

AI & UE

Artificial Intelligence & Ultra Ethernet

SOLUTION TRACK



Key Features

- Support for UE Link Layer and Physical Layer features for both 112 Gbps and 224 Gbps per lane
- Support for UE Link Layer Retry (LLR) protocol
- Support for UE Credit-Based Flow Control (CBFC) protocol
- Support for UE Link Negotiation for LLR and CBFC
- Full statistics of LLR, CBFC, and Link Negotiation per UEC specification
- LLR and CBFC interoperation with PAUSE/PFC
- LLR sequence number error injection
- LLR CtIOS error injection
- CBFC CtIOS error injection
- Up to 256 streams per port for traffic generation
- Frame size up to 16K bytes

Ultra Ethernet is designed to address the scalability, congestion, and latency limitations of traditional Ethernet and RoCE, enabling reliable, high-performance networking for large-scale AI and HPC clusters with hundreds of thousands to millions of endpoints.

The **AI & UE Solution Track** is for use with Z800 Freya and Z1608 Edun traffic generators. It enables verification, optimization, and robustness testing of UE Link Layer functionality under realistic and demanding load conditions.

This Solution Track is primarily intended for:

- Switch and NIC/GPU developers implementing UEC features
- AI-intensive data-center operators planning large-scale UE deployments
- Vendors targeting HPC/AI clusters that require deterministic, loss-free transport.

In addition to the standard Ethernet testing offered by XenaManager3 (XM3), the **AI & UE Solution Track** adds UE-specific Link Layer behaviors required for validating UEC-enabled switches and xPUs.

These include:

- Link Layer Retry (LLR)
- Credit-Based Flow Control (CBFC)
- Link Layer Negotiation (LLDP for UE extensions)
- Stateful UE protocol control and message exchange
- UE error injection, message inspection, and capture

The functionalities cover stateful protocol communication, error injection, and capture capabilities for comprehensive testing.

With these capabilities, the **AI & UE Solution Track** transforms Z800 Freya and Z1608 Edun modules into UE-compliant endpoints, enabling highly realistic and standards-aligned traffic behavior for early development, interoperability validation, and performance stress testing.

The **AI UE Solution Track** follows the UEC standard and will in the future be expanded with capabilities for testing e.g. Packet Rate Improvements, Telemetry, Negotiation Enhancements, and Idle Reduction.

ABOUT SOLUTION TRACKS

Solution Tracks add advanced features and functionalities for specialized test scenarios to the already extensive list of core features available on Xena systems. Solution Tracks do not require any hardware update to the module they are installed on, and one module can support multiple Solution Tracks. Solution Tracks are dynamic, with new features and enhancements being added over time as demand and technology evolves. These features and enhancements are included in the general software updates and will be available as long as the module is covered by a valid warranty.



AI & UEC Solution Track

Link Layer Retry (LLR)	
LLR Frame Types	LLR-eligible, LLR-ineligible, and mix of both
LLR Configuration	Support LLR behavior configuration: Discard, Block, Best-Effort
	Tx and Rx path configuration
LLR Replay	Auto/Manual*) configuration of LLR Replay buffer
	Delayed replay*)
Congestion Control	Support interoperation with PAUSE/PFC*)
CtIOS Types	LLR_ACK, LLR_NACK, LLR_INIT, LLR_INIT_ECHO
CtIOS Transmission	Support Pre-Emptive CtIOS transmission*)
	Delayed CtIOS*)
LLR Error Injection	Corrupt preamble*)
	Duplicate sequence
	Drop sequence
	Poisoned FCS
	CtIOS spacing violation*)
	CtIOS corruption*)
LLR Error Detection	Detect sequence repeat frames
	Detect non-compliant preamble')
	Detect LLR-eligible frames
	Detect LLR-ineligible frames
	Detect CtIOS spacing rule violation*)

*) Future updates



Link Layer Retry (LLR)	
LLR Tx statistics	Tx CtIOS of each type
	Tx LLR-eligible frames with good FCS
	Tx LLR-eligible frames with poisoned FCS
	Tx total LLR-eligible frames
	Tx total LLR-ineligible frames
	Discarded LLR-eligible frames
	Replay completions
	Injected non-compliant preambles*)
	Injected sequence repeat frames
	Injected sequence drop frames
	Injected poisoned FCS frames
	LLR Rx statistics
Rx LLR_ACK/LLR_NACK sequence number errors	
Rx LLR-eligible frames with good FCS	
Rx LLR-eligible frames with poisoned FCS	
Rx LLR-eligible frames with bad FCS	
Rx LLR-eligible frames with good FCS that had expected sequence number	
Rx LLR-eligible frames with poisoned FCS that had expected sequence number	
Rx LLR-eligible frames with bad FCS that had expected sequence number	
Rx total LLR-eligible frames count	
Rx total LLR-ineligible frames count	
Replay detections	
Non-compliant preambles*)	
Missing sequences	
Duplicate sequences	
CtIOS space rule violations*)	

*) Future updates

Credit-Based Flow Control (CBFC)	
VC Support*)	Up to 32 VCs ($2 \leq \text{NumVCs} \leq 32$)
	Up to 32 Lossless VCs ($1 \leq \text{NumLosslessVCs} \leq 32$)
Credit Limit Modes*)	Total Credit Limit
	Per-VC Credit Limit
Credit Sizes*)	Basic: 32, 64, 128, 256, 512, 1024 and 2048 bytes
	Additional: 40, 48, 56, 80, 96, 112, 160, 192, 224, 320, 384, 448, 640, 768, 896, 1280, 1536, and 1792 bytes
	Handling of non-ideal credit size
Total Credit Limit*)	Configurable up to $2^{19}-1$
Per-VC Credit Limit*)	Configurable up to Total Credit Limit
Per-Packet Overhead*)	Configurable: $-16 \leq \text{PktOvhd} \leq 12$
Lossless VC Management*)	Support 802.1 LLDP for Lossless VC initialization
	Support 802.1 LLDP for Lossless VC removal
	Support 802.1 LLDP for adding additional lossless VCs
Lossless VC Mapping*)	VLAN PCP/DEI
	IP DSCP
	IEEE Std 802.1CBdb-2021 Stream Identifier
CBFC Error Injection*)	CC_Update Error Injection
	CF_Update Error Injection
CBFC Error Detection*)	Detection of non-compliant Link Negotiation
	Detection of corrupt CC_Update
	Detection of corrupt CF_Update
Statistics*)	All standard statistics with additional metrics for enhanced visibility

*) Future updates



AI & UEC Solution Track

Link Negotiation (LLDP)	
Support 802.1 LLDP	Support 802.1 LLDP
	<ul style="list-style-type: none"> • Support for LLR and CBFC*) • Manual configuration for compliance verification*) • Auto mode for test provisioning • Multiple LLDP agents per port • Customizable LLDP configuration*) • Statistics and link neighbor information*)

Traffic Generation	
Traffic Generation Support	Up to 256 streams per port
	Maximum frame size 16K bytes
	Latency and jitter measurement
	Modifier support per stream

Speed modes	112G SerDes	224G SerDes
Z800 Freya	1x800G, 8x100G*), 4x200G*), 2x400G*)	
Z1608 Edun	1x800G, 8x100G*), 4x200G*), 2x400G*)	4x200G

*) Future updates

Easy Deployment Process

Solution Tracks are perpetual feature packs enabling advanced features on modules and underlying ports. When a Solution Track is ordered the extra features will be activated at the time of shipment. In the near future it will be possible to activate Solution Tracks on existing modules via XenaManager 3. Please note that activating Solution Tracks requires that the system is running Xena Release 106 or later.

Ordering Information

Product Description

Solution Track for AI features on Freya-800G-4S-1P-OSFP
Solution Track for AI features on Edun-1600G-4S-1P-OSFP

Product Code

ST-Freya-800G-4S-1P-OSFP-AI
ST-Edun-1600G-4S-1P-OSFP-AI



Local sales offices are located throughout the world. Visit our website to find the most convenient location.

1-800-5-LeCroy • teledynelecroy.com

