



# DRIVE AGX Orin Development Platform

August 2023





# Overview

- [DRIVE Platform](#)
- [DRIVE OS](#)

[Link to Latest Online PDF Version](#)

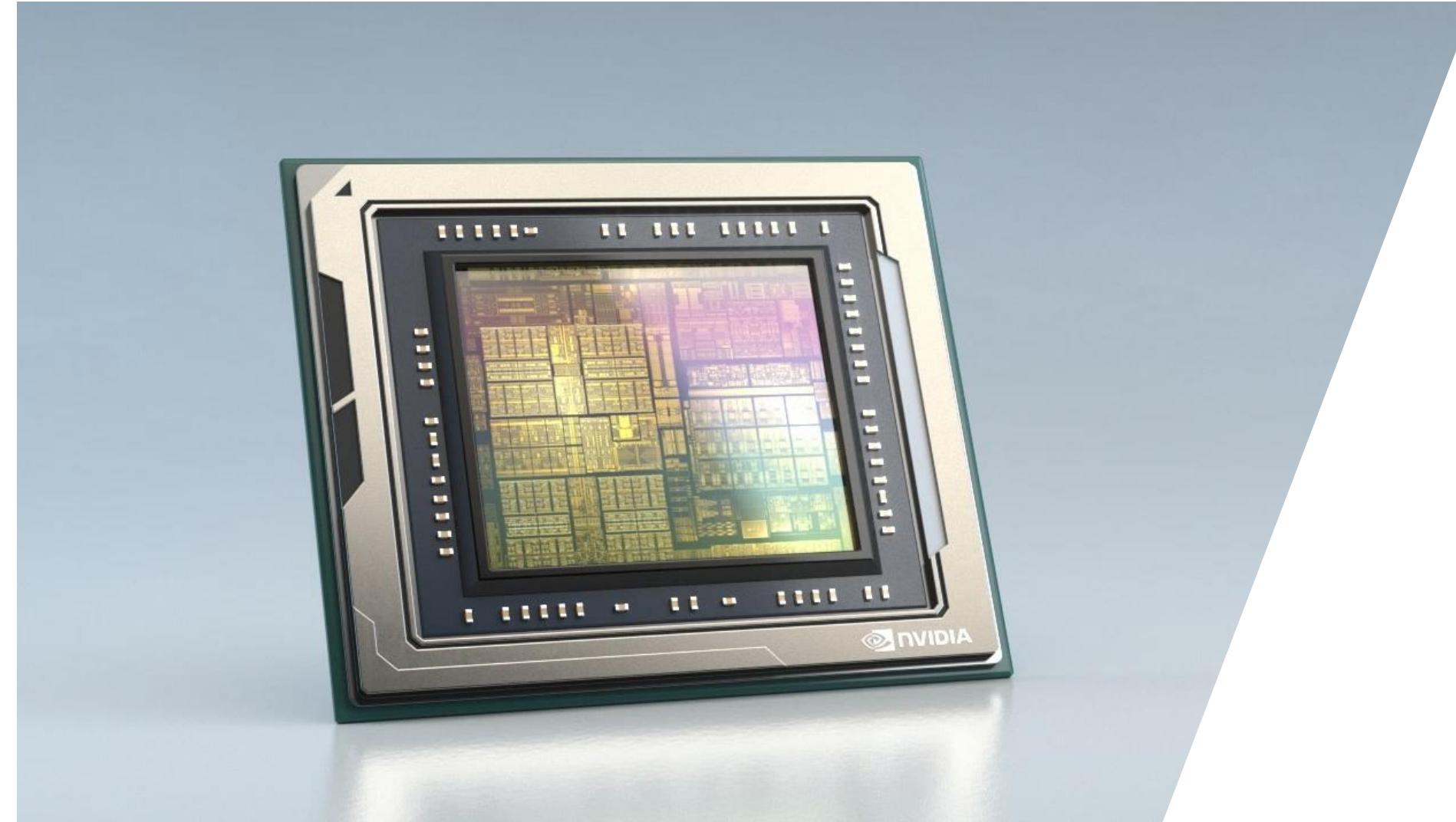


The background of the slide is a dynamic, abstract composition. It features a multitude of thin, elongated streaks in various shades of green and white, set against a solid black background. These streaks are oriented diagonally, creating a sense of movement and depth. Some streaks are sharp and distinct, while others are blurred, suggesting a long-exposure or motion-captured effect. The overall aesthetic is modern and technological.

**DRIVE Platform**



# NVIDIA DRIVE End-to-End Solutions for Autonomous Vehicles

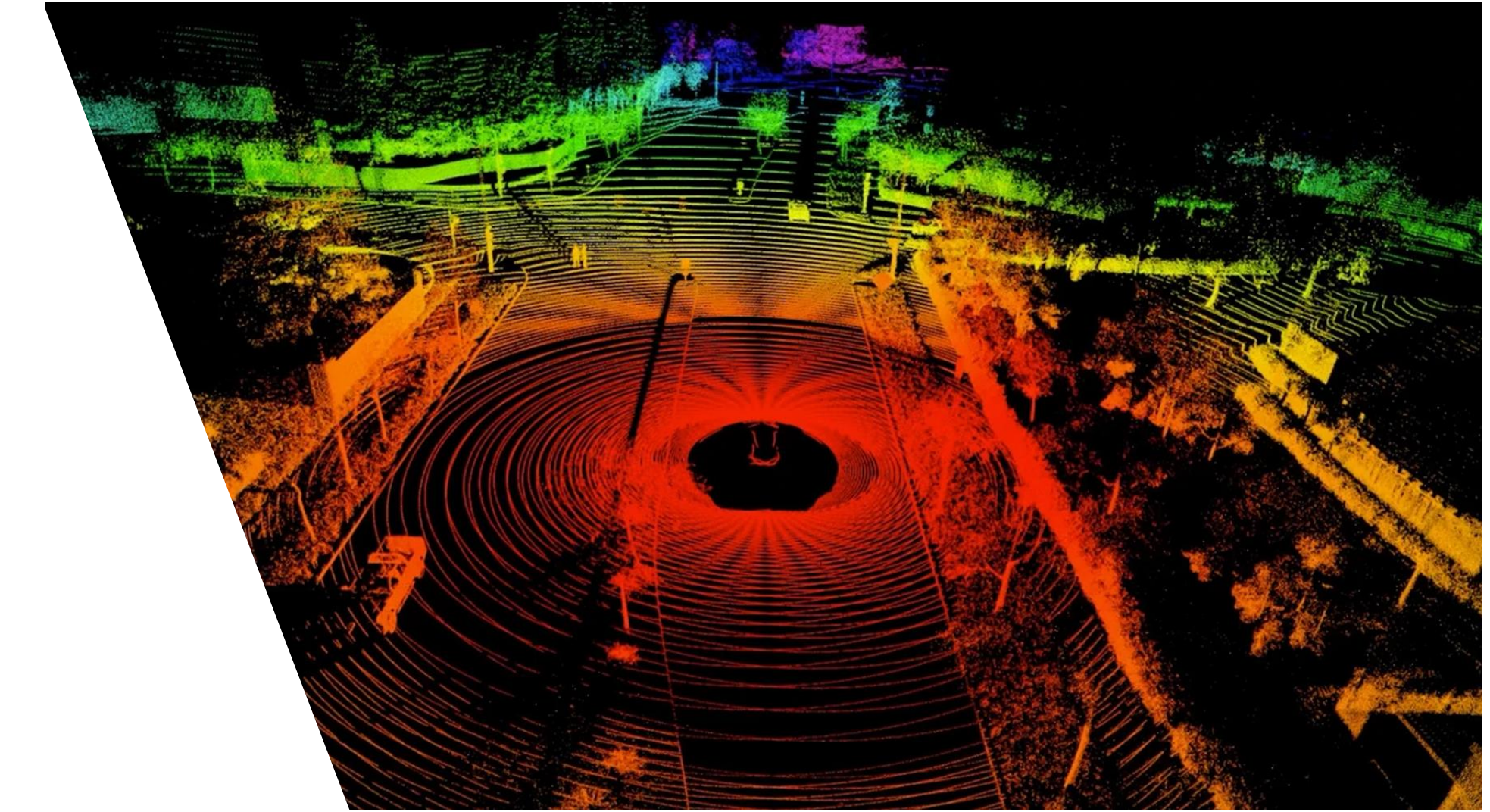


**DRIVE Orin SoC**  
Software-Defined Platform

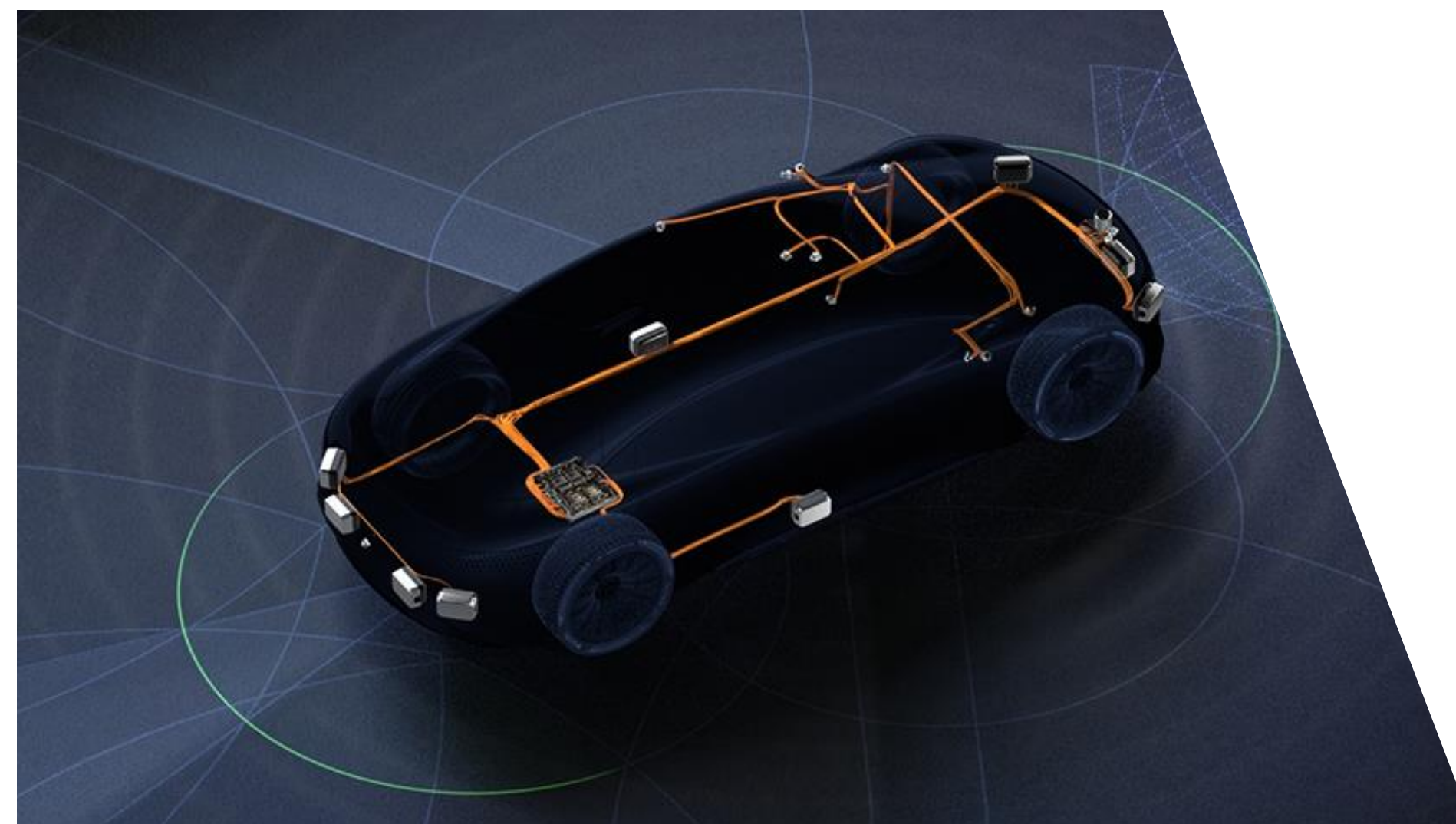


**DRIVE AGX Orin DevKit**  
High-Performance  
Development Platform

[DRIVE AGX Developer Program](#)



**DRIVE OS**  
AV Software Foundation  
OS, CUDA & DriveWorks



**DRIVE Hyperion**  
Reference Architecture  
with Sensor Specification



**DRIVE Sim**  
AV Development and Validation Tools  
Built on NVIDIA Omniverse

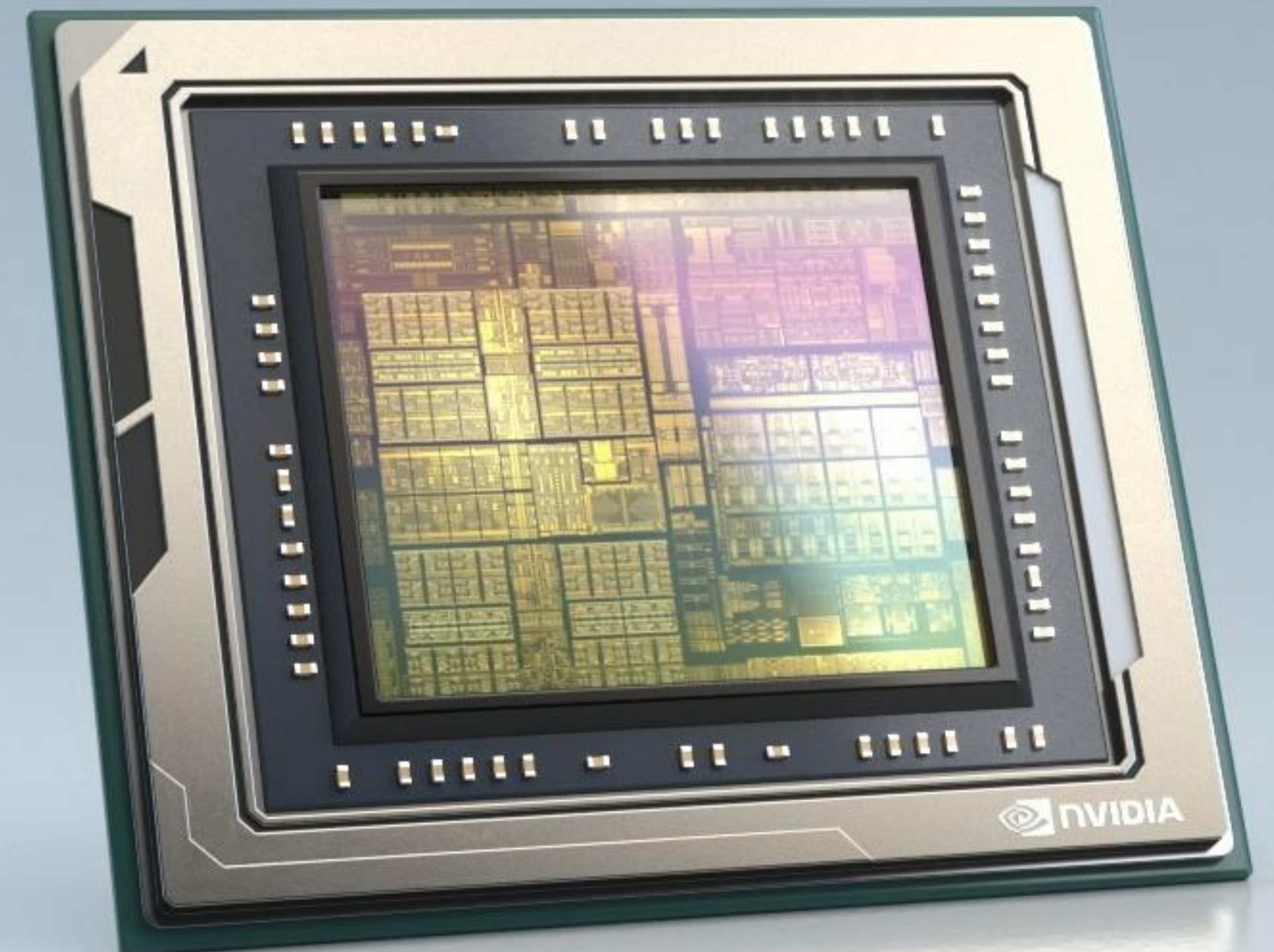
[Early Access Program](#)



# DRIVE Orin SoC

Advanced, software-defined platform  
for autonomous vehicles

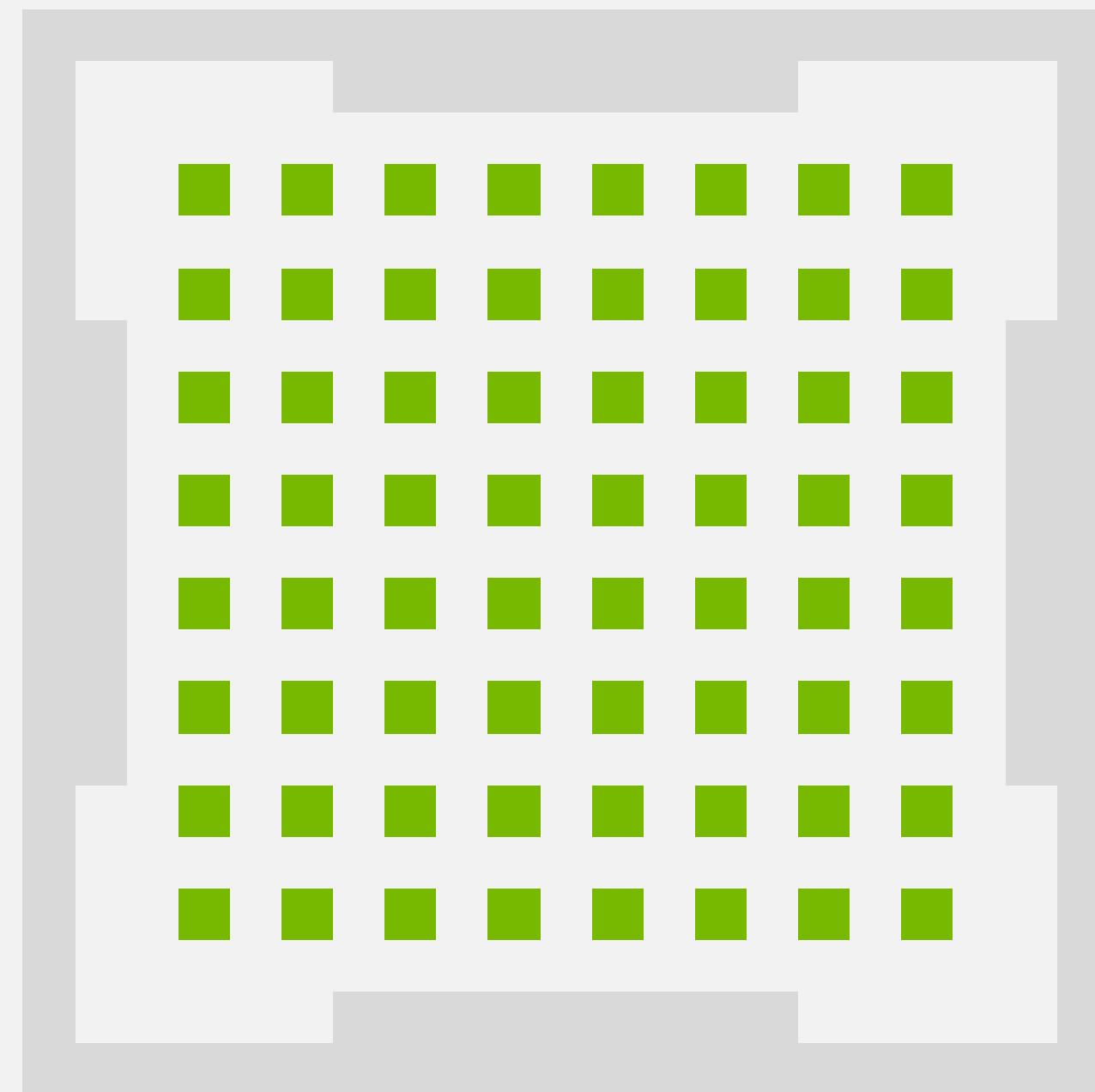
- **254 INT8 TOPS - CUDA Tensor Core GPU + DLA**
- 12 A78 (Hercules) ARM64 CPUs
- 205 GB/s memory bandwidth
- 4 R52 Lock-step Pairs Integrated Safety Island ASIL-D
- ISO 26262 (FUSA) ASIL-B Chip | ASIL-D Systematic
- Hardware Accelerators:
  - Deep Learning Accelerators (DLA)
  - Programmable Vision Accelerator (PVA)
  - Optical Flow Accelerator (OFA)





# DRIVE Orin Hardware Accelerators

Optimal efficiency for diverse workloads

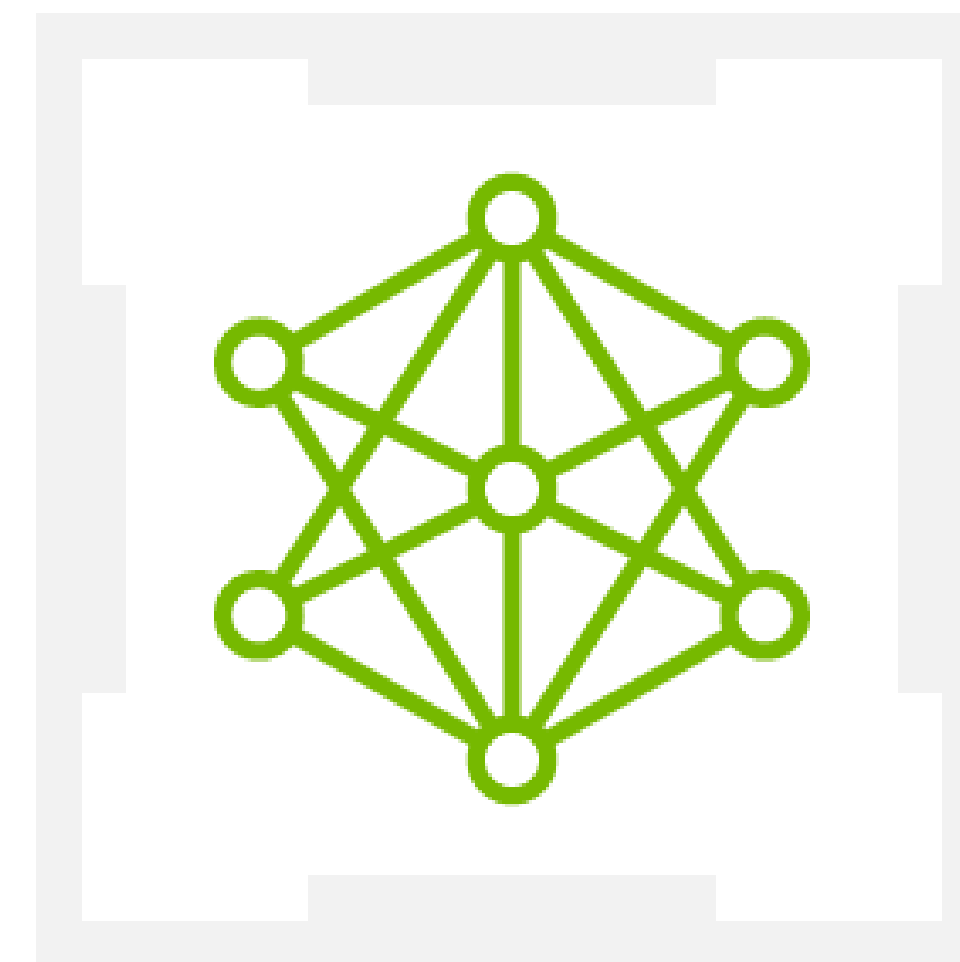


## Ampere GPU

Accelerates All Parallelizable Workloads  
Maximum Performance and Flexibility

Improvements for Orin:  
Increased Performance & Enhanced Tensor Cores

167 INT8 DL TOP/s  
83.5 FP16 DL TOP/s



## 2x Gen2 DLA

Accelerates Deep Neural Networks  
Optimal Performance/Watt for DNNs

Improvements for Orin:  
Depthwise Convolution & Hardware Scheduler

87 INT8 DL TOP/s total



## Gen2 PVA\*

Accelerates Computer Vision Algorithms  
Highly Specialized, Minimal Power Consumption

Improvements for Orin:  
Optical Flow Accelerator & More Performance

2048 INT8 GMAC/s

# Self-Driving Hardware And Software Development Kit

Open & scalable platform purpose built for automotive

## DRIVE AGX Orin DevKit

DRIVE OS – AV SW Foundation  
Auto-grade Silicon & IO  
254 TOPS | 200W



Available Now

Directly from NVIDIA and  
Authorized Distributors Like [Arrow](#)

### Rich IO for Development, Sensors and Vehicle Bus

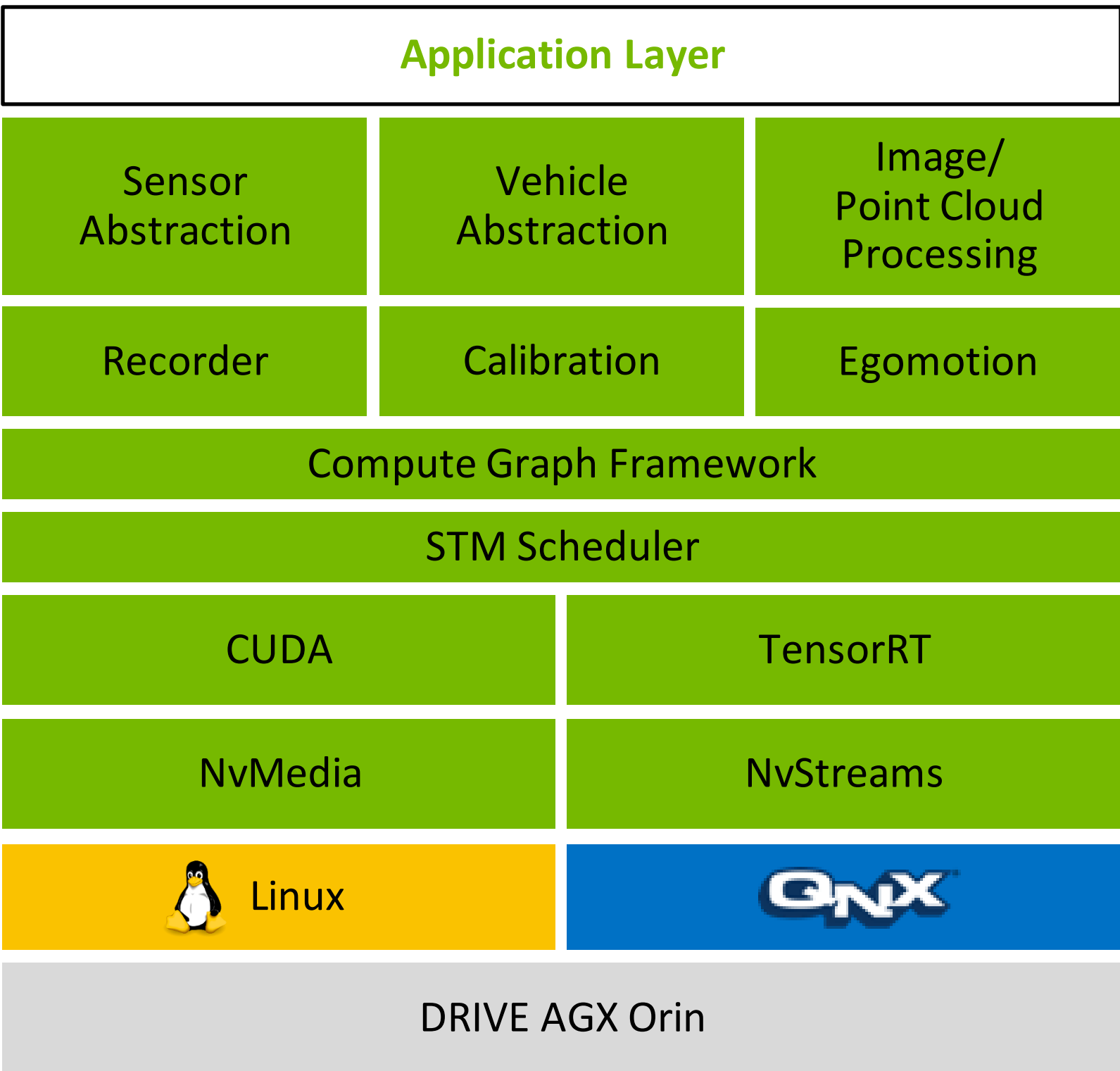
- Vehicle Bus, GMSL, Ethernet, PCIe, USB, DisplayPort, Wi-Fi, Bluetooth
- ISO 26262 compliant sensors supported via partners

### Software Included

- DRIVE OS with DriveWorks
- Middleware, tools and algorithms
- ISO 26262 safety certifiable DRIVE OS  
QNX, drivers, and platform APIs

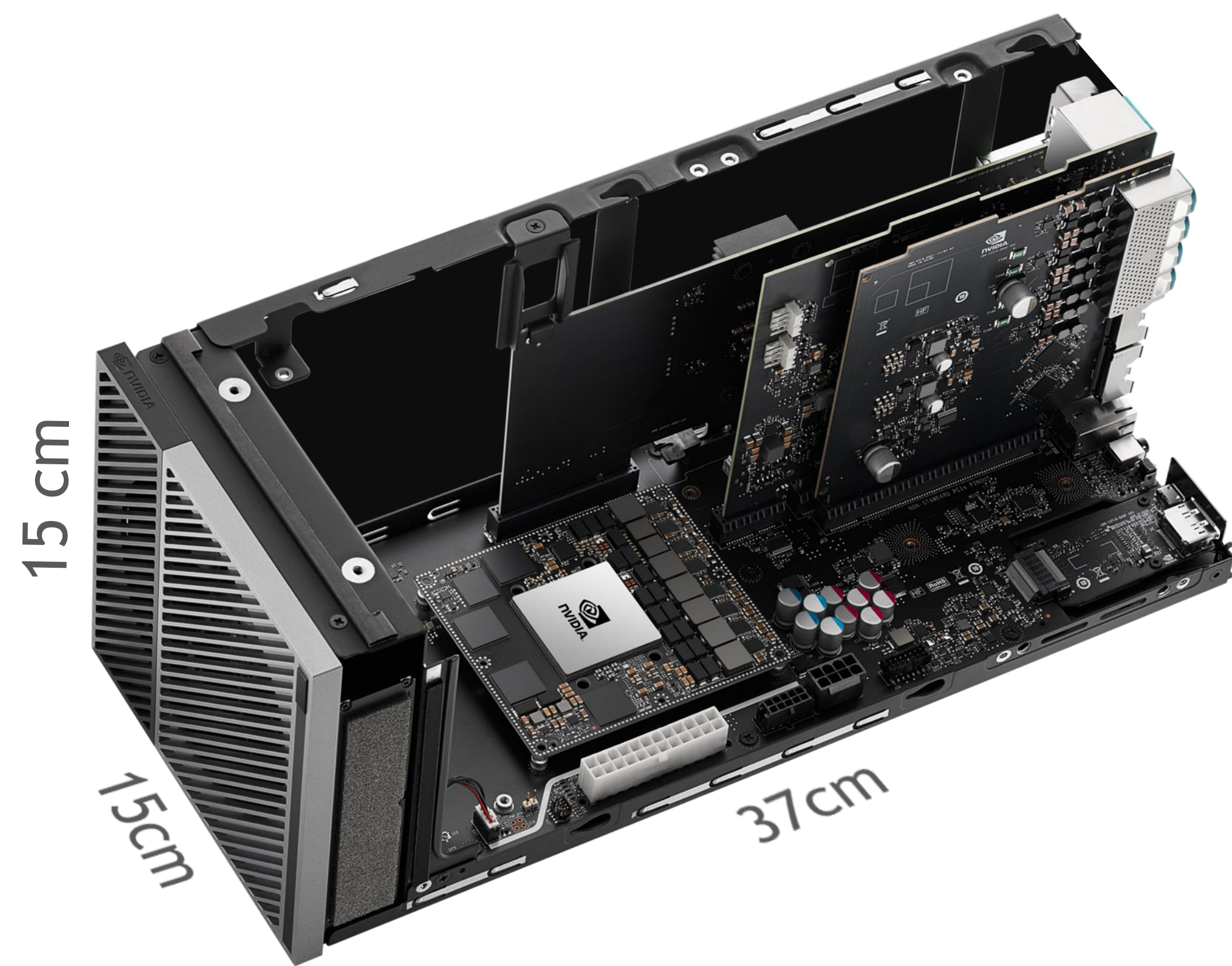
### Safe and Performant Compute Platform

- Orin SoC with CUDA Tensor Core GPU and 12 A78 (Hercules) ARM64 CPUs
- Architected for safety, production boards available via Tier1s





# Spec Overview



Components		
Orin SoC	GPU	Integrated CUDA Tensor Core GPU
	Accelerators	Deep Learning Accelerators (DLA) Programmable Vision Accelerator (PVA) Optical Flow Accelerator (OFA)
	CPU	12 A78 (Hercules) ARM64 CPUs
Safety MCU		Infineon Aurix TC397
Storage		256 GB UFS
Power Supply		Built-in
Wiring Harness		Additional Accessory
Performance		
DL Inference TOPS (INT8)		254 TOPS
Memory Bandwidth		205 GB/s
System RAM		32GB LPDDR5 at 3200 MHz
Operating Parameters		
Temperature		0 to 45°C
Power TDP		200W
Voltage		9V to 16V (Static), 7V to 32V (Transient)



# Auto-Grade and Development Interfaces

Convenient bench development | Reliable in-vehicle operation

Ethernet ~30Gb/s total	2x 10x 6x	10 GbE 1 GbE 100 MbE	1 H-MTD*, 1 RJ45 9 H-MTD*, 1 RJ45 MATEnet*	
Camera	16x	GMSL	MATEAX GMSL 1/2*	
USB	2x 2x	USB 3.2 USB 2.0	Type C Type A	
PCIe**	1x	PCIe x8	Mini-SAS	
Video Out	1x		DisplayPort 1.4	
Wiring Harness (Opt. Accessory)	6x	CAN*	Wiring Harness Connector (DevKit)  DB9 (Wiring Harness)	
	1x	LIN*		
	1x	FlexRay*		
	12x	USS*		

\*Auto-grade connectors    \*\*Can be used to connect Orin DevKits





# Supported Sensors

## Sensors for DRIVE Orin Ecosystem Partners

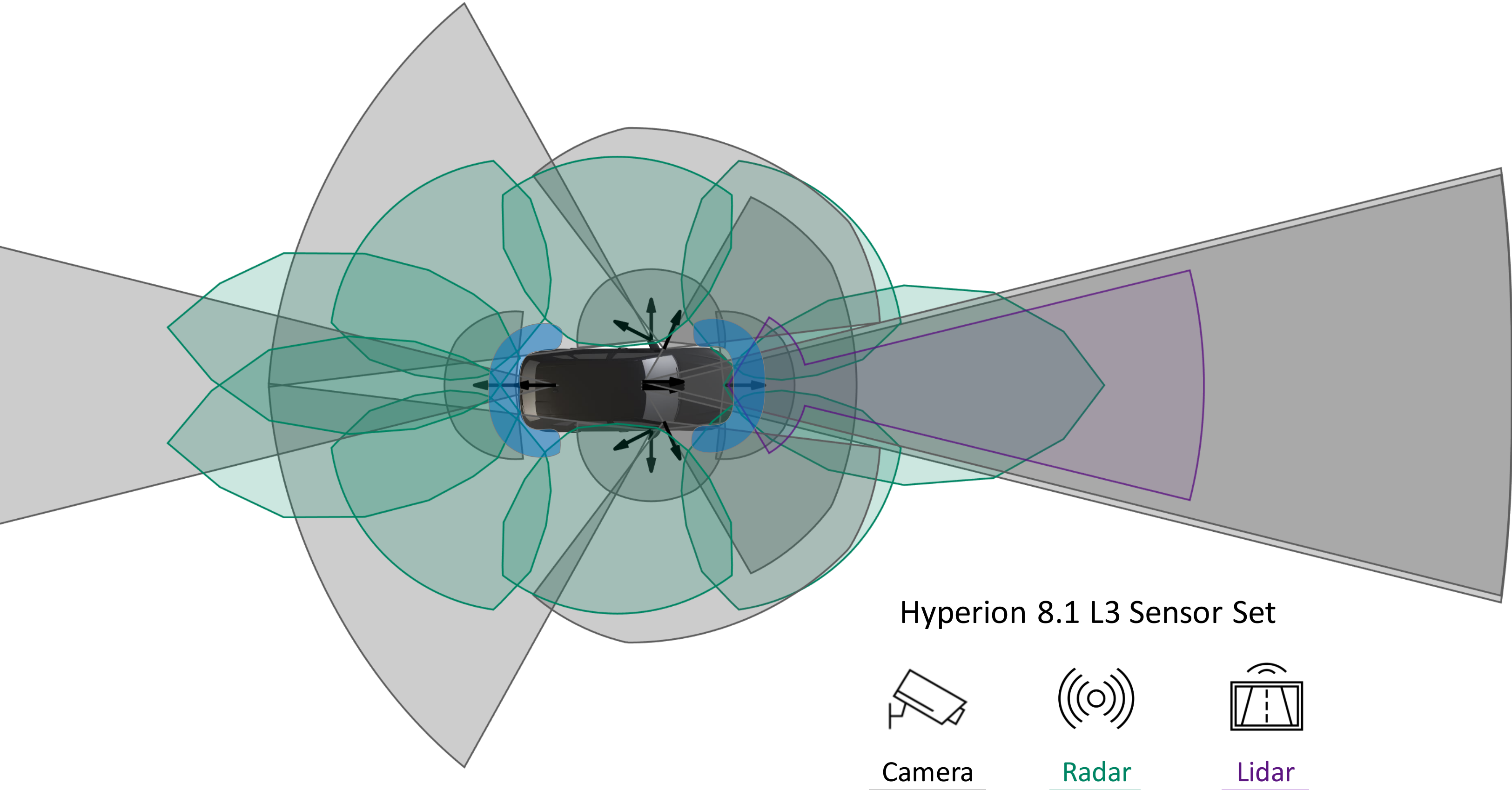
- Sensors supported for ecosystem developers
- See [DRIVE AGX Orin Sensors and Accessories](#) for details

Ecosystem Sensor Vendors

Cameras	Lidars	Radars
<ul style="list-style-type: none"><li>• SONY</li><li>• Leopard</li><li>• Omnivision</li><li>• Entron</li><li>• On Semiconductor</li><li>• Sekonix</li><li>• Quanta</li></ul>	<ul style="list-style-type: none"><li>• Velodyne</li><li>• Luminar</li><li>• Hesai</li><li>• Ouster</li><li>• Innoviz</li><li>• AEVA</li></ul>	<ul style="list-style-type: none"><li>• Continental</li><li>• Arbe</li></ul>

## Hyperion 8.1 Reference Architecture

- Hyperion 8.1 is NVIDIA’s automotive grade L2+ / L3 AV production architecture
- See [DRIVE Hyperion 8.1 Sensors and Accessories](#) for details





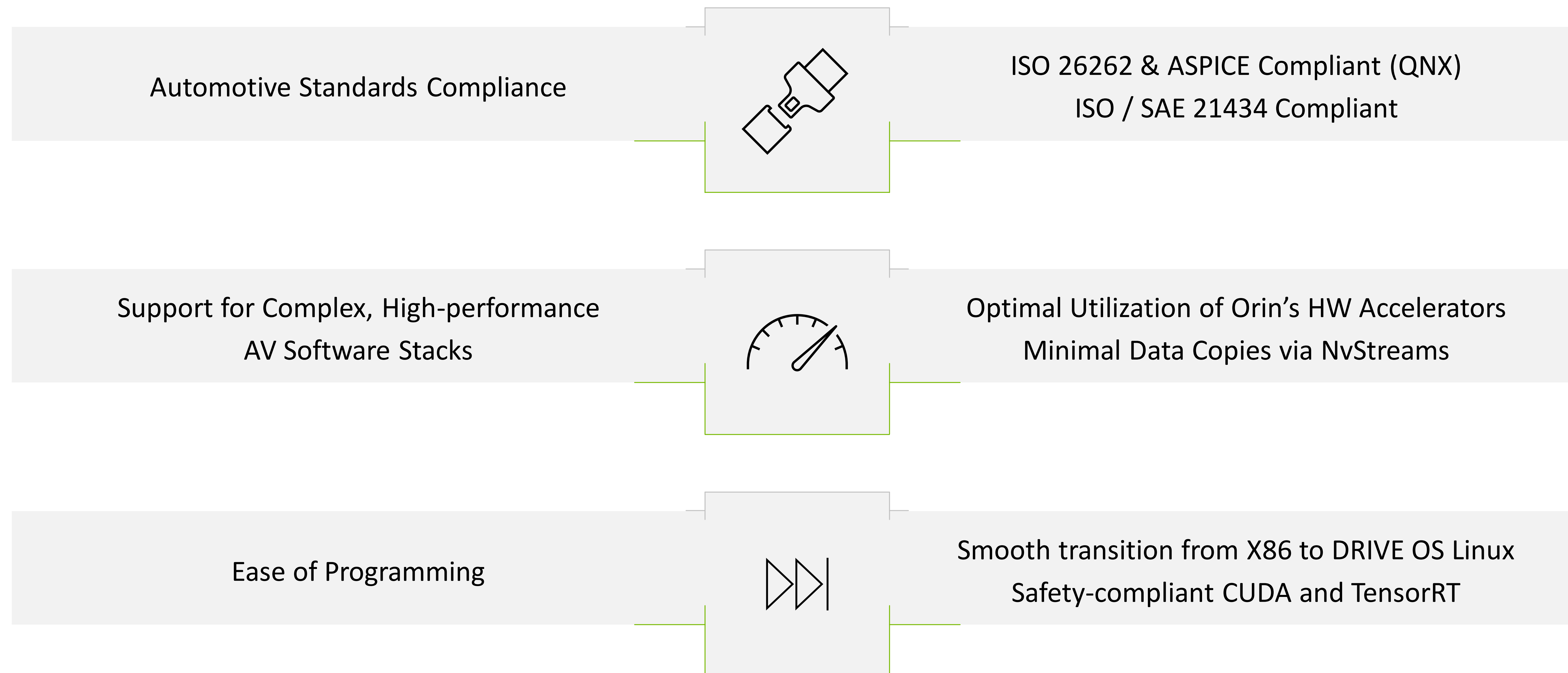
The background is a black field filled with numerous thin, curved, and overlapping lines in shades of green and white. These lines create a sense of motion and depth, resembling a stylized representation of a road or a complex network. The lines are most concentrated in the lower right quadrant, where they form a dense, almost three-dimensional structure that looks like a series of stacked, curved planes. The overall effect is a dynamic and futuristic visual.

**DRIVE OS**



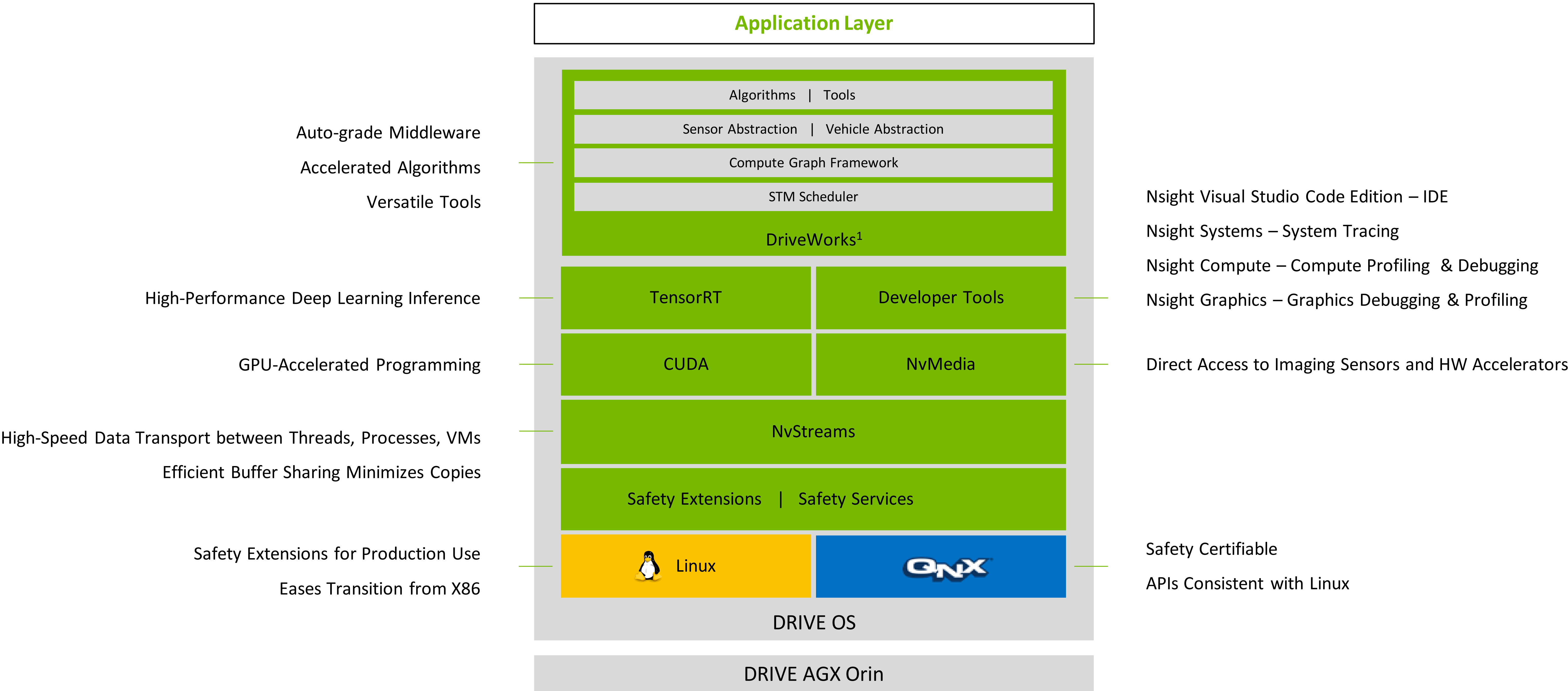
# DRIVE OS – NVIDIA’s AV Software Foundation

Operating system, foundational libraries, and tools for cutting-edge automotive applications





# DRIVE OS Components



[Link to DRIVE OS Documentation](#)

[Link to DriveWorks Documentation](#)

<sup>1</sup> For development only

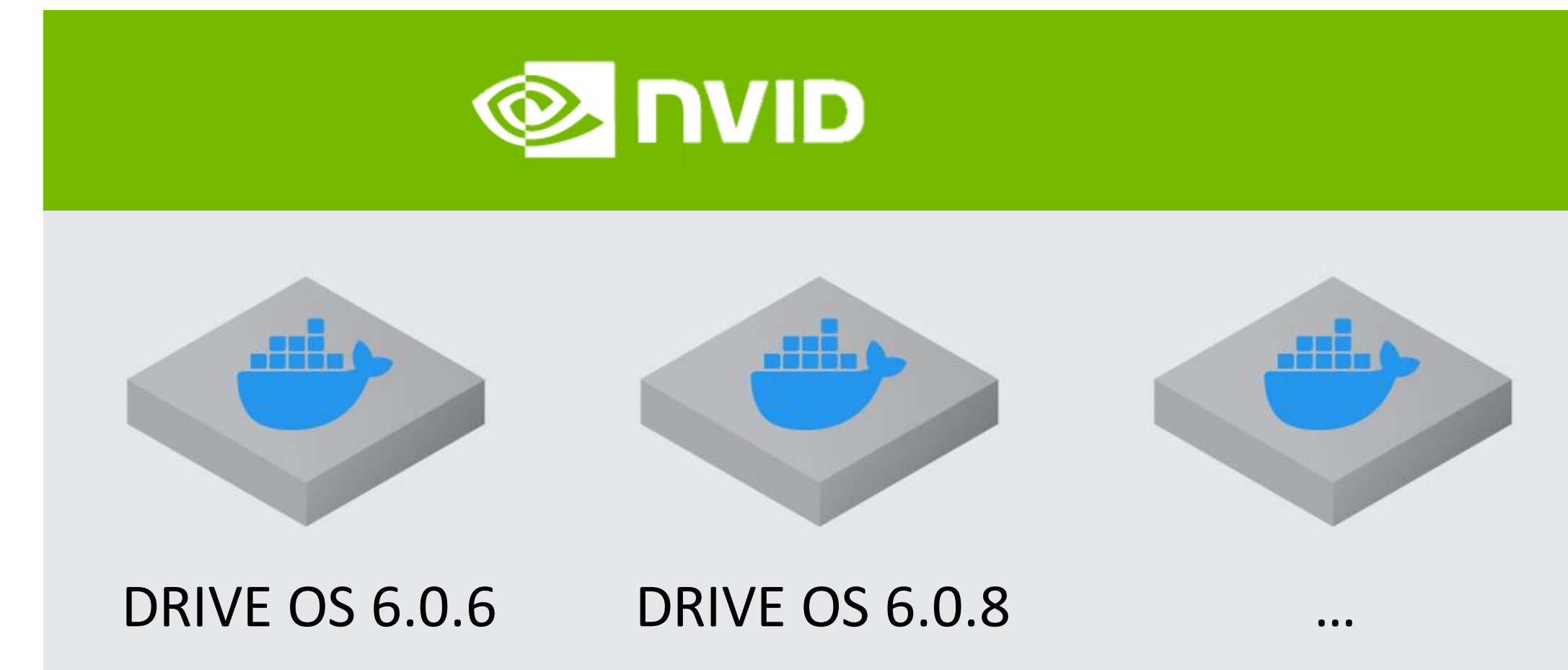


# New with DRIVE OS 6

Smoother development experience | All-new middleware features

## DRIVE OS 6 New Features

- Host and target Docker support
- Linux safety extensions
- Chip-to-chip communication via NvStreams

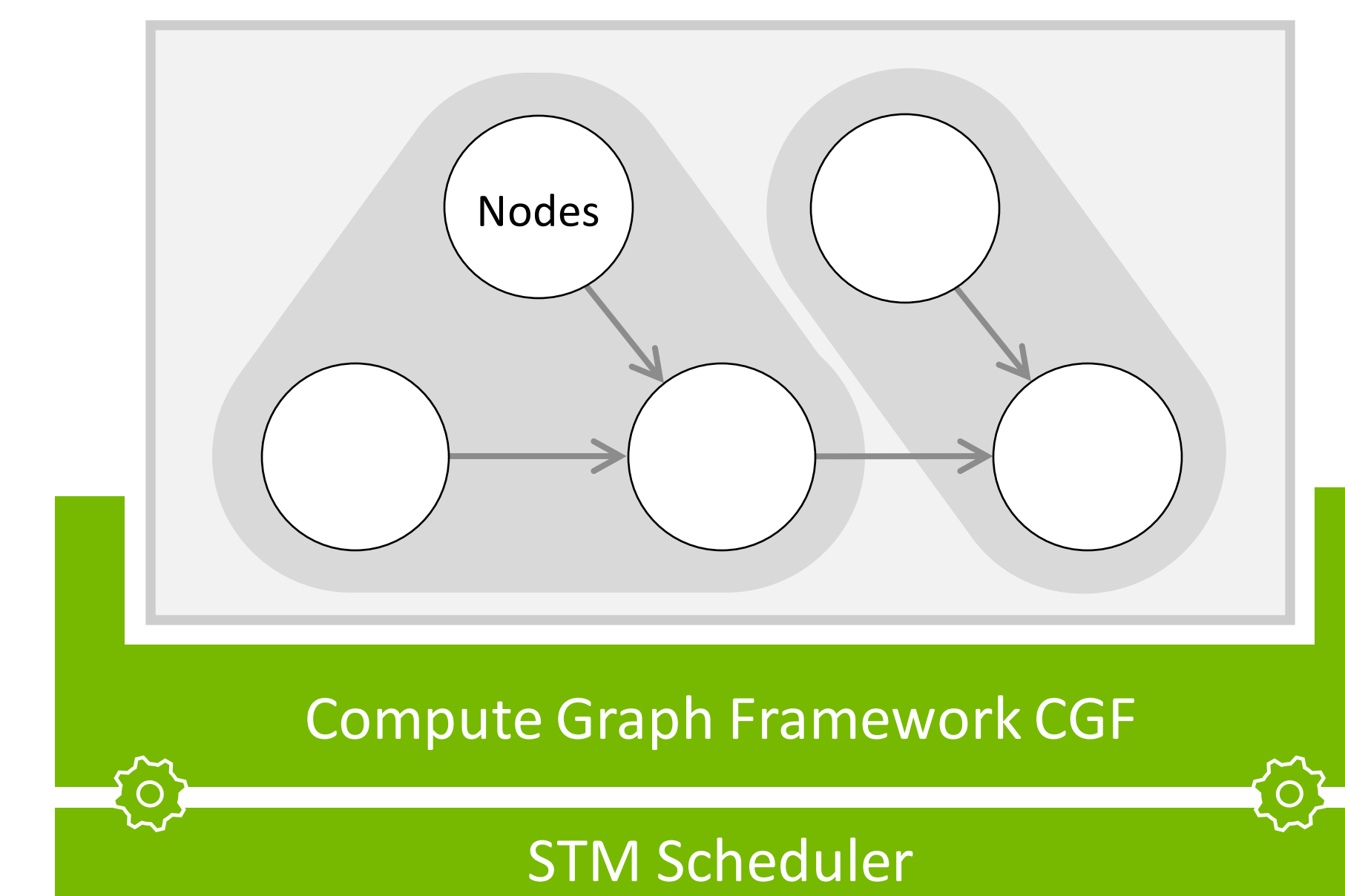


NGC is NVIDIA's Portal of Enterprise Services, Software, and Support for AI, Digital Twins, and High-Performance Computing

## DriveWorks 5 New Features

DriveWorks becomes a full-fledged AV middleware:

- With Compute Graph Framework (CGF), applications can be expressed as graphs and nodes
- System Task Manager (STM) is a static, non-pre-emptive scheduler compiling an optimal schedule for CGF graphs





# DRIVE OS 6 Software Components

Component	Version
Ubuntu Host Development Environment	20.04
Ubuntu Target Root File System <sup>1</sup>	
Linux Kernel <sup>1</sup>	5.10
Blackberry QNX SDP <sup>2</sup>	7.1.1
Blackberry QNX QOS <sup>2</sup>	2.2
QCC Toolchain	8.3
GCC Toolchain	9.3
C++ Feature set	17
DriveWorks <sup>4</sup>	5.x
CUDA Toolkit	11.4
NVIDIA UDA CUDA Driver <sup>1</sup> (x86)	r470
TensorRT	8.x <sup>3</sup>
cuDNN	8.x <sup>3</sup>
Vulkan	1.2
Wayland <sup>1</sup>	1.18
PKCS#11	Y

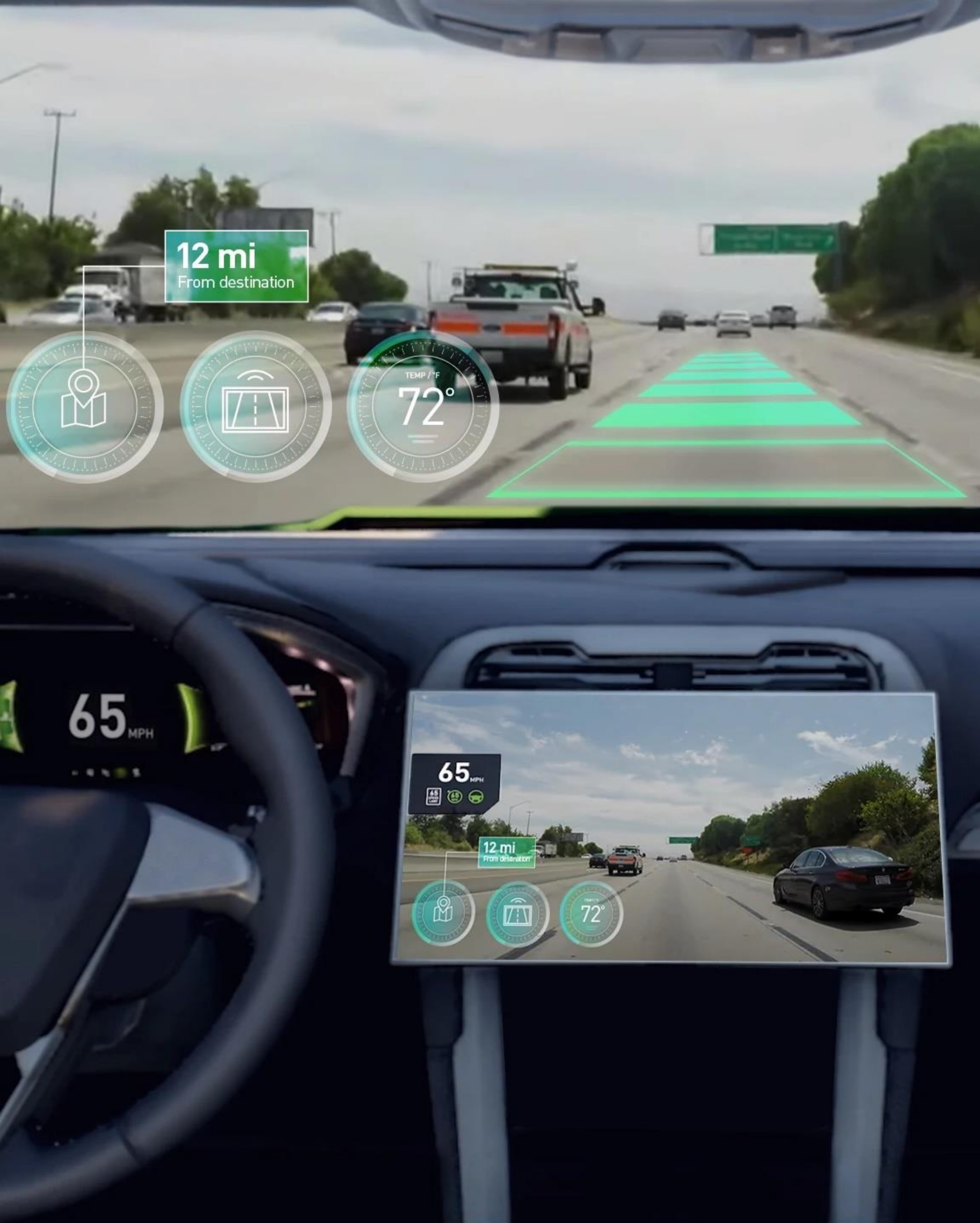
<sup>1</sup> Linux only, not available on QNX

<sup>3</sup> Final version number TBD

<sup>2</sup> QNX only, not available on Linux

<sup>4</sup> For development only





# Why QNX for Safety?

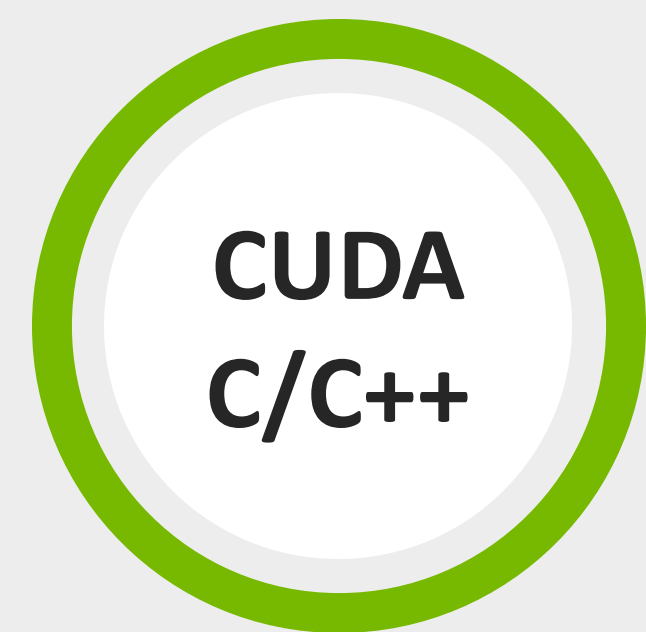
## Safety OS key selection criteria

- ISO 26262
  - ASIL D certified RTOS
  - TCL3 qualified toolchain
- POSIX PSE52 standards certification
  - Requirement for CUDA support
- Common Unix heritage with Linux
  - Rich dependent library support



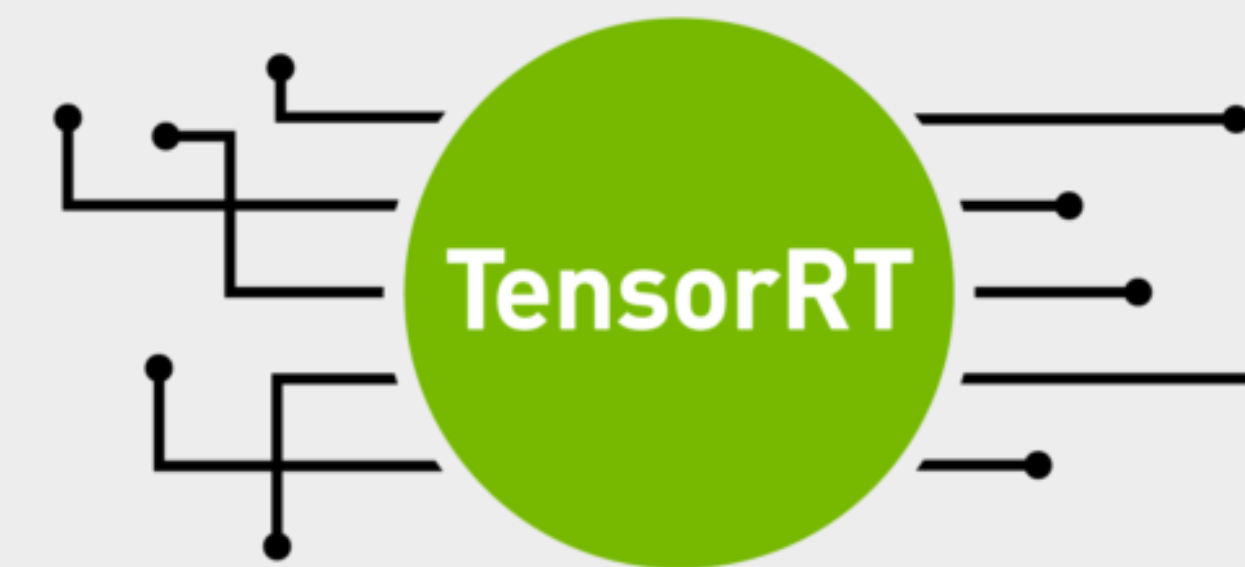
# Hardware Accelerated Compute Engines

Open | Scalable | Seamless | End-to-end



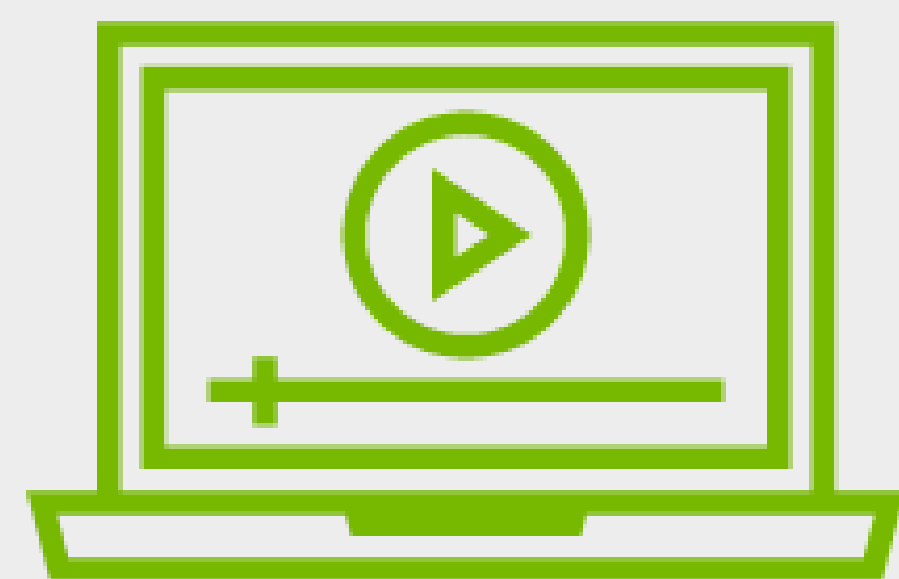
## CUDA

Parallel computing model for compute intensive applications



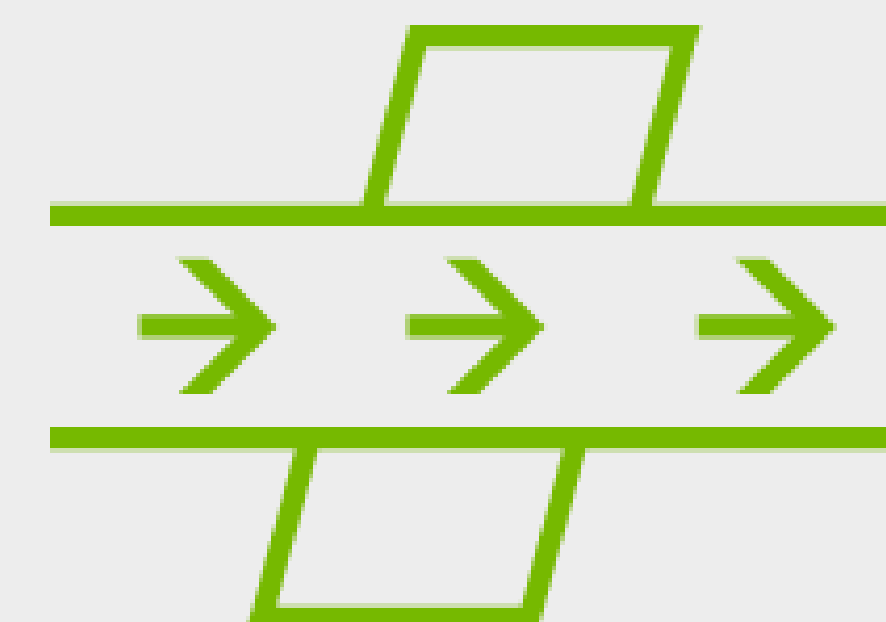
## TensorRT

SDK for high-performance deep learning inference



## NvMedia

Optimized API providing direct access to hardware accelerated compute engines and sensors, support Orin new Optical Flow Accelerator, DLA, AV1 encode & decode



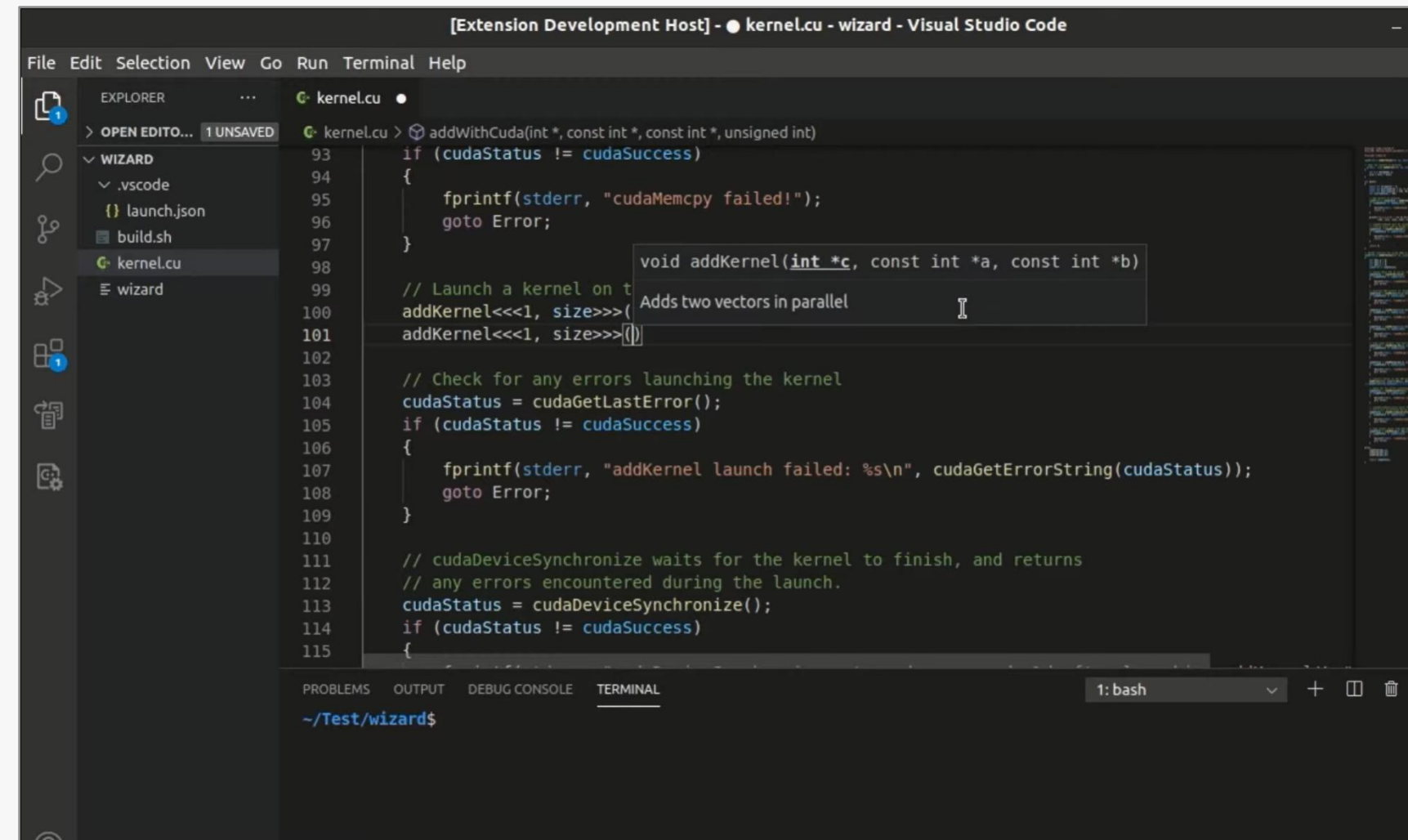
## NvStreams

Highly efficient API enabling access to high-speed data transports, support over PCIe & Mellanox accelerated support across inter-ECU boundaries

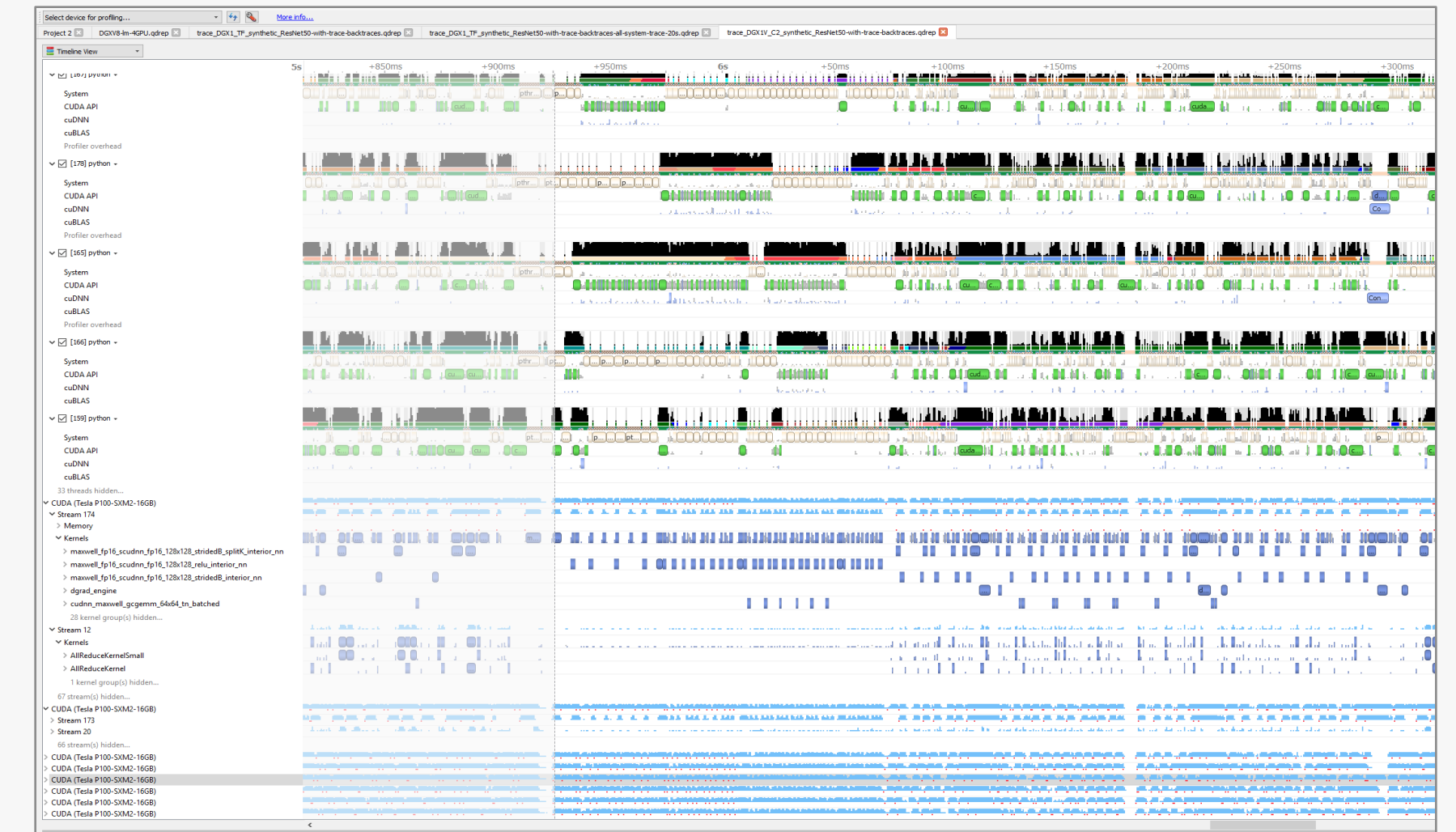


# Nsight Developer Tools

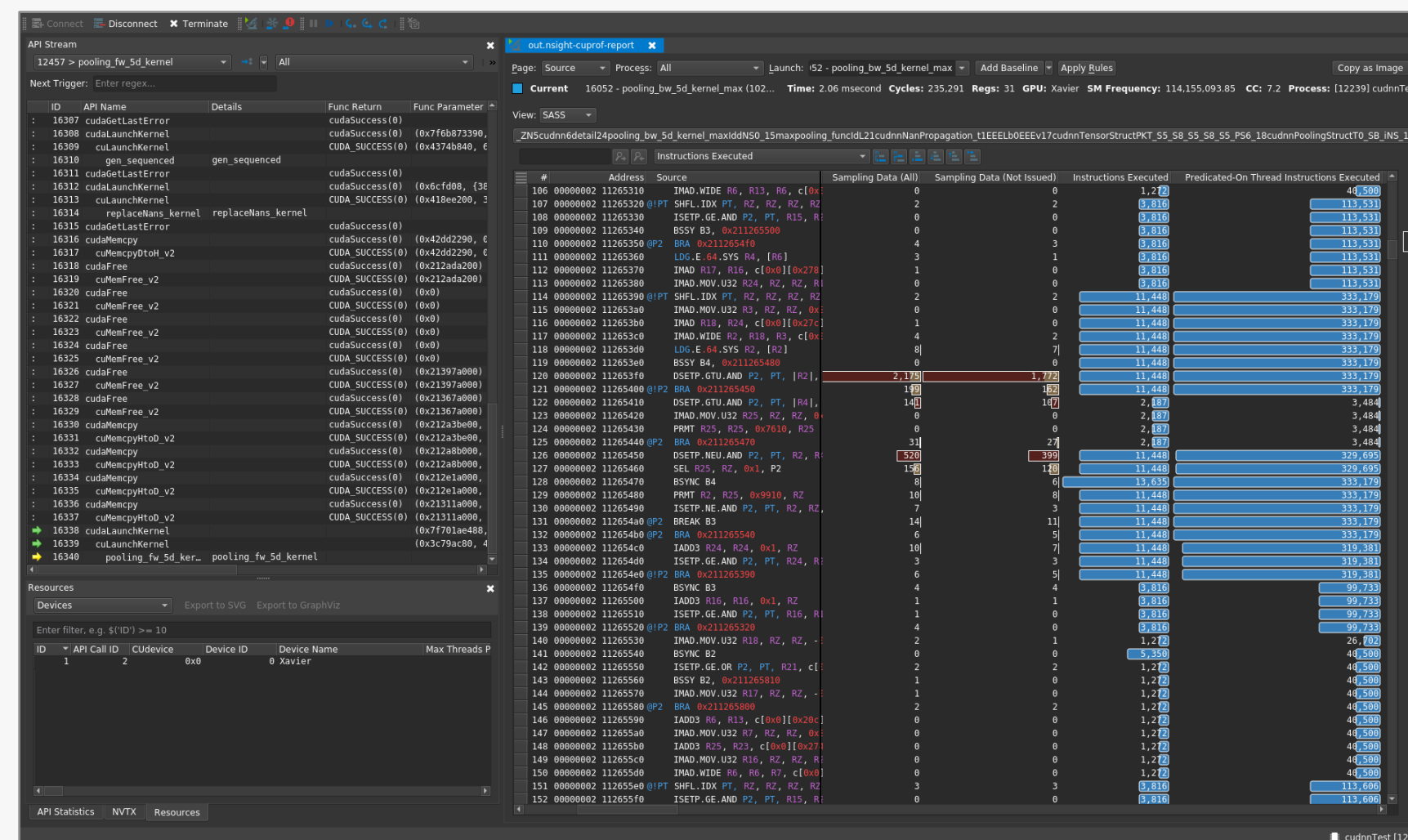
For GPU and CPU software debugging and profiling



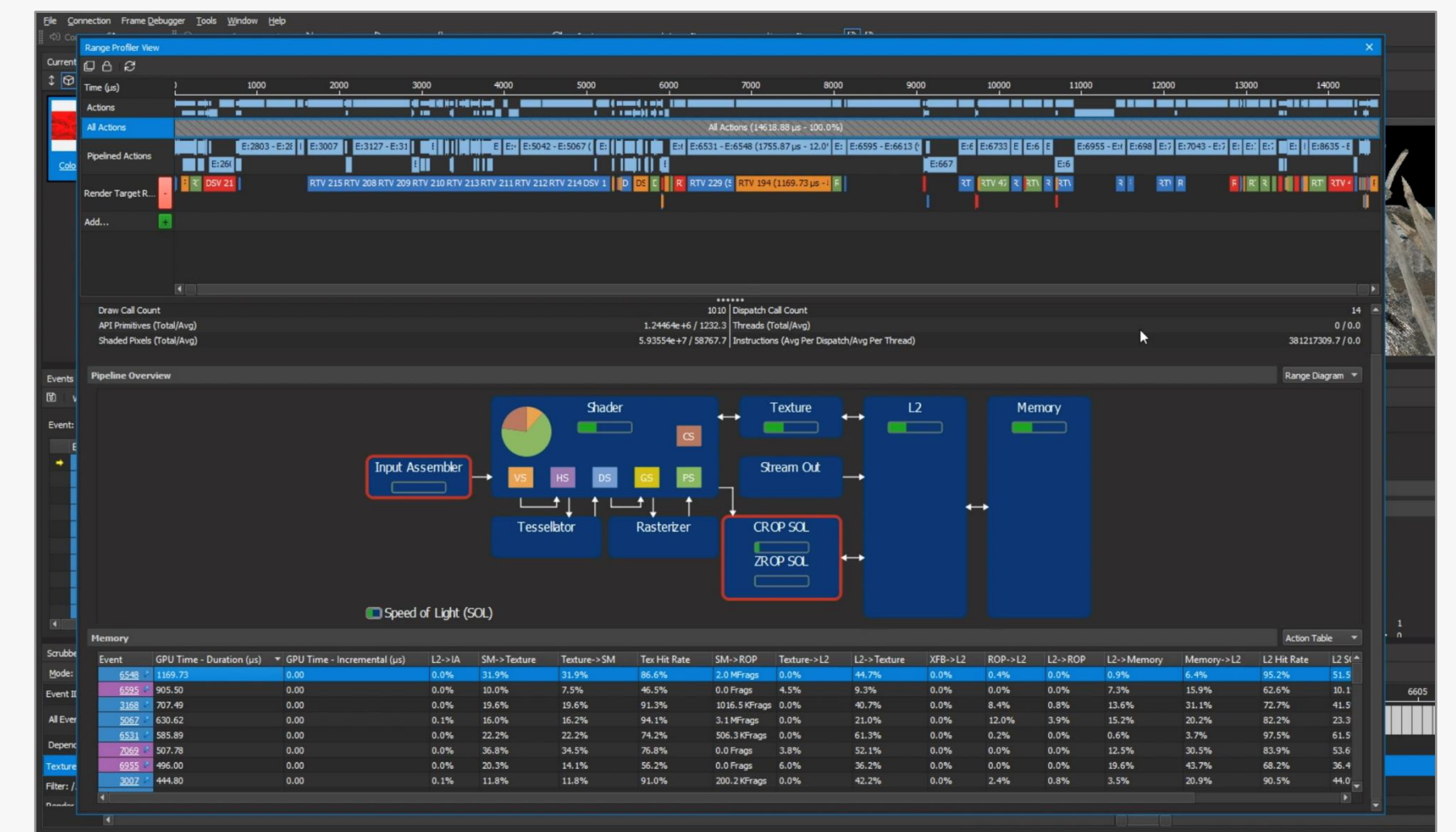
Nsight Visual Studio Code Edition  
IDE GPU application development



Nsight Systems  
System trace



Nsight Compute  
Compute profiling



Nsight Graphics  
Graphics debugging & profiling

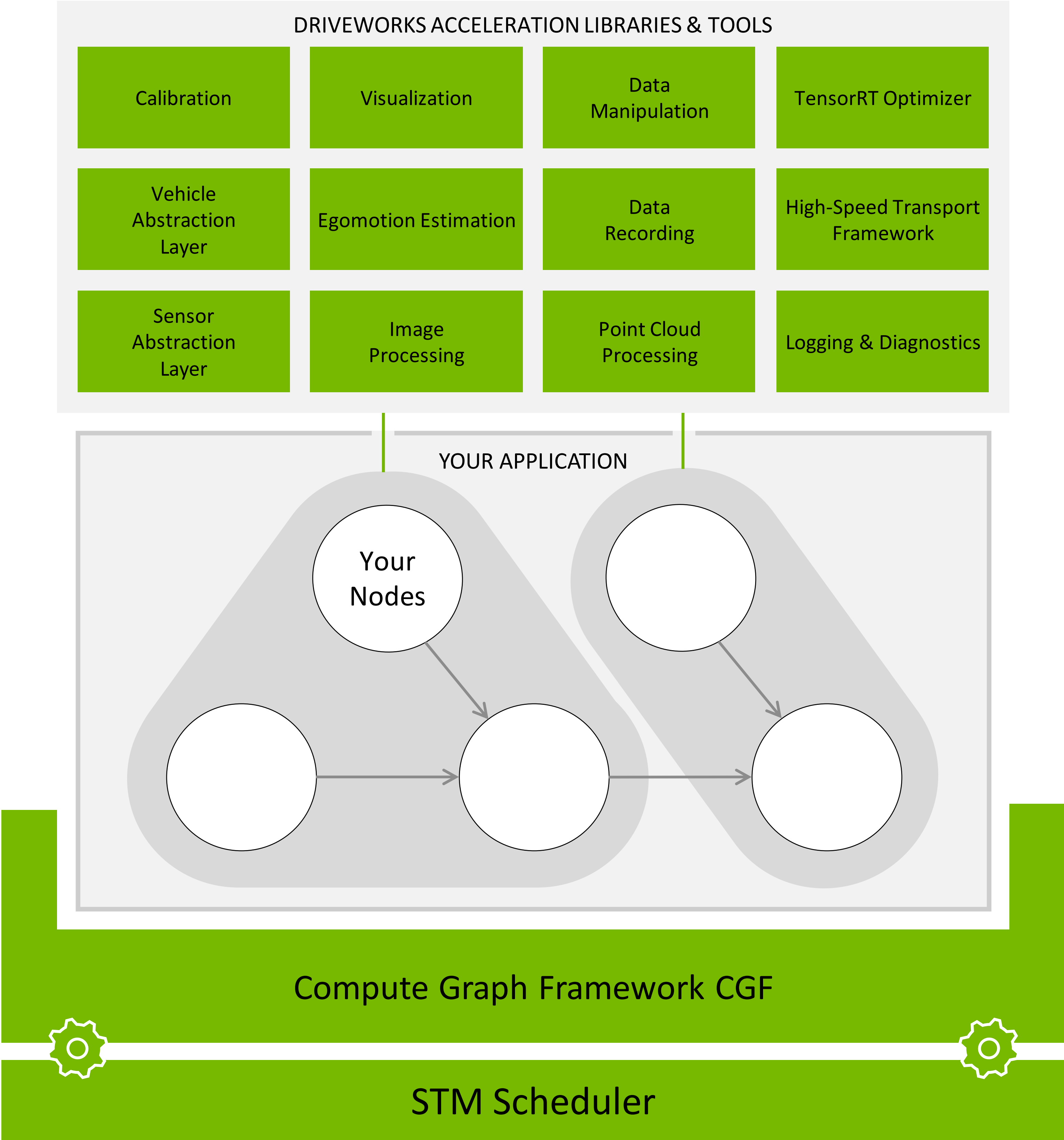
Maximized with NVTX source code instrumentation NVIDIA tools extension



# DriveWorks — Comprehensive Middleware Solution

**Rich Library of Algorithms and Tools**  
to accelerate your applications

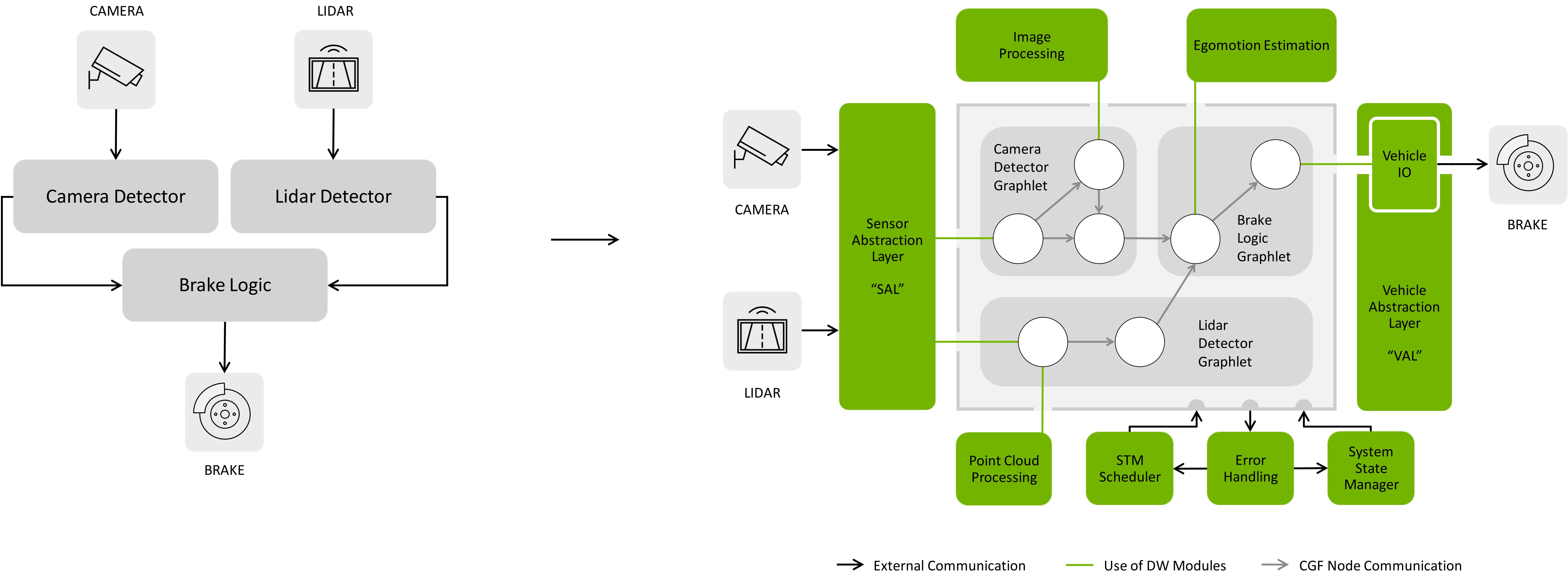
**Compute Graph Framework**  
to leverage deterministic scheduling





# Exemplary Application as a Compute Graph

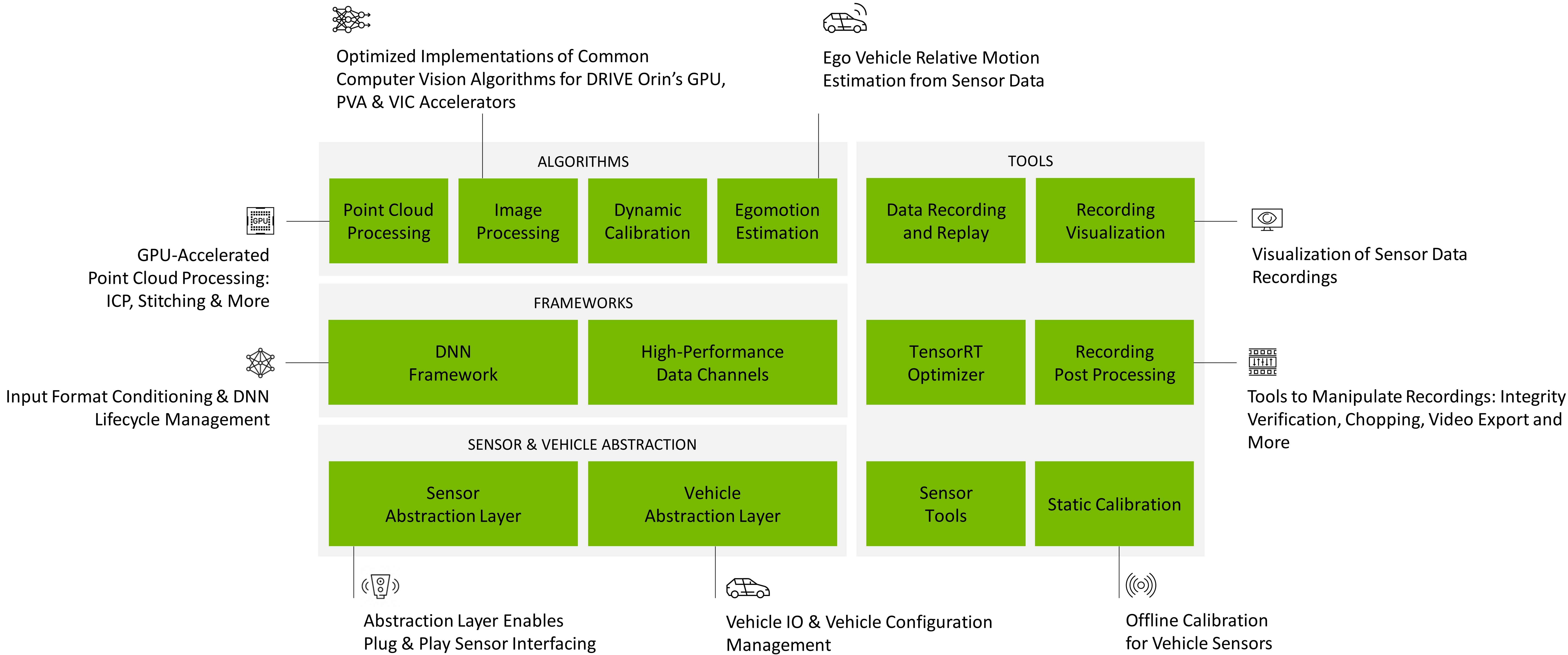
CGF enables structured and dependable software





# DriveWorks Modules

A rich library of algorithms and tools to bootstrap AV development





# Get Started with DRIVE SDK

Extensive documentation & training material  
available on NVIDIA Developer

## Learn More

- Visit the [DRIVE training](#) page for webinars and other resources
- Check out information related to [DRIVE Hyperion](#), [DRIVE AGX Orin](#) and [DRIVE SDK](#)

## Get Access

- Join the [DRIVE AGX SDK Program](#) on NVIDIA Developer
- [Read the docs](#) for DRIVE OS and DriveWorks documentation
- [Download DRIVE OS](#) which includes DriveWorks, NvMedia, CUDA, cuDNN and TensorRT

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