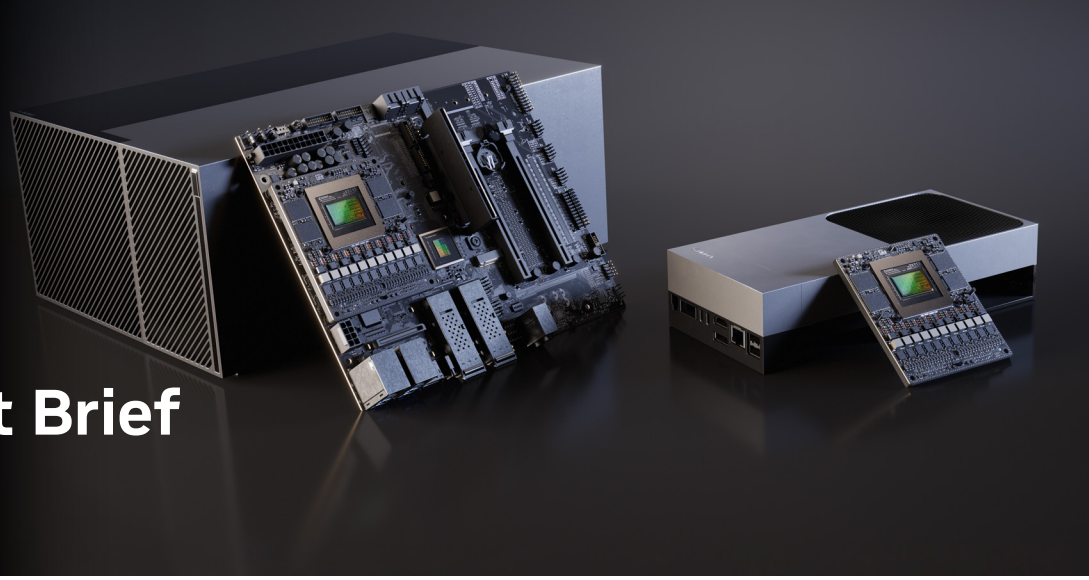
Solution Overview

NVIDIA IGX Safety Product Brief



NVIDIA IGX, coupled with Halos OS, provides the foundations for robotics safety.

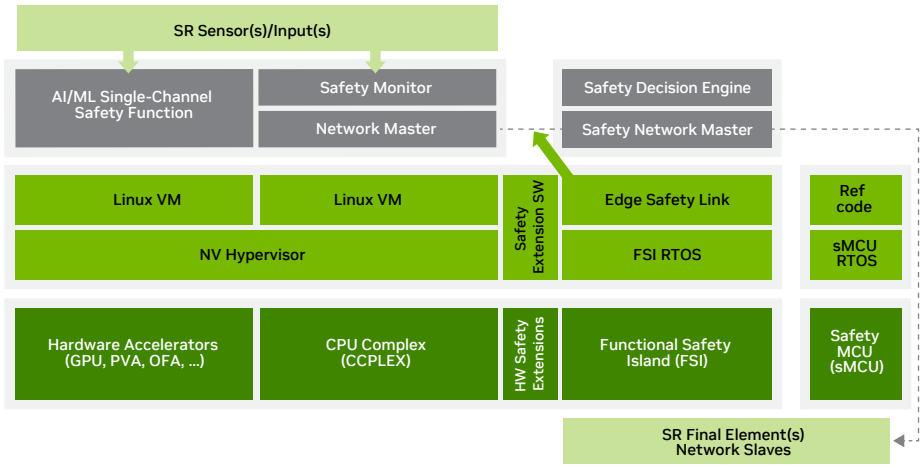
The safety support in the NVIDIA IGX™ platform includes:

- **NVIDIA Thor™ SoC Safety Extensions:** The hardware features for fault detection and control implemented in the NVIDIA IGX platform.
- **Thor Functional Safety Island (FSI):** An independent, redundant set of processors with onboard memory implemented in the NVIDIA Thor SoC, used as a monitoring and safety processor working beside other NVIDIA Thor SoC engines. It has its own power rail and clocks to be maximally independent of other components.
- **Safety Microcontroller Unit (SMCU):** An independent microcontroller located on the carrier board (not on the Jetson Thor SoM) that works in conjunction with the NVIDIA Thor SoC to monitor faults and trigger appropriate safety responses.

The Safety Extensions, FSI, and SMCU are used through NVIDIA Halos OS Core, that includes the Safety Extension Package (SEP) service.

IGX Thor supports two software safety architectures:

- Halos Core Linux, with RTOS on FSI and sMCU
- Halos Core Linux and QNX, which includes NV Hypervisor, supporting a Linux VM and a QNX VM on CCPLEX, with RTOS on FSI and sMCU



IGX and Halos

NVIDIA Halos is a full-stack, comprehensive safety system for autonomous machines that unifies safety elements from vehicle and robot architecture to AI models. It comprises hardware and software elements, tools, models, and the design principles for combining them to safeguard AI-based, end-to-end AV and robotic stacks. At the center of Halos is Halos OS, the software safety operating environment (Halos Core, Halos SDK, Halos Applications, and Halos Infra).

NVIDIA IGX is the Halos AI robotics platform, delivering the highest degree of autonomy while achieving robust levels of safety standards.

NVIDIA Halos AI Systems Inspection Lab (accredited by ANAB) helps to ensure that NVIDIA IGX customers meet rigorous safety and cybersecurity standards through impartial assessments.

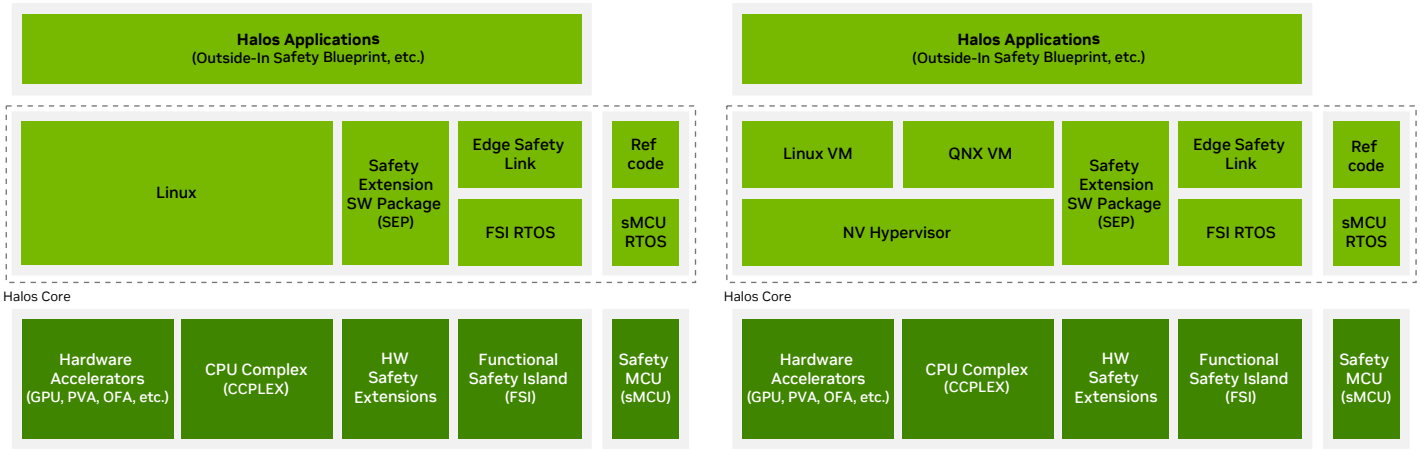
IGX customers get an inspection report and an inspection certificate to be used with technical services or certification agencies for final certification.

NVIDIA IGX Functional Safety Support

SoC Safety Extensions	Halos Core SEP	Edge Safety Link	Safety Collaterals
> DRAM ECC	> Drivers for IST (In System Test)	> A safe and secure interface between IGX and safety-related elements, such as safety-related sensors and actuators	> IGX Thor in Safety-Related Systems Application Note, including how to address standards such as IEC 61508, ISO 13849, ISO 25119, ISO/IEC TS 22440, DO178C, and DO254
> Temperature, clock, and voltage monitoring	> Hardware Safety Manager and Error Collator for monitoring and collating error signals	> The infrastructure on which safety protocols such as FSOE, PROFIsafe, or CIP Safety can be implemented	> Safety Manual and FMEDA
> ARM RAS	> Error Propagation to FSI and NVIDIA IGX sMCU		> Inspection report by TUV Rheinland
> Hardware safety extensions	> Diagnostic monitoring, including Safe State and FuSa State monitoring and heartbeat mechanism at various layers		
> IST (In System Test)			
> FSI (Functional Safety Island)			
> Support for Freedom From Interference (FFI)			

Safety Architecture Examples

Additional examples available in IGX Thor in the Safety-Related Systems Application Note.



NVIDIA IGX Functional Safety Support Summary

- **Avoidance of systematic failures in hardware.** The process with which IGX SoC has been developed is compliant with ISO 26262 up to ASIL D and compatible up to IEC 61508 SIL 3/SC 3.
- **Avoidance of systematic failures in software.** The process with which Halos Core for IGX has been developed (named “NVIDIA PLC-L3”) is compliant with ISO 26262 up to ASIL D and compatible up to IEC 61508 SIL 3/SC 3.
- **Detection and control of random hardware failures.** Thor SoC meets the applicable ISO 26262 requirements for random hardware integrity of ASIL B and compatible up to IEC 61508 SIL 2 (SIL 3 for Safety Island).

Ready to Get Started?

Learn more about NVIDIA Halos for robotics.