

Leo Smart Memory Controllers

Family Brief

Leo Smart Memory Controller™ | Agentic AI Memory Expansion | Fabric-Connected Memory Pooling | Scalable Memory for Next-Generation Data Centers

Asteralabs (NASDAQ: ALAB) provides rack-scale AI infrastructure through purpose-built connectivity solutions. By collaborating with hyperscalers and ecosystem partners, Asteralabs enables organizations to unlock the full potential of modern AI. Asteralabs' Intelligent Connectivity Platform integrates CXL®, Ethernet, NVLink Fusion, PCIe®, and UALink™ semiconductor-based technologies with the company's COSMOS software suite to unify diverse components into cohesive, flexible systems that deliver end-to-end scale-up, and scale-out connectivity. The company's custom connectivity solutions business complements its standards-based portfolio, enabling customers to deploy tailored architectures to meet their unique infrastructure requirements. Discover more at www.asteralabs.com

Benefits and Features

- **X-Series:** Fabric-attached memory to improve tokenomics for long-context, KV-cache-intensive workloads
- **E-Series:** Increase memory bandwidth and capacity for Agentic AI and general-purpose cloud workloads
- **P-Series:** Dynamic pooling and sharing to unlock stranded memory capacity and improve utilization
- Enables reliable **DDR4 memory reusability** to improve infrastructure TCO
- CXL 3.2/PCIe 6 with backwards compatibility to CXL 2.0/PCIe 5
- Up to 4x DDR5 channels with up to 2 DIMMs per channel (DPC)
- Up to 4x DDR4 channels with up to 3 DIMMs per channel DPC
- Data center security features to provide end-to-end protection compliant with leading industry standards such as NIST, OCP, FIPS, etc.
- **Seamless interoperability** with all major CPU, GPU and memory vendors for cloud-scale deployment
- **Hyperscale-grade RAS diagnostics:** Signal, link monitoring & memory diagnostics for rapid fault isolation and accelerated time-to-deployment of applications
- **Connectivity System Management and Optimization Software (COSMOS)** suite with deep telemetry and diagnostics for link and device health monitoring

Aurora (A1000 and A2000) Smart Memory Hardware Solutions

- Plug-and-play card solutions complete with Leo X-Series, E-Series or P-Series Memory Controllers
- All the benefits and features of Leo Smart Memory Controller family
- PCIe x16 CEM card and custom form factors
- Lower TCO via more granular serviceability—can replace a single failing DIMM
- Configurable memory capacity - Up to 8x DDR5 RDIMMs, up to 4TB & Up to 12x DDR4 RDIMMs, up to 768GB
- On-board debug connectors for fleet management on Cloud Servers
- High-volume, production-qualified solutions with robust supply chain
- Full turnkey solution with COSMOS suite

Applications

X-Series

- Agentic AI workloads that provides a lower latency and higher bandwidth path for GPU-to-KV-cache access improving token economics
- Engineered for long-context and multi-turn inference, and large memory capacities for machine-driven, agent orchestration and execution

E-Series

- Cloud servers with compute-intensive workloads such as Artificial Intelligence and Machine Learning
- Enables redeployment of DDR4 memory in new AI cloud and General-purpose compute servers
- Improves memory capacity for In Memory Database applications

P-Series

- Unlocks stranded memory capacity and improves utilization with pooling and sharing in cloud servers
- Lower Total Cost of Ownership in cloud data centers with higher workload density per node, reducing hardware expenditure, thermal output, and power consumption
- Memory sharing simplifies software complexity by allowing compute units to access uniform datasets at direct latency without network delays in HPC applications

Description

Leo X-Series Smart Memory Controllers support memory expansion and pooling in PCIe-only mode to eliminate bandwidth/capacity bottlenecks, reduce TCO, and optimize memory utilization for cloud and AI Inference infrastructure. Ideally matched with Aster Labs' Scorpio™ 320-Lane Smart Fabric Switch, the industry's largest PCIe scale-up switch to provide most performant KV Cache solution for Agentic AI.

Leo E-Series and P-Series CXL Smart Memory Controllers support memory expansion, pooling, and sharing to eliminate bandwidth/capacity bottlenecks, reduce TCO, and optimize memory utilization for cloud and AI infrastructure. Leo includes a comprehensive portfolio of controllers and hardware solutions. It provides maximum capacity with up to 4 channels of 2DPC DDR5 with a maximum speed of 6400MT/s or 4 channels of 3DPC DDR4 with a maximum speed of 3200MT/s.

Leo enables robust memory expansion and disaggregated memory pooling and sharing for CPUs, AI accelerators, and smart I/O devices. It eliminates the need to overprovision memory thereby reducing overall TCO and optimizing CPU efficiency and application performance for computational workloads, while also enabling reuse of DDR4 DIMMs in data centers.

Both **Leo E-Series** and **P-Series** memory controllers provide proven 2nd generation Hyperscale-grade RAS, resilient firmware updates, and cross server platform interoperability facilitates reliable memory reuse.

Aurora (A1000 and A2000) Smart Memory Hardware Solutions offer all the benefits of Leo Memory Controllers and enable quick plug-and-play deployment

with faster time-to-market for system OEMs and data centers.

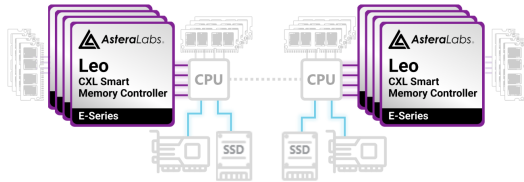
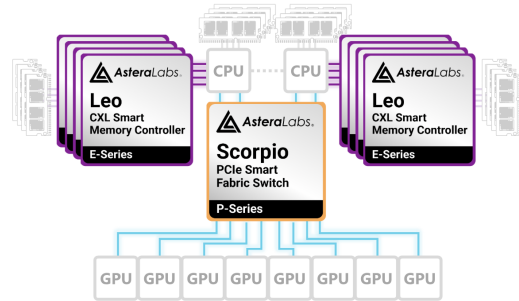
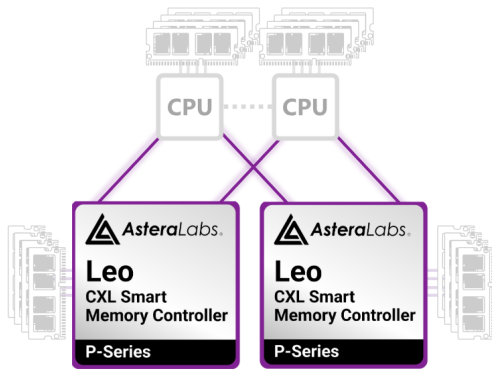
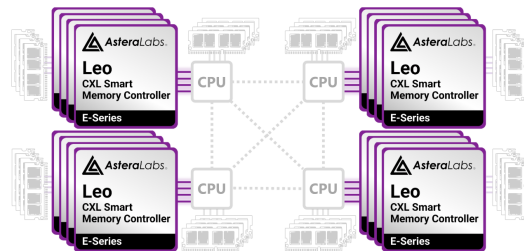
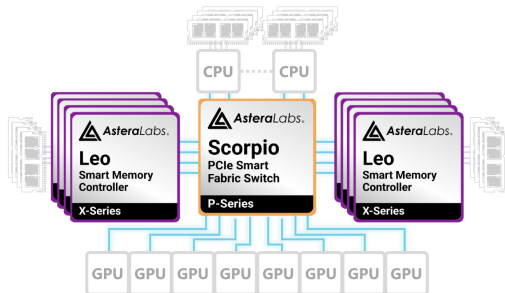
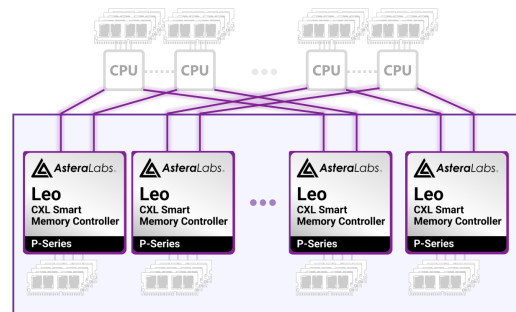
Leo includes the **COSMOS** suite, which supports advanced In-Band and Out-of-Band Diagnostics for Fleet management in Large-Scale Server Deployments. It also provides advanced reliability, availability, and serviceability (RAS) features, including automated repair engines that help identify reliable DIMMs for reuse.

These software components are provided as SDK APIs, CLIs and Explorer. They enable baseboard management controllers (BMCs) and system management controllers (SMCs) to utilize an array of customizable diagnostics and telemetry features for managing and optimizing a large fleet of systems. Leo X-Series provides a complete software-stack solution with COSMOS infrastructure, including GPU DMA operation, proven fleet management, data center RAS, and security features deployed at CSPs.

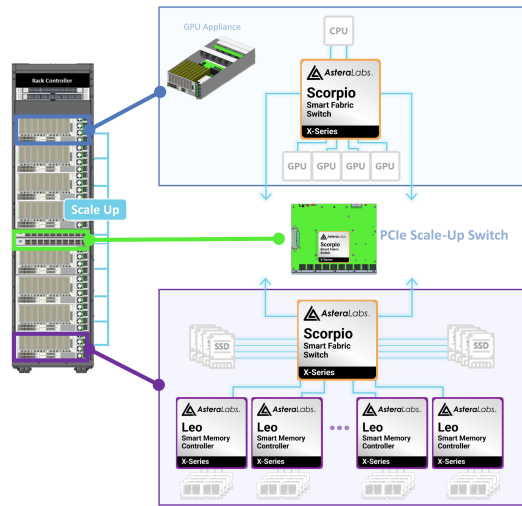
Product Family Information

Product Series	Part Number	CXL	Memory	Form-Factor / Dimensions (mm)		
				Configuration	Max speed (MT/s)	
Leo X-Series	PCIe and platform-specific protocols					
A1000 PCIe Add-in Card						
Leo E-Series	CM61654LE*	CXL 3.2		4ch DDR5, 2 DPC	6400	25x49
				4ch DDR4, 3 DPC	3200	25x49
	CM51652LE*	CXL 2.0		2ch DDR5, 2 DPC	5600	27x27
Leo P-Series	CM61654LP*	CXL 3.2		4ch DDR5, 2 DPC	6400	25x49
				4ch DDR4, 3 DPC	3200	25x49
	CM51652LP*	CXL 2.0		2ch DDR5, 2 DPC	5600	27x27
A2000 CXL Add-in Card	A2000*	CXL 3.2	8x DDR5 RDIMM slots		6400	PCIe Dual-Width, Air cooled
A2000 CXL Add-in Card	A2000*	CXL 3.2	12x DDR4 RDIMM slots		3200	PCIe Dual-Width, Air cooled
A1000 CXL Add-in Card	A1000*	CXL 2.0	4x DDR5 RDIMM slots		5600	PCIe Dual-Width, Air cooled

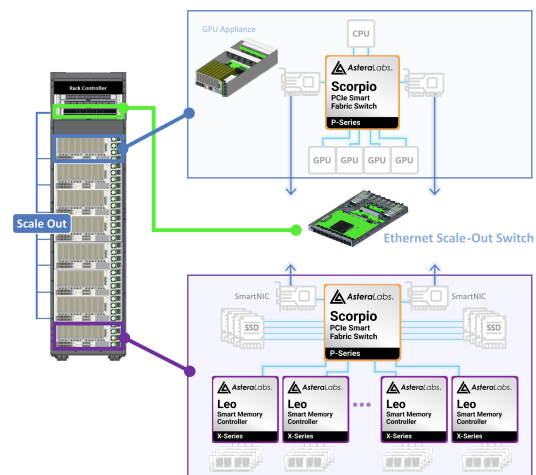
Example Topologies

Memory Expansion

Integrated KV Cache Server

Sharing and Pooling

In-Memory Database, Symmetric Link Processing (SMP) Server

PCIe Fabric Attached

Multi Server Connectivity


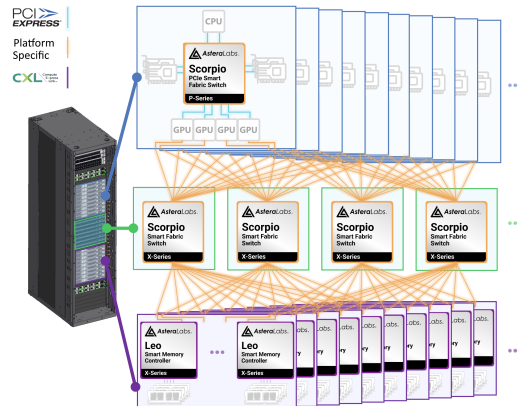
PCIe Fabric-Attached



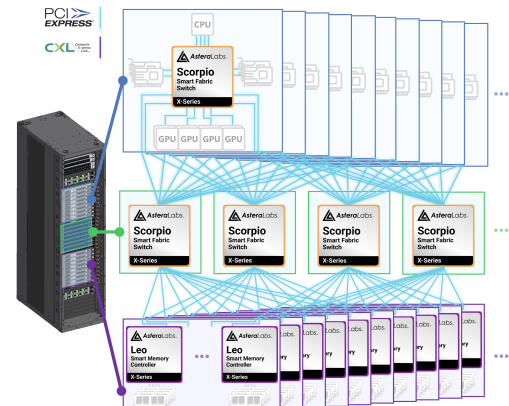
Ethernet Network Attached



GPUs with Dedicated Scale-Up Connectivity



GPUs with Single PCIe Scale-Up Connectivity



COSMOS Monitoring and Management

Leo is architected for intelligent memory-fabric operations, with COSMOS providing the monitoring, management, diagnostics, and security required to operate memory expansion infrastructure at scale.

- **Fleet management:** COSMOS provides device identification, firmware version visibility, remote firmware updates, and log retrieval for streamlined fleet-level operations and long-term manageability.
- **Hyperscale-Grade health monitoring:** Memory health management, continuous monitoring of temperature, voltage, PCIe link state, Rx/Tx eye margins, and CXL/DDR performance counters helps teams detect degradation before it impacts workloads.
- **Root-cause analysis:** Error counters, PCIe recovery data, link-degradation indicators, and timestamped events accelerate analysis of protocol, link, and performance issues.
- **Advanced debug and configuration:** Link bifurcation, configurable thresholds, forced PCIe presets, LTSSM logs, and logic-analyzer support simplify device integration, validation, and failure isolation.
- **RAS and security management:** PHY diagnostics, PRBS/TGC testing, poison and error injection, key provisioning, and anti-rollback capabilities strengthen signal integrity, RAS readiness, compliance, and platform security.