GSI TECHNOLOGY

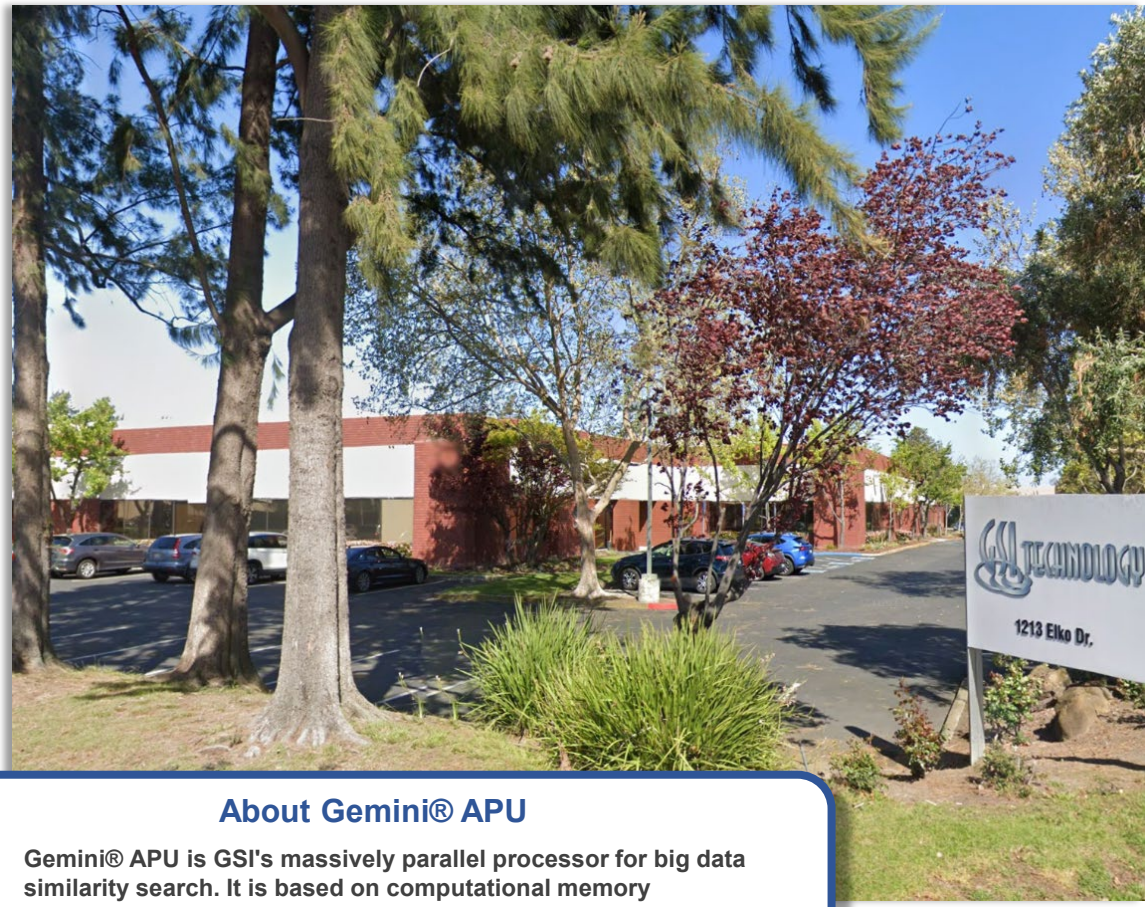
High Performance Memory Technology for Leading-Edge AI Applications

January 2022

ABOUT GSI TECHNOLOGY

26 years of High-End Hardware Experience

- **Founded in 1995**
- **Public Company**
  GSIT
- **~170 Employees Worldwide, US HQ**
  Design/R&D in Sunnyvale, CA, Austin, TX, Atlanta, GA, & Israel; Operations in Taiwan
- **Granted 113 Patents for Innovative Technology**



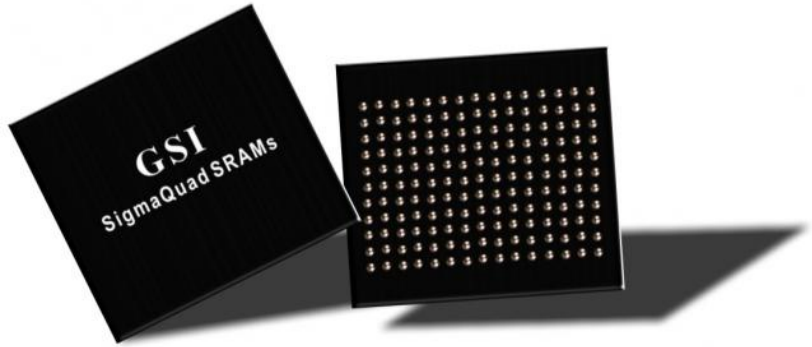
High Performance Memories

GSI is a leading supplier of high-performance memories used in demanding industries, such as aerospace and defense, as well as in high performance datacenters. In 2015, GSI acquired MikaMonu and its associative computing intellectual property.

About Gemini® APU

Gemini® APU is GSI's massively parallel processor for big data similarity search. It is based on computational memory technology. GSI currently holds 51 patents for our associative computing technology.

What We Do



High Performance Processors and SRAM

Aerospace & Defense
Rad-Hard and Rad-Tolerant Memory

Gemini® APU Processor

GSI Rad-Hard Memories

	SYNC BURST & NBT SRAMs Pipeline/Flow Through	SIGMAQUAD-II+ 165 CCGA 165 LGA 165 PBGA
288Mb		GS82612QT19/37 350 MHz/250 MHz
144Mb	GS81320(Z)18/36 333 MHz/250 MHz 144 CQFP	GS81332QT19/37 350 MHz/250 MHz
72Mb	GS8680(Z)18/36 333 MHz/250 MHz 144 CQFP	GS8692QT19/37 350 MHz/250 MHz
36Mb	GS8360(Z)18/36 333 MHz/250 MHz 144 CQFP	
36Mb	GS8360(Z)18/36 333 MHz/250 MHz 100 TQFP	
ALL	Military Temp Range (TJ) = -55°C to +125°C	TID = 300 krads (Si) SEL Immunity > 83 MeV-cm2/mg

In Production

Build upon request

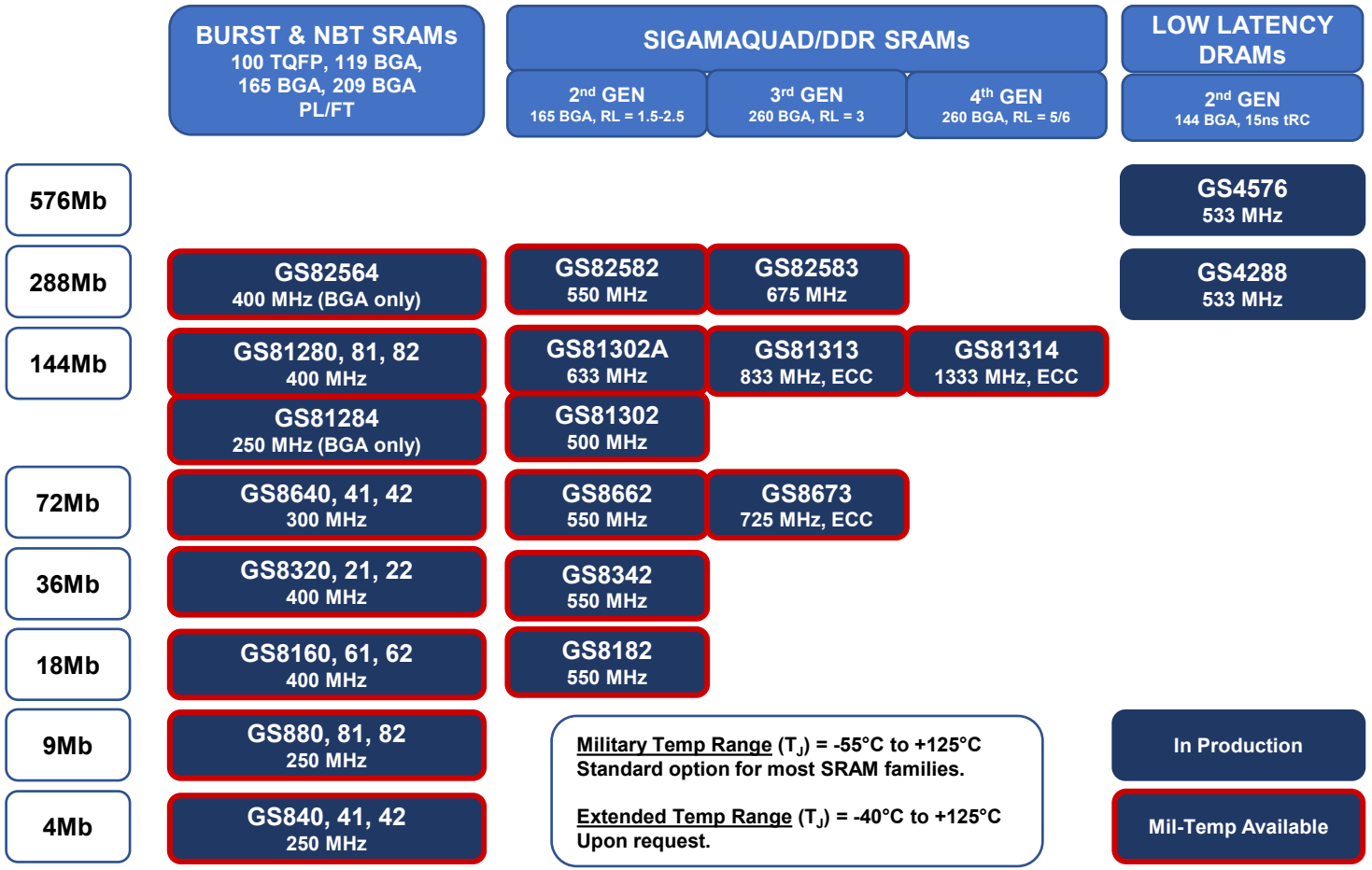
GSI Rad-Tolerant Memories

	SYNC BURST & NBT SRAMs Pipeline/Flow Through 100 TQFP	SIGMAQUAD-II+ 165 PBGA
288Mb		GS82582QT19/37 350 MHz/250 MHz
144Mb	GS81280(Z)18/36 333 MHz/250 MHz	GS81302QT19/37 350 MHz/250 MHz
72Mb	GS8640(Z)18/36 333 MHz/250 MHz	GS8662QT19/37 350 MHz/250 MHz
36Mb	GS8320(Z)18/36 333 MHz/250 MHz	
ALL	Military Temp Range (TJ) = -55°C to +125°C	TID = 50 krads (Si) SEL Immunity > 44 MeV-cm2/mg

In Production

Build upon request

GSI Military and Extended Temp Memories



ABOUT THE APU FAMILY

A non-Von Neumann processing, and similarity search accelerator capability.

Leveraged state-of-the-art SRAM design to create APU technology.

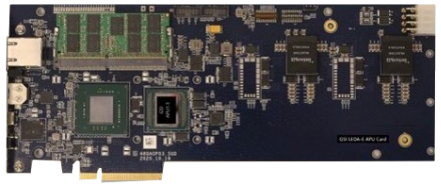
GSI Servers Based
Leda E & Leda S Cards

GSI-G-2U
High performance 8 APU server

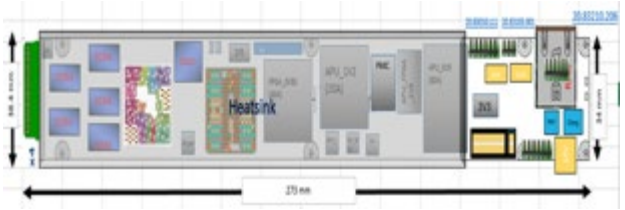
GSI-S-1U
Extreme performance 16 APU server

GSI APU PCI Cards
Server & Standalone

LEDA-E
Full size extreme performance



LEDA-S
SSD E1.L form factor



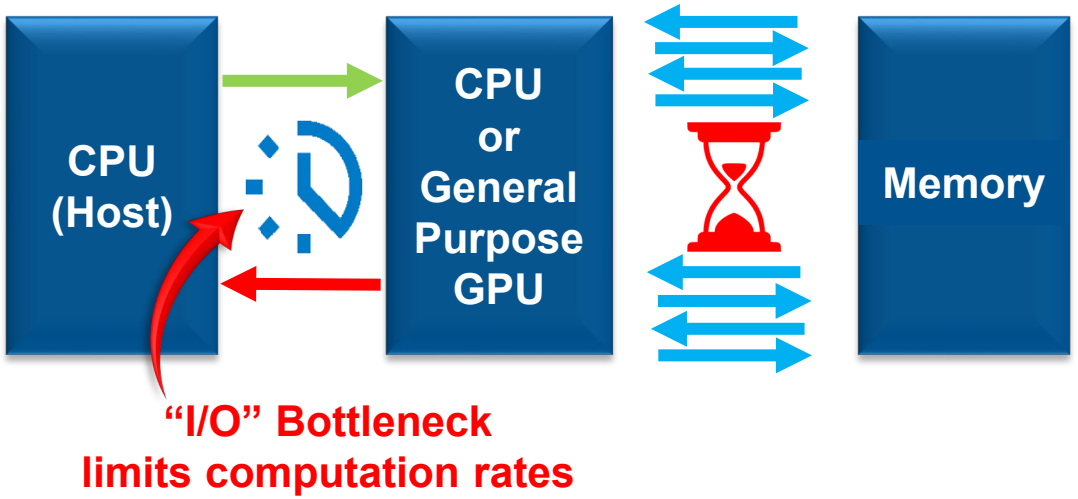
GSI Gemini 1 Chip

APU 1.3 500 MHz*

*Roadmap item

AI PROCESSING LIMITATIONS

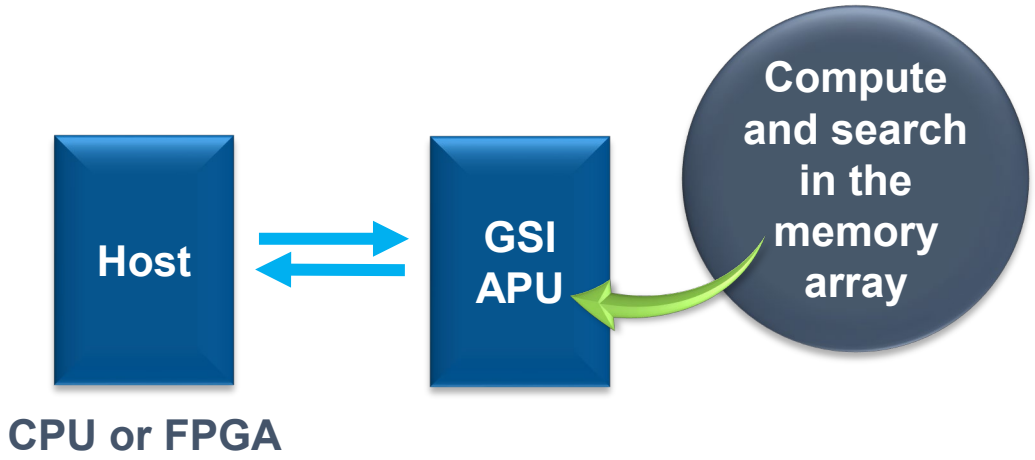
Von Neumann Architecture Creates a Massive I/O Bottleneck



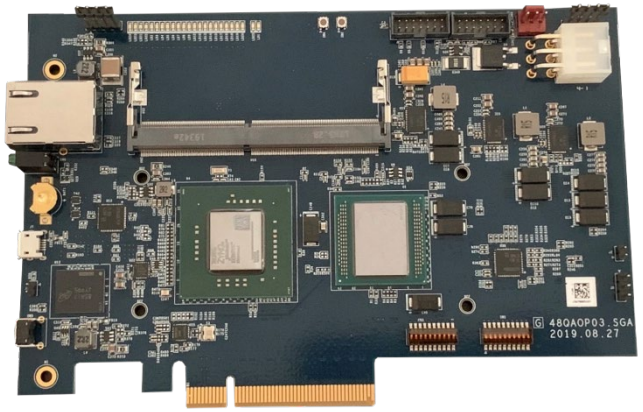
- CPU/GPU limited by "von Neumann" bottleneck with large datasets
- Slower computation rates due to throughput limitations
- Significant power consumption

GSI APU REMOVES BOTTLENECK

A Revolutionary Computing Model



APU on Leda-G Board



- In-memory processing **reduces computation time** from minutes to seconds, milliseconds, or microseconds
- Significantly **reduced power consumption** and total cost of ownership
- Massive parallel data processing with **2 million-bit processors** per chip versus 1,000's in a GPU
- **Scalable—**uniquely lower power scalability and low latency

TARGET APPLICATIONS

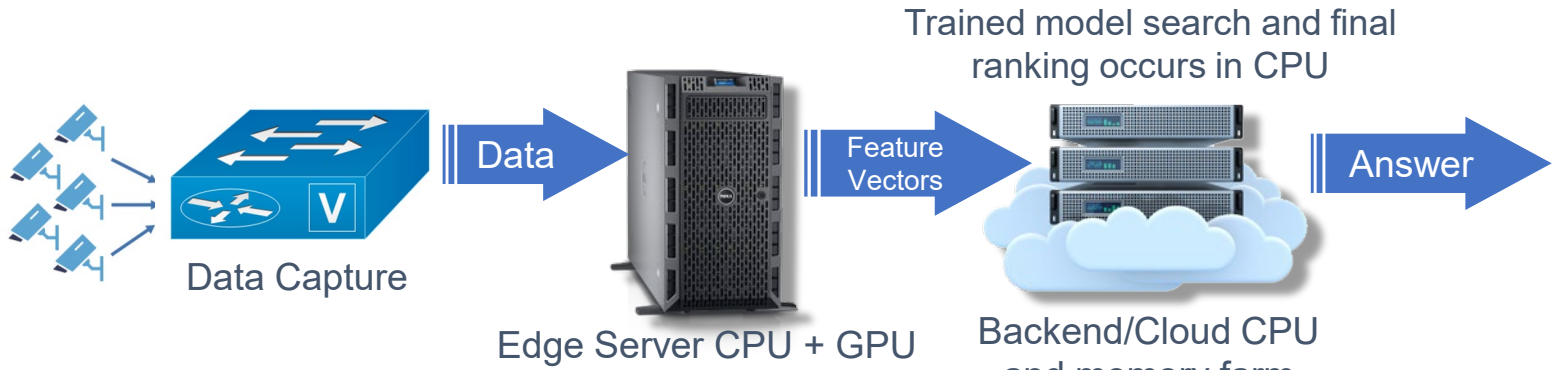
GSI APU Excels in Similarity Search

Search Markets	Nvidia GPU Google TPU Intel HABANA Graphcore IPU	CPU	FPGA	GSI APU
Facial/Object Recognition SAR, ATR Dense Registration Signal Classification Re-Identification Cryptography Visual & Video Search Elastic, AWS Open Search	✗	✗	✗	✓

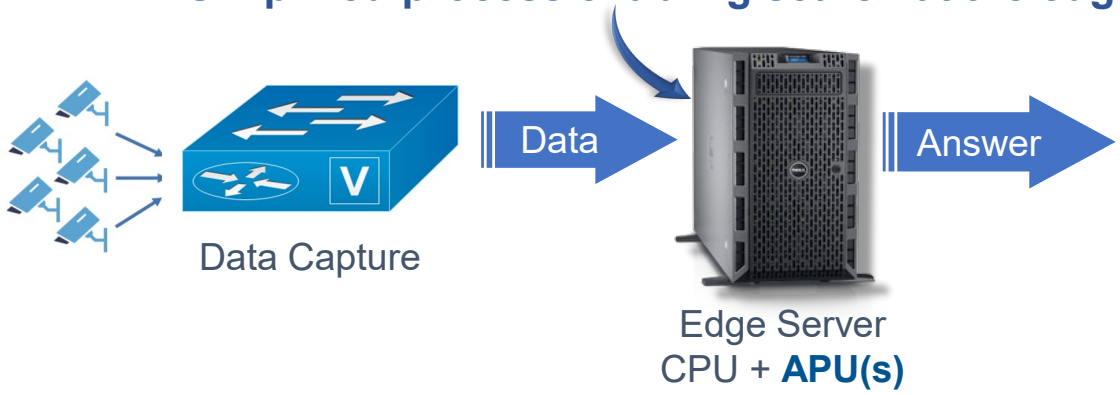
GSI APU outperforms all current search solutions.

REAL-TIME EDGE RESULTS

Traditional Inference Processing vs. APU Local Processing



Simplified process enabling search at the edge with GSI APU



- **Lower latency**
- **Fewer CPU/GPUs needed**
- **Less power used**

THE POWER SAVING SOLUTION EXAMPLE

Comparisons for a 5 Km x 5 Km SAR Image in 1 Second at 0.5 m Resolution

Power Used	84 M KW	19.9 M KW	2.2 M KW
5-Year Total Cost[1]	$13.4 M	$3.2 M	$0.35 M

GSI's APU uses on average **93%** **less power**

Intel Xeon Gold Based
~ 23 cabinets

NVIDIA V-100 based
~ 5 cabinets

GSI APU based
1/3 cabinet and portable

Lower power cost, lower system cost, lower cost overall[1]

1. "Total Cost of Ownership" reflects hardware systems cost plus power cost calculated at average $0.13 per kilowatt hour for US-based systems.

GSI APU IN SPACE

Radiation-Tolerant Onboard Processing

Challenge

Satellites processing massive datasets

- Insufficient bandwidth for transmitting to ground stations causes tremendous daily data loss
- Safe satellite constellation navigation requires rapid response

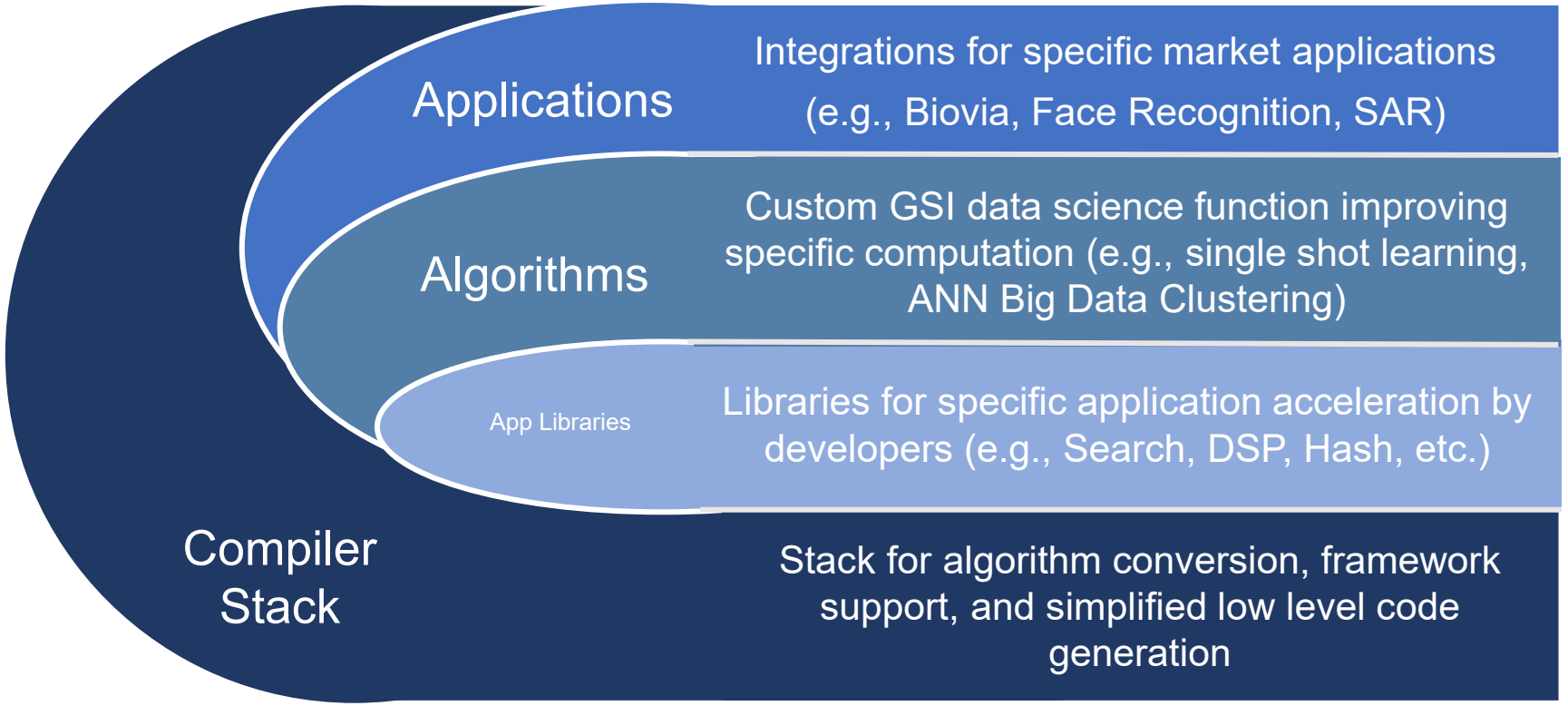
Rad-Tolerant GSI APU Solution

- Onboard AI, multiple data source integration, automatic target recognition, and weather analysis
- Collision avoidance and improved communications

GSI APU can provide in-sat near real-time processing capability.

APU SOFTWARE AND ALGORITHMS

GSI has turn-key solutions, software integrations, and tools for custom development.



Thank You!