



Introduction to Klepsydra

**Software Framework for highly efficient
AI inference and ROS2 Execution to enable
Intelligence for robotic systems**

Problem

(Cognitive) Robotics - fast growing field combining ROS2 & diverse AI ...



- ☒ Data generated at the edge grow much faster than the ability of robotic computers to handle incoming data
- ☒ Adding more computing power is either costly, requires too much energy, or is limited by weight and volume of end-device
- ☒ Combining AI & ROS2 for one model & one platform is already complex!

Introduction

When implementing edge AI and edge data processing, are you ...

- ... **struggling** to deploy your AI/ML models to the edge?
- ... **fight** with lack of computing resources on the edge?
- ... **cannot focus** on the actual intelligent system but fight with performance bottlenecks when deploying on the edge?

WE can help

Introduction

Our efficient Software Framework enables you to:

- Process 10x more data using the same edge processor and AI Model
- Reduce power consumption up to 50%, with no changes to your existing AI Model
- Minimize deployment and development time, accelerating your project
- Safe and secure: Complies with space safety standards and is cybersecurity protected.

Build YOUR software, run YOUR AI with our framework!

Your engineers stay in control developing on a platform designed for acceleration



We deliver the performance layer, YOU build the System

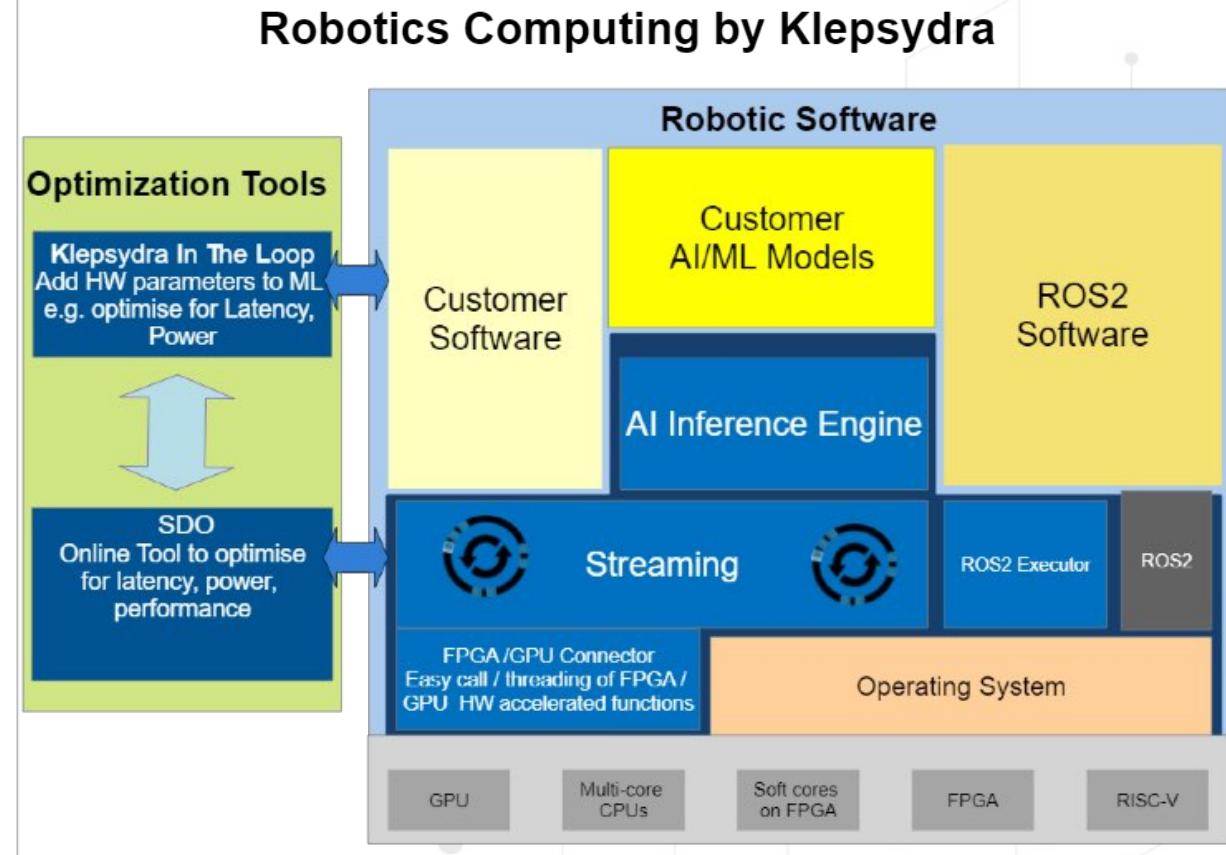
Klepsydra Product Suite



Klepsydra AI is a high-performance edge DNN engine that deploys AI algorithms to the edge and delivers up to **10x higher performance** compared to other solutions.

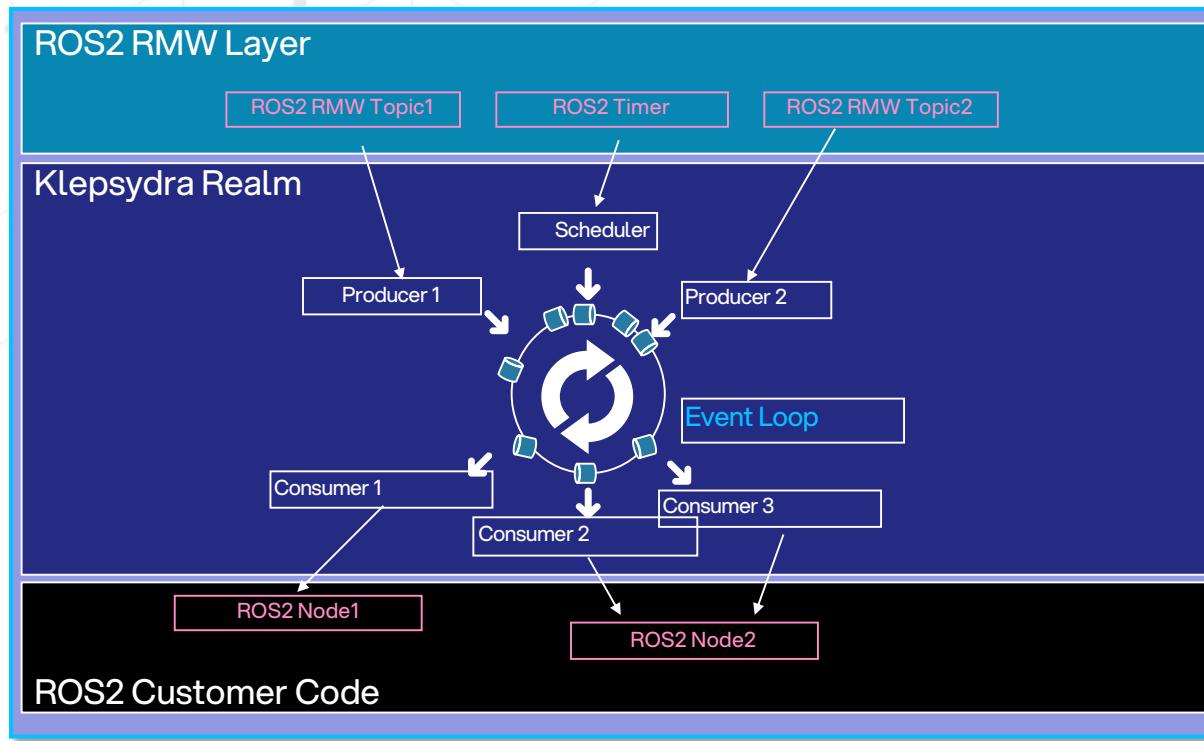
Compatibility Matrix

- DNN operator support:** Broad coverage in float32 and uint8 (quantized).
- Validated models:** Includes AlexNet, MobileNet V1/V2, YOLOv4-v8 (S/N), ResNet50, VGG19, UNet, LSTM.
- Hardware compatibility:** Runs on x86, ARM Cortex-A (A9, A53, A72, A76, etc.), RISC-V (RV64GC, RV32GC), and SPARC (LEON 3/4/5).
- OS flexibility:** Supports Ubuntu, Yocto, RTEMS6, VxWorks, and DDC-I.

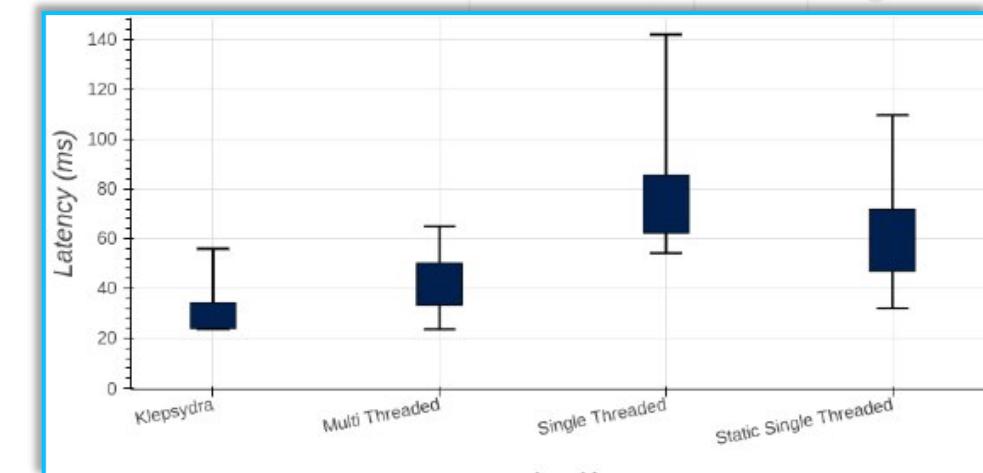


Klepsydra AI – Robotics Edition

- Novel approach to optimising ROS2 execution



LATENCY OF CRITICAL PATH BY EXECUTOR				
Executor / N	Klepsydra	Multi threaded	Single threaded	Static Single Threaded
64	1.3	5.4	1.9	1.0
512	2.1	7.2	2.5	1.7
1024	2.9	6.9	4.1	3.0
2048	7.6	11.9	9.8	8.8
4096	29.1	41.7	73.9	59.4
6144	117.8	172.6	476.1	407.2
8192	504.8	527.1	779.4	654.1



High performance

CORE TECHNOLOGY:

- ultra-low-latency Lock-free ring buffer
- Two-dimensional threading model - pipelining threads and parallelisation threads.

BREAKTHROUGH PERFORMANCE

- 2–10x faster data processing
- Up to 75% lower power consumption

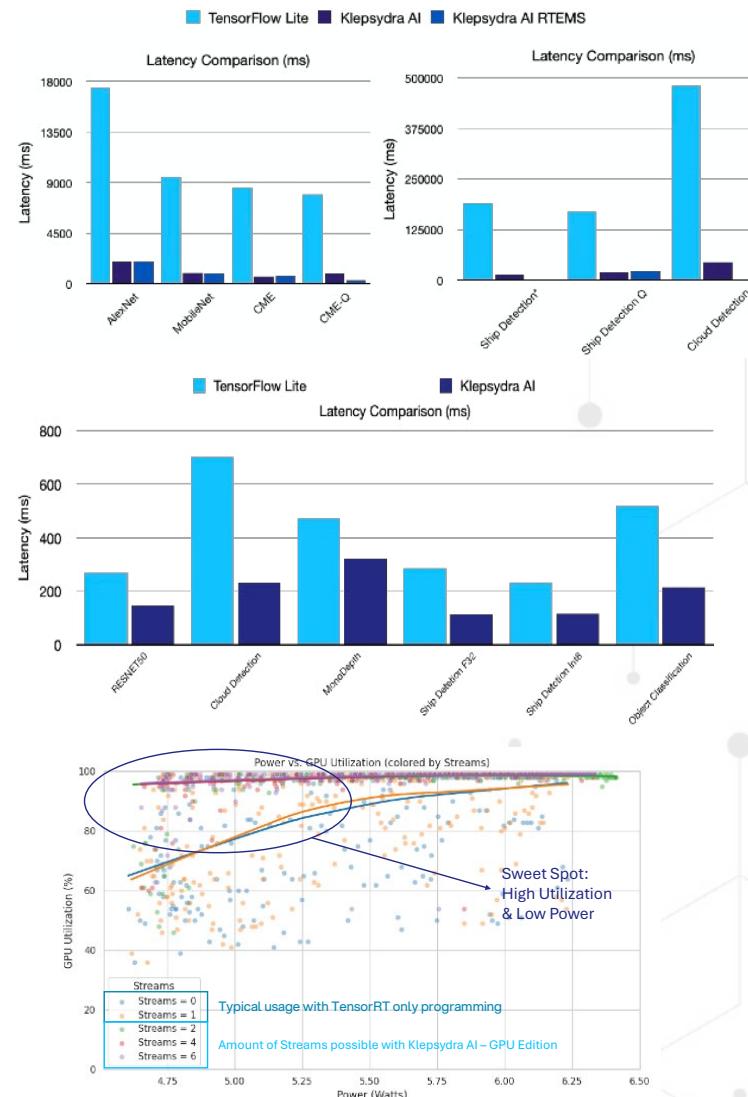
ADAPTIVE PERFORMANCE

- Optimizes for low latency, high throughput, or minimal CPU usage.

KLEPSYDRA
TECHNOLOGIES

R
RISC-V®

arm



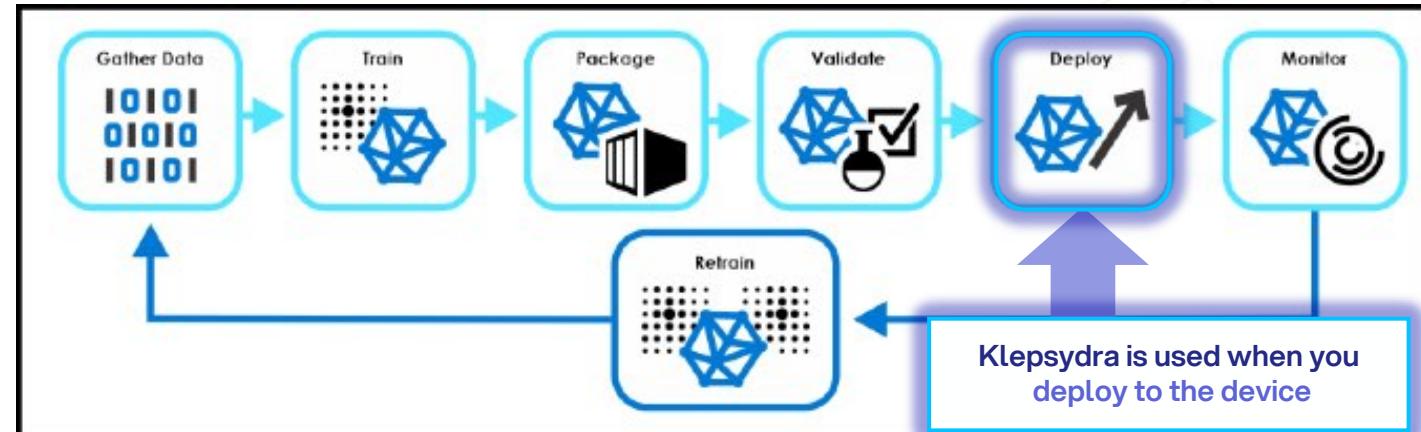
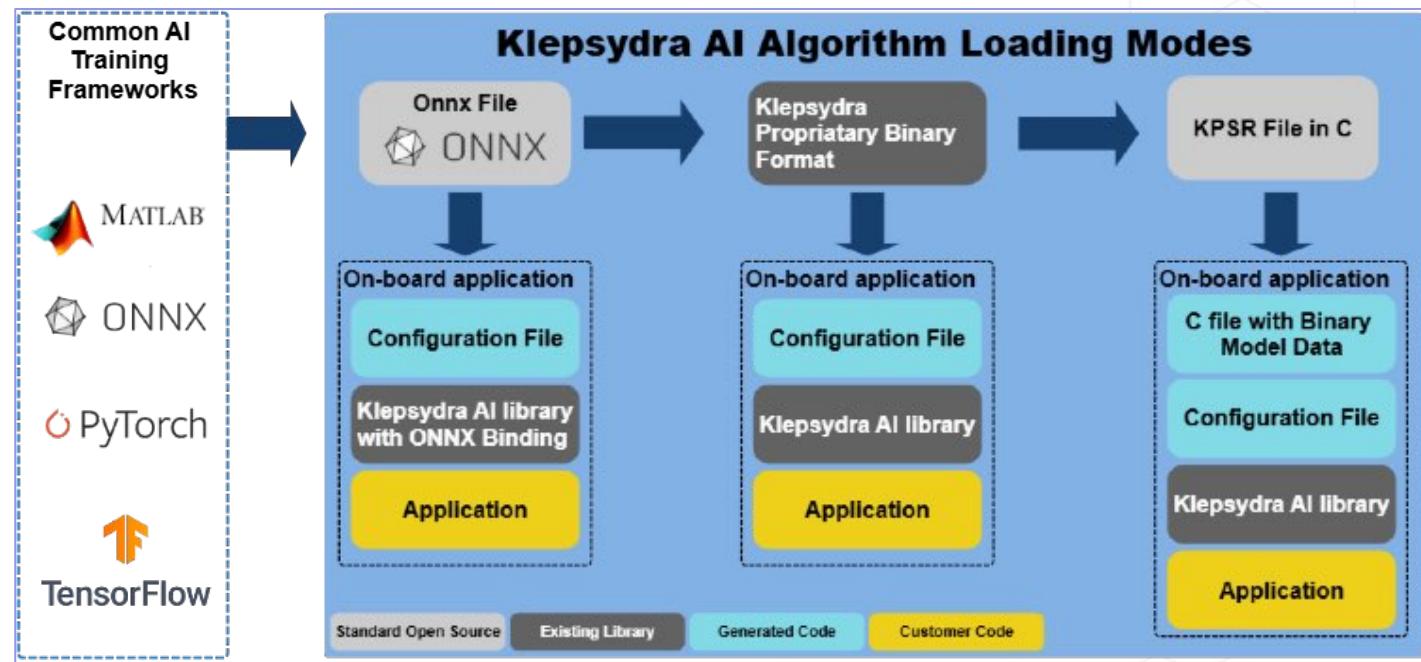
Integration with Leading AI tools

Machine Learning Frameworks:
Supports TensorFlow, PyTorch,
ONNX, etc.

Input File Format: Requires ONNX
(Opset 12, channel-last).

User guides and examples:

- Step-by-step User Guides provided.
- Extensive list of examples covering all the API are provided for the user to rapidly start developing with the framework.



Safety and Security

STANDARDS COMPLIANCE



E-40-ST



Q-80

QUALIFIED OPERATING SYSTEMS SUPPORT

WNDRV

VxWorks



RTEMS6 SM

Supports Highest Levels of Cyberprotection

Algorithm encryption

Prevents reverse engineering of AI applications.

Run-time protection

Blocks unauthorized memory access and algorithm tampering.

Minimal overhead

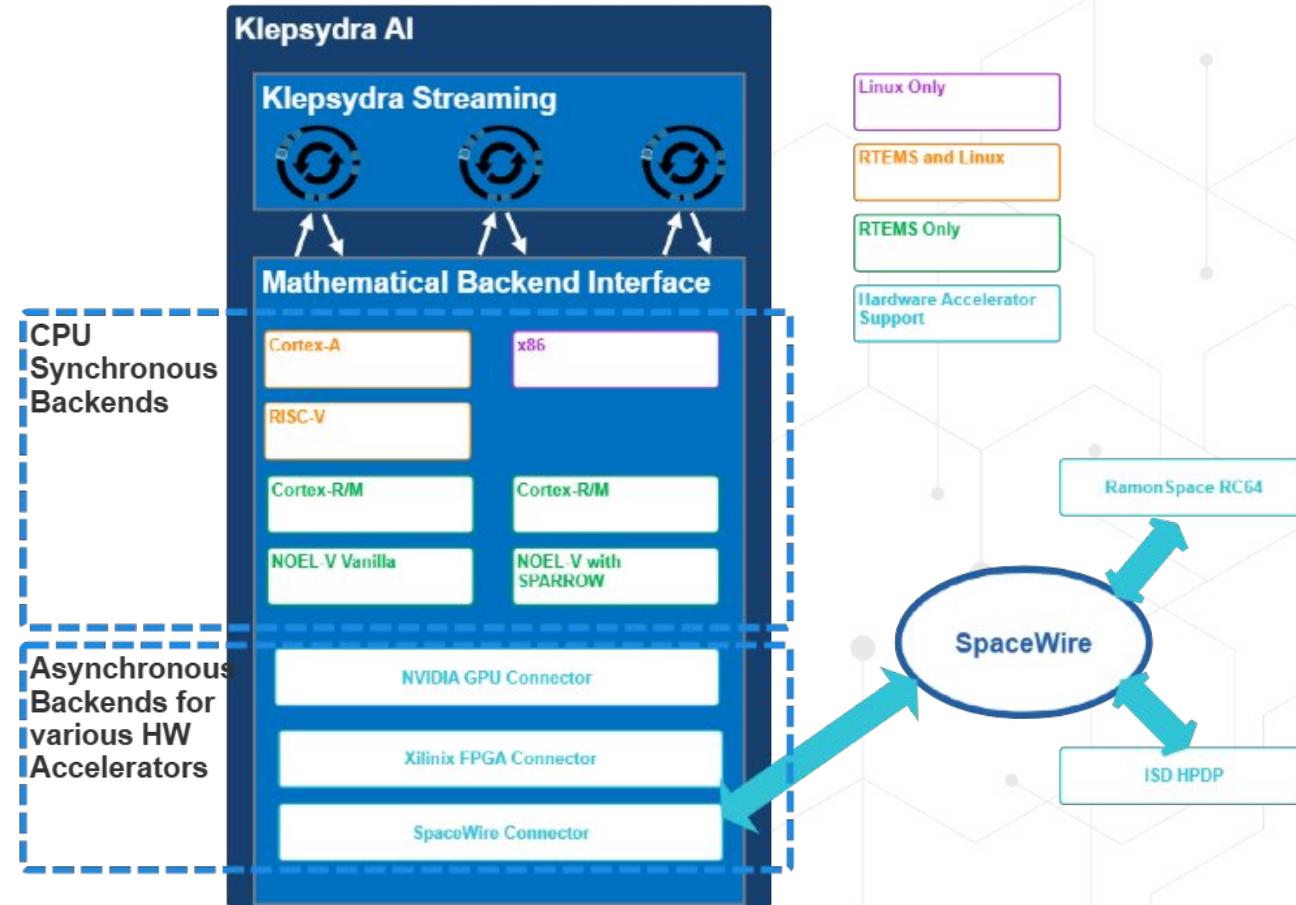
Raspberry Pi 4 benchmarks show negligible performance impact.

Validated solution

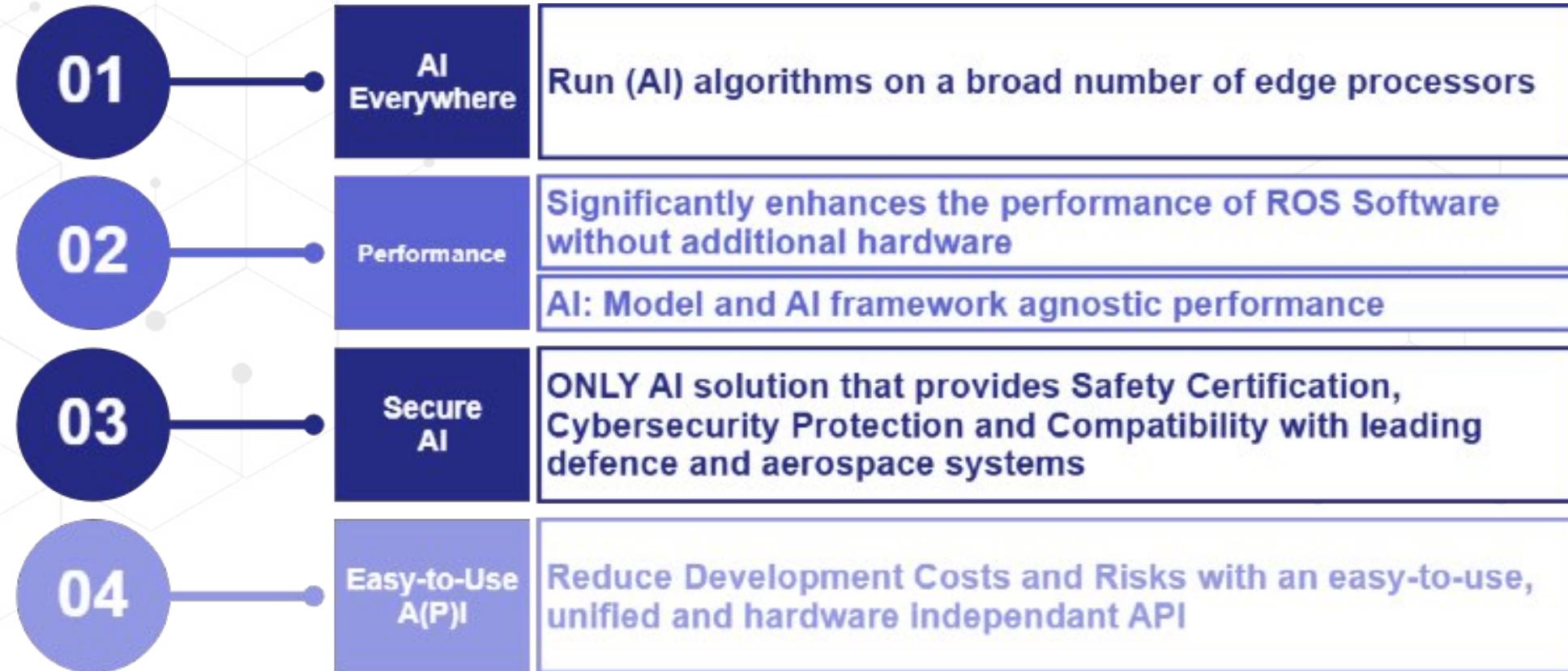
Encryption process verified with partner tools.

Extensibility Framework

- **Extensible framework:** Easily integrates custom mathematical backends on CPUs, FPGAs, or radiation-hardened processors.
- **Mission-ready flexibility:** Enables fast, low-overhead deployment of AI tailored to specific space missions.
- **Cost & complexity reduction:** Avoids the need to build solutions from scratch.
- **Native middleware support:** Compatible with SpaceWire, CSP, ZeroMQ, and ROS2.
- **Plug-and-play foundation:** Delivers high-performance, adaptable, space-ready AI services.



Unleash the full potential of Edge AI



- 01** **AI Everywhere** Run (AI) algorithms on a broad number of edge processors
- 02** **Performance** Significantly enhances the performance of ROS Software without additional hardware
AI: Model and AI framework agnostic performance
- 03** **Secure AI** ONLY AI solution that provides Safety Certification, Cybersecurity Protection and Compatibility with leading defence and aerospace systems
- 04** **Easy-to-Use A(P)I** Reduce Development Costs and Risks with an easy-to-use, unified and hardware Independent API

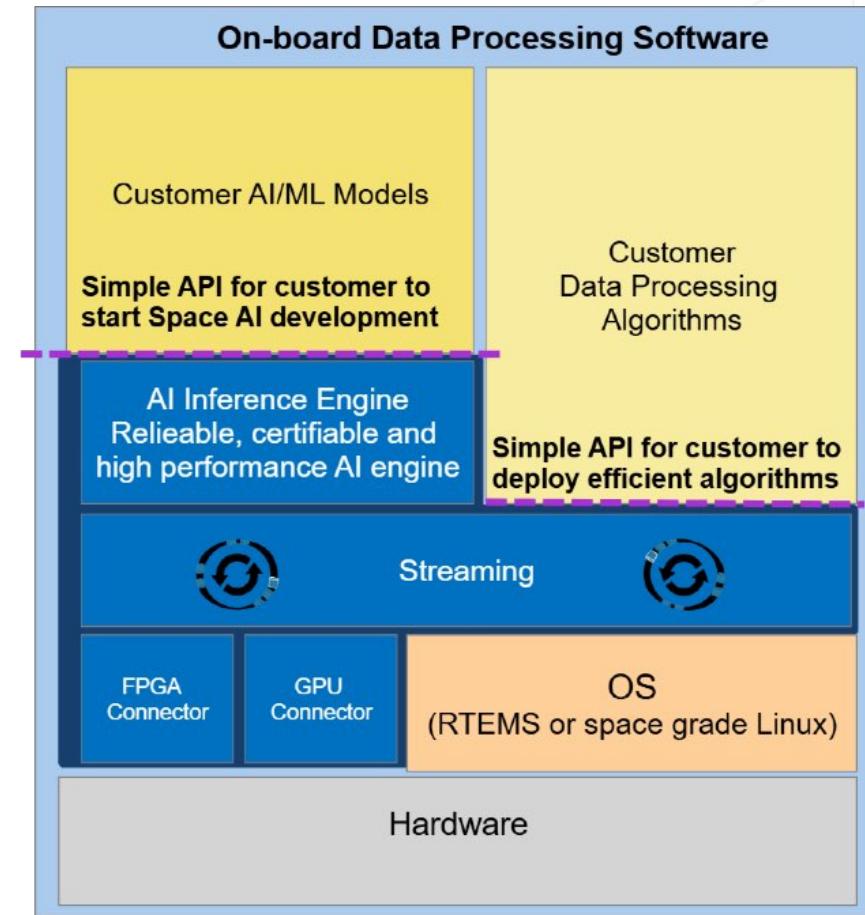
Experience the power of seamless edge computing with our easy-to-use framework, designed to enhance autonomy and intelligence at the edge.

Partnership

Robotics SW running on our SW framework

→ Easy-to-use and reliable Edge Data Processing & Edge AI Platform

- Secure execution
- Flexible platform compatible with all major AI frameworks
- Easy-to-use
- Classical data processing & Edge AI on a single platform



Company Information

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