.210.906.500	3	Data	Data			
9.038.210.907.500	4	Data	Data			
9.038.210.908.500	5	Data	Data			
9.038.210.909.500	6	Data	Data			
9.038.210.910.500	7	Data	Data			
9.038.210.911.500	8	CRC	CRC			
9.038.210.912.500	9	CRC	CRC			
9.038.211.231.500				SYNC	0	0
9.038.211.231.500				0	SDP Token	SDP Token
9.038.211.232.500				1	ACK	ACK
9.038.211.233.500				2	ACK_Nak_Seq_Num[3...]	ACK_Nak_Seq_Num[7...]
9.038.211.234.500				3	16-Bit CRC[15:0]	16-Bit CRC[7:0]
9.050.033.377.500				8	TLP Length[15:0] A, ST...	TLP Length[15:0] B
9.050.033.378.500				9	Frame CRC[3:0] Sequen...	Sequence Number[7:0]
9.050.033.379.500				10	4 DW Header, with da...	Best Effort Default LN...
9.050.033.380.500				11	Default Default Defaul...	Length[7:0]

Protocol View

Protocol View is a chronologically aggregated view of packets transmitted on the upstream and downstream lanes, across all layers. This view can be synchronized with other views, such as the Details View, and is ideal for debugging a broad range of issues from protocol events to low-level errors. Data is viewable in K/D format, scrambled, or unscrambled. Timing measurements, fast searches, and bookmarking are available.

Time	Down 1	Up 1
9.050.033.395.500		CRC
9.050.033.395.500		CRC
9.050.033.396.500		CRC
9.050.033.396.500		CRC
9.050.033.396.500		CRC
9.050.033.399.500		TLP Ww
9.050.033.399.500		TLP Ww (0x341) 4 bytes
9.050.033.405.500		
9.050.033.405.500	DLLP Ack	
9.050.033.405.500	DLLP Ack (0x341)	
9.050.033.409.500	DLLP Ack	
9.050.033.409.500	DLLP Ack (0x341)	
9.050.037.937.000	TLP Ww	
9.050.037.937.000	TLP Ww (0x341) 4 bytes	
9.050.038.267.000		DLLP Ack
9.050.038.267.000		DLLP Ack (0x341)
9.050.286.118.000		TLP Ww
9.050.286.118.000		TLP Ww (0x342)
9.050.286.452.000		DLLP Ack
9.050.286.452.000		DLLP Ack (0x342)
9.050.287.836.000		TLP Cpb

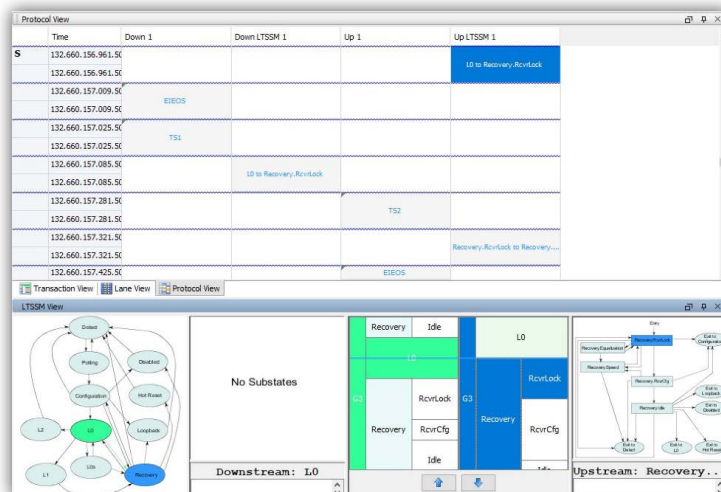
Details View

Details View displays decoded fields for the packet or transaction selected in either Spreadsheet, Transaction, Lane, or Protocol Views. PCIe, NVMe, NVMe-MI, SMBus, and other decodes are formatted and displayed per their respective specifications. NVMe events are displayed either with the TLP or independently via a one-click hide option in the BusXpert software ribbon. Data can be displayed in various formats and widths.

Field	Value	Field	Value
Reserved	0	Reserved	0
TD	0 (Default)	EP	0 (Default)
Att[1:0]	0 (Default)	Att[0]	0 (Default)
Length	010	Completion ID	0000
Completion Status	0 (Successful Completion)	Byte Count Modified	0
Byte Count	0	Requester ID	0A00
Tag	00	Lower Address	00
Opcode	00 (Namespace Management)	Reserved	0
Fused Operation	0 (Normal operation)	Command Identifier	

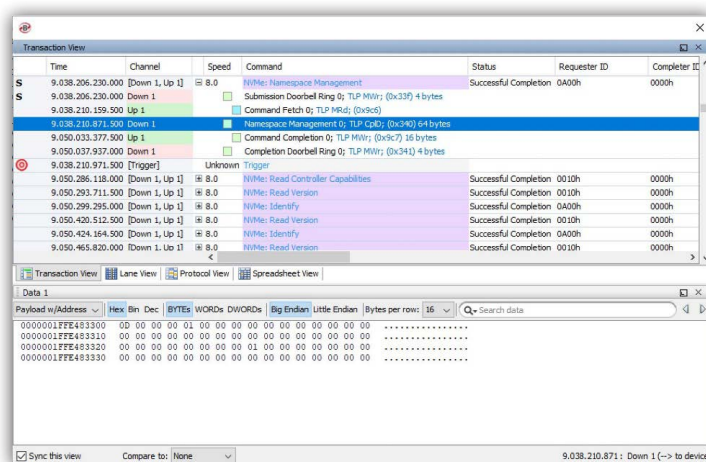
LTSSM View

LTSSM View is an interactive state diagram comprised of the top-level LTSSM states: detect, polling, configuration, L0, L0s, L1, L2, recovery, loopback, hot reset, and disabled. The upstream and downstream sub-states are color-coded and also displayed side-by-side for the current top-level state in the diagram or area selected in one of the trace views. The LTSSM details below each sub-state also describe the state, sub-state, or transition that is currently selected, including state.substate entry time (start time)/exit time (end time), duration (end time minus start time), and description of the current state.substate from the PCIe specification.



Data Viewer

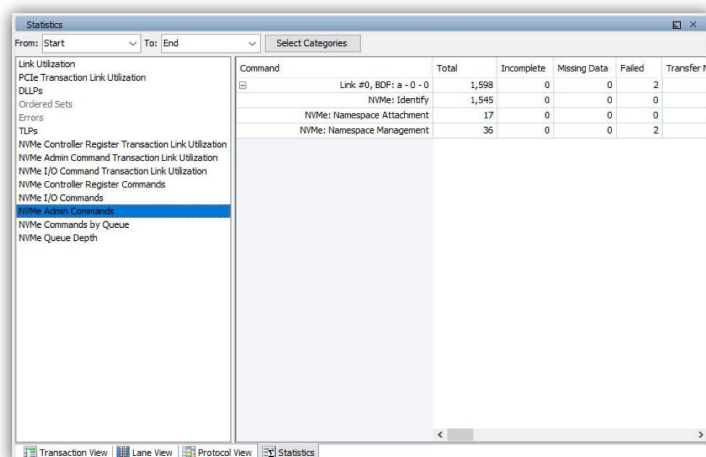
Data Viewer displays the packet or payload for the event selected in either Spreadsheet, Transaction, Lane, or Protocol views. The address for each packet is conveniently displayed first (top-left) and the user can compare up to four packets/payloads. Data is viewable in Hex, Bin, Dec, Bytes, Words, DWords, and Big Endian or Little Endian. Data viewer is also searchable.



Additional Software Functions

- PCIe and NVMe Statistics: Overall view of the types of traffic captured, navigate into areas of interest, look for max/min performance areas, etc.
- Histogram: User-configurable, graphical representation of trace data
- Bookmarks: X-O markers and timing calculator
- Quick Search: Contextual type search field
- Advanced Search (Multi-state)*: Build search events from the search library or copy/paste from one of the trace views
- Quick Hide/Show on the BusXpert software ribbons
- Advanced Hide/Show (Multi-state)*

*configuration-dependent



SI-Fi™ Interposers

SerialTek's Gen4 (16.0 GT/s) PCI Express® (PCIe®) and Non-volatile Memory Express® (NVMe®) interposers with SI-Fi™ allow users to monitor an unprecedented variety of PCIe and NVMe bus traffic with unparalleled power and ease.

Enabled by SerialTek's proprietary SI-Fi™ technology, users can save hours over legacy approaches requiring interposer calibration. This technology improves critical test coverage by providing high signal integrity, even over changing conditions, such as link training (LTSSM), power management, hot plug, reset, and other tests where the physical link/lane characteristics may change.

Each lane's analog signal is received at the probe's differential input and distributed to two separate phase matched differential outputs with a nominal gain of 0dB, allowing the host and device signals to pass through the interposer, allowing for real-world PCIe link training and easier set-up of the analyzer and DUT.

SI-Fi™ PCIe Gen4 Interposers continue SerialTek's TCO approach. With the focus on signal integrity, flexible, low-cost, SFF-8644-based cables connect each interposer to the analyzer. These cables are readily available and rated greater than 20GHz, resulting in uncompromised SI at all PCIe transfer rates.

All sideband signals are passed through the interposer from root complex (host) to controller (device), and all are made available to the analyzer for trigger, decode, and analysis.

Key Features

- SI-Fi™ Interposers require no calibration
- Supports PCI Express Gen 1.0, 2.0, 3.0, and 4.0
- Accurate capture of PCIe data traffic at line rates including 16.0 GT/s (Gen4), 8.0 GT/s (Gen3), 5.0 GT/s (Gen2), and 2.5 GT/s (Gen1)
- Single U.2 / U.3 interposer supports both single-port and dual-port capture (only one analyzer is needed for dual-port)
- "Passive" tapping to avoid masking, hiding, or "cleaning up" electrical and/or link issues
- Low-cost, flexible, high-performance cabling for reliable analyzer to interposer connections

U.2 and U.3 Overview

- U.2 and U.3 available in one interposer or separate interposers
- U.2 / U.3 interposer supports single-port (1×4) and dual-port (2×2) drives
- U.2 / U.3 interposers available in standard and extended lengths
- Dual-port: analyze both ports with only one analyzer



Configurations and Purchase Information

Editions	Real-Time Protocol Processor	SI-Fi Probing	Embedded Processing	Internal Storage	Trace Buffer	Network Connection	NVMe-MI	Advanced Triggering	Advanced Filtering	Advanced Search	x8 Upgrade-able	Dual-port (2x2)	Cascading
Basic	✗	✗			36GB	1GbE		1 State	1 State	1 State			
Standard	✗	✗	Fast	512GB	36GB	10GbEx1	✗	1 State	1 State	1 State			
Pro	✗	✗	Faster	1TB	72GB	10GbEx2	✗	✗	✗	✗	✗		
Enterprise	✗	✗	Fastest	2TB	144GB	10GbEx2	✗	✗	✗	✗	✗	✗	✗

All Gen4 configurations except Enterprise can be upgraded to a higher configuration

Description	Code
Kodiak Gen4 Enterprise Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G4-04-ENT
Kodiak Gen4 Pro Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G4-04-PRO
Kodiak Gen4 Standard Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G4-04-STD
Kodiak Gen4 Basic Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G4-04-BAS
Kodiak Gen3 Enterprise Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G3-04-ENT
Kodiak Gen3 Pro Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G3-04-PRO
Kodiak Gen3 Standard Edition PCIe/NVMe x4 Protocol Analyzer	PK1A-G3-04-STD
Kodiak Gen3 to Gen4 Protocol Analyzer Upgrade	PK1A/G4-UPG
Kodiak Pro to Enterprise Edition Protocol Analyzer Upgrade	PK1A/ENT-UPG
Kodiak Standard to Pro Edition Protocol Analyzer Upgrade	PK1A/PRO-UPG
Kodiak Basic to Standard Edition Protocol Analyzer Upgrade	PK1A/STD-UPG

SI-Fi Interposers

Description	Code
PCIe Gen4 x4 Slot Interposer with SI-Fi technology	PEI-G4-04-SLS
PCIe Gen4 x4 U.2 single (1x4) and dual-port (2x2) Interposer (standard length).	PEI-G4-04-U2S
PCIe Gen4 x4 U.2 single (1x4) and dual-port (2x2) Interposer (extended length)	PEI-G4-04-U2E
PCIe Gen4 x4 U.3 single (1x4) and dual-port (2x2) Interposer (standard length)	PEI-G4-04-U3S
PCIe Gen4 x4 U.3 single (1x4) and dual-port (2x2) Interposer (extended length)	PEI-G4-04-U3E
PCIe Gen4 x4 U.2 and U.3, single (1x4) and dual-port (2x2) Interposer (standard length)	PEI-G4-04-UXS
PCIe Gen4 x4 U.2 and U.3, single (1x4) and dual-port (2x2) Interposer (extended length)	PEI-G4-04-UXE
PCIe Gen4 M.2 Interposer	PEI-G4-04-M2S

Technical Specifications



Kodiak Enclosure

- Dimensions: 443 x 67 x 305 mm (17 x 2.6 x 12")
- Weight: 7 kg (15 lbs)
- Mounting: 19" Rack Mount Option, Tilt Feet Option
- Ambient Operating Temperature: 5-35°C at up to 2133m (7000 feet) altitude

Displays and Indicators

- Front Panel LCD: 800x320 4.6" WCGA, Touchscreen
- System Status: RGB LED



Front-Panel Connectors

- Interposer Connection: 4x SFF-8644
- Ethernet (10 GbE): 2x SFP+ (10 GbE)
- Ethernet (1 GbE): RJ45
- PCIe Interface: 2x OCuLink
- USB Interface: 2x USB 3.1 Type A



Rear-Panel Connectors

- Power: IEC C13, 90-264 Vac, 47-63 Hz
- Clock Out: SMA, 50 Ω, 3.3 Vdc, 10 MHz
- Clock In (10 MHz): SMA, 50 Ω, 3.3 Vdc, 10 MHz
- Trigger Out: SMA, 50 Ω, 3.3 Vdc
- Trigger In: SMA, 50 Ω, 3.3 Vdc
- Maintenance: RJ45, USB Micro-B (Not for customer use)

Interposer Power Unit (Common)

- Input: 100-240 Vac/50-60 Hz
- Output: 5 Vdc
- Power: 50 W
- Plug: Molex 039-01-2060
- Safety: UL, CUL, CE, TUV-GS, PSE
- EMI: CE, FCC
- Environmental: ROHS, WEEE, VI

M.2 Interposer

- Dimensions: 154 mm(W) x 34 mm(H) x 232 mm(L) (6 x 1.3 x 9")
- Power connector: Molex 87427-0602
- Analyzer connectors: 2x SFF-8644
- Device connector: M.2 Socket 3, Key M, 22110, 2280, 2260, 2242, 2230
- Host module connectors: 2x MCIO 38 pin
- SMBUS injection connector: 2x5 pin 0.1" header, 3.3 Vdc
- REFCLK output connectors: 2x U.FL, AC coupled LPHCSL
- REFCLK output control connector: 2 pin 0.1" header, 3.3 Vdc
- REFCLK buffer control connector: 3 pin 0.1" header, 3.3 Vdc
- Sideband signal access connector: 2x9 pin 0.1" header, 3.3 Vdc

U.2/3 Interposer

- Dimensions: 194 x 29 x 337 mm (7.6 x 1 x 13")
- Power connector: Molex 87427-0602
- Analyzer connectors: 4x SFF-8644
- Device connector: SFF-8639 receptacle
- Host connectors: SFF-8639 plug
- SMBUS injection connector: 2x5 pin 0.1" header, 3.3 Vdc
- REFCLKA output connectors: 2x U.FL, AC coupled LPHCSL
- REFCLKA output control connector: 2 pin 0.1" header
- REFCLKA buffer control connector: 3 pin 0.1" header
- REFCLKB output connectors: 2x U.FL, AC coupled LPHCSL
- REFCLKB output control connector: 2 pin 0.1" header
- REFCLKB buffer control connector: 3 pin 0.1" header
- Sideband signal access connector: 2x9 pin 0.1" header, 3.3 Vdc

X4 Slot Interposer

- Dimensions: 25 x 116 x 248 mm (1 x 4.5 x 9.7")
- Power connector: Molex 87427-0602
- Analyzer connectors: 2x SFF-8644
- Device connector: PCIe CEM slot x16 straddle mount connector
- Host module connectors: PCIe CEM x4 Edge fingers
- SMBUS injection connector: 2x5 pin 0.1" header, 3.3 Vdc
- REFCLK output connectors: 2x U.FL, AC coupled LPHCSL
- REFCLK output control connector: 2 pin 0.1" header
- REFCLK buffer control connector: 3 pin 0.1" header
- Sideband signal access connector: 2x9 pin 0.1" header, 3.3 Vdc

Maintenance and Licensing

- Free lifetime software updates – no maintenance fees
- Free full-featured viewer software – easily share annotated traces between computers and colleagues and replay captured traffic
- Use SerialTek hardware on any computer – no additional licenses needed

Warranty

- Two-year limited warranty, Basic and Standard Editions
- Three-year limited warranty, Pro and Enterprise Editions
- Six-month limited warranty, Interposers

Minimum Requirements

- Intel Core, 2 GHz or compatible processor
- 4 GBytes of RAM
- 1280 x 1024 display resolution with at least 65,536 colors
- 64-bit OS only (Windows 7, Ubuntu 14, Centos7 or higher)
- 1GbE controller

More information at: www.serialtek.com/kodiak

