NVMe Fast FPGA RAID Recorder System
Product Brochure

Unlike 3rd-party Network-Attached-Storage (NAS) systems which have limited read/write bandwidth, MLE NVMe Fast FPGA RAID (FFRAID) Recorder System, based on MLE's NVMe FFRAID Accelerator, can scale to 400 Gbps or more, delivering loss-less and gapless data recording from multiple data sources onto a RAID of NVMe™ SSDs.

MLE NVMe FFRAID Recorder is a turnkey system - delivered as a ready-to-run appliance - to support data-in-motion pre- and post-processing and is highly scalable with regards to bandwidth and recording capacity.

Bench-Top

19" Rackmount

SWaPC Embedded

▲ Various formfactor choices for a turnkey MLE NVMe FFRAID recording system

Key Features

- Scalable from **100 to 400 Gbps, or more**
- Cascading of multiple systems with time-synchronization
- Start-Pause-Stop Data Recording
- Pre-trigger Data Recording in circular buffers
- Adaptable signal front-ends
- Read/write compatible with **Linux Software-RAID**
- Supports **Self-encryption TCG OPAL** SSDs

Applications

- Autonomous Vehicle Path Record & Replay
- Automotive / Medical / Industrial Test Equipment
- Broadcast Recording
- High-speed Radar / Lidar / Camera Data Acquisition & Storage
- Network Telemetry and Analytics
- Very Deep Network Packet Capture of Ethernet or IPv4 or TCP/UDP Data

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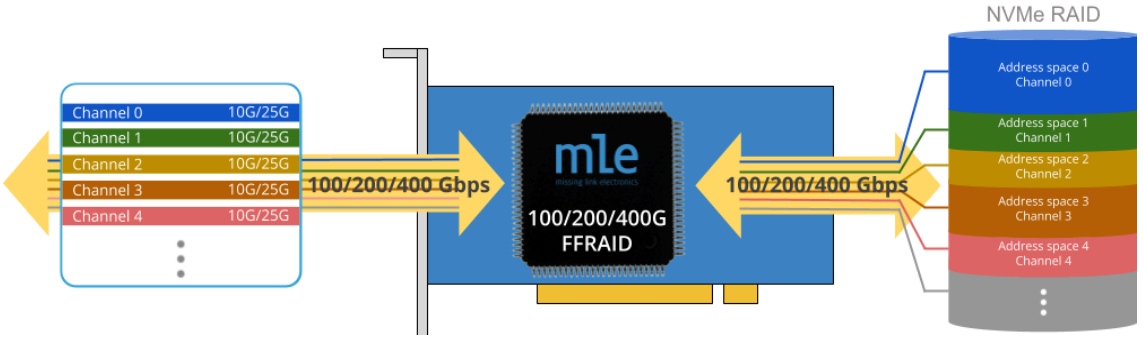
NVMe FFRAID Accelerator Subsystem

MLE NVMe FFRAID Recorder is a customizable turnkey solution which is based on the MLE NVMe FFRAID Accelerator Subsystem, featuring:

- Scalable **channel-based architecture**
- Compatibility and interoperability with **Linux MDRAID**
- Support for many data acquisition use cases including **decimation** or **metadata indexing**
- Simplex record, simplex replay, half-duplex and full-duplex modes

Channel-Based Architecture

MLE's NVMe FFRAID Accelerator implements a channel-based architecture where each data source/sink can be associated with a dedicated FPGA-accelerated RAID engine and a dedicated storage space. Each channel can be connected with 10/25/50/75/100 Gbps ingress / egress signal I/O. Adaptable signal front-ends support many different I/O standards in a "mix & match" fashion.



Recording Capacity and Scalability

MLE NVMe FFRAID Accelerator supports a wide range of NVMe SSDs and can be scaled from M.2 SSDs to high-performance U.2 or U.3 SSDs. Scalability also includes selecting from different SSD capacities and Drive-Writes-per-Day (DWPD) models. Here is a table of possible recording times in minutes:

Storage (TiB) \ Recording Speed (Gbps)	100	150	200	250	300	350	400
5	7.2	4.8	3.6	2.9	2.4	2.0	1.8
10	14.3	9.5	7.2	5.7	4.8	4.1	3.6
15	21.5	14.3	10.7	8.6	7.2	6.1	5.4
20	28.6	19.1	14.3	11.5	9.5	8.2	7.2
25	35.8	23.9	17.9	14.3	11.9	10.2	8.9
30	42.9	28.6	21.5	17.2	14.3	12.3	10.7
35	50.1	33.4	25.1	20.0	16.7	14.3	12.5
40	57.3	38.2	28.6	22.9	19.1	16.4	14.3
45	64.4	42.9	32.2	25.8	21.5	18.4	16.1
50	71.6	47.7	35.8	28.6	23.9	20.5	17.9

For more details regarding the MLE NVMe FFRAID Accelerator please refer to our datasheet, i.e. MLE Technical Brief 20251016 "NVMe Fast FPGA RAID Accelerators".

NVMe FFRAID Recorder Turnkey Systems

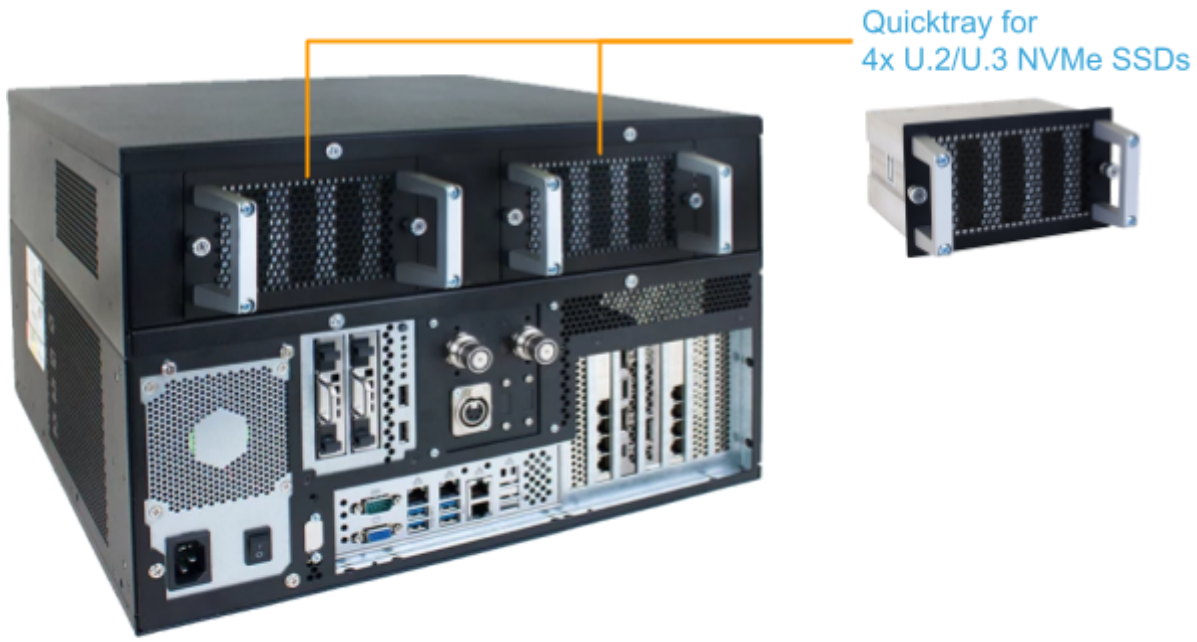
MLE NVMe FFRAID Recorder is a ready-to-run turnkey system which

- integrates multiple MLE NVMe FFRAID Accelerator subsystems
- on off-the-shelf FPGA cards
- along with a standard Linux server
- which has been optimized for PCIe/NVMe cost/performance and
- with a choice of pre-validated NVMe U.2/U.3 SSDs

Formfactor choices for a turnkey NVMe FFRAID recording system include bench-top appliance, 19”-rack mount systems, or embedded recording systems which have been optimized for Size, Weight, Cost and Power.

1. Bench-Top NVMe FFRAID Recorder System

MLE NVMe FFRAID Bench-Top Recorder System can be highly customized based on the “Mayflower”[1] system from Inonet GmbH. The Inonet Quicktray makes it easy to swap a RAID-0 unit of 4x NVMe SSDs - a nice feature for data recording in the field, or the recording of many different data sets.



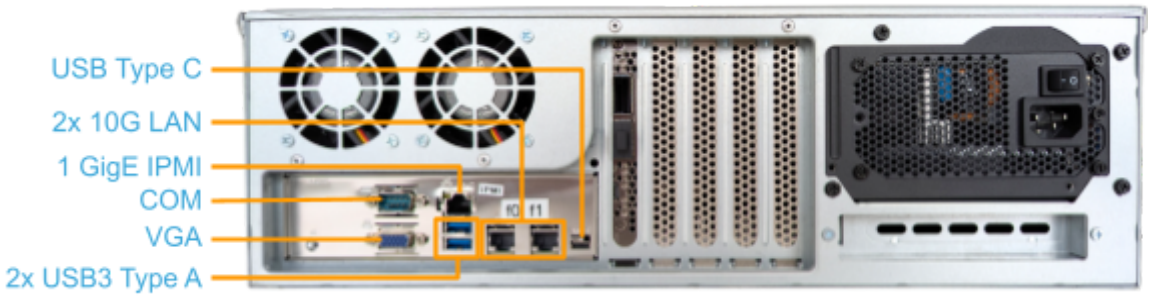
▲ Bench-Top NVMe FFRAID Recorder (Exemplary View)

[1] https://www.inonet.com/fpga-server/?lang=en

2. 19” Rackmount NVMe FFRAID Recorder System

MLE NVMe FFRAID 19” Server is intended for rack-level integration.

▲ 19” Rackmount NVMe FFRAID Recorder Front Panel (Exemplary View)



▲ 19” Rackmount NVMe FFRAID Recorder Rear Panel (Exemplary View)

3. Embedded Recording Systems

Embedded recording systems can come in various form factors and use different SoC-FPGAs, all optimized for Size, Weight and Power, and/or Cost (SWaPC).

On the right is an example of NVMe FFRAID Embedded Recorder system based on AMD Versal AI Edge System-on-Chip.

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