DRIVE AGX Orin Development Platform

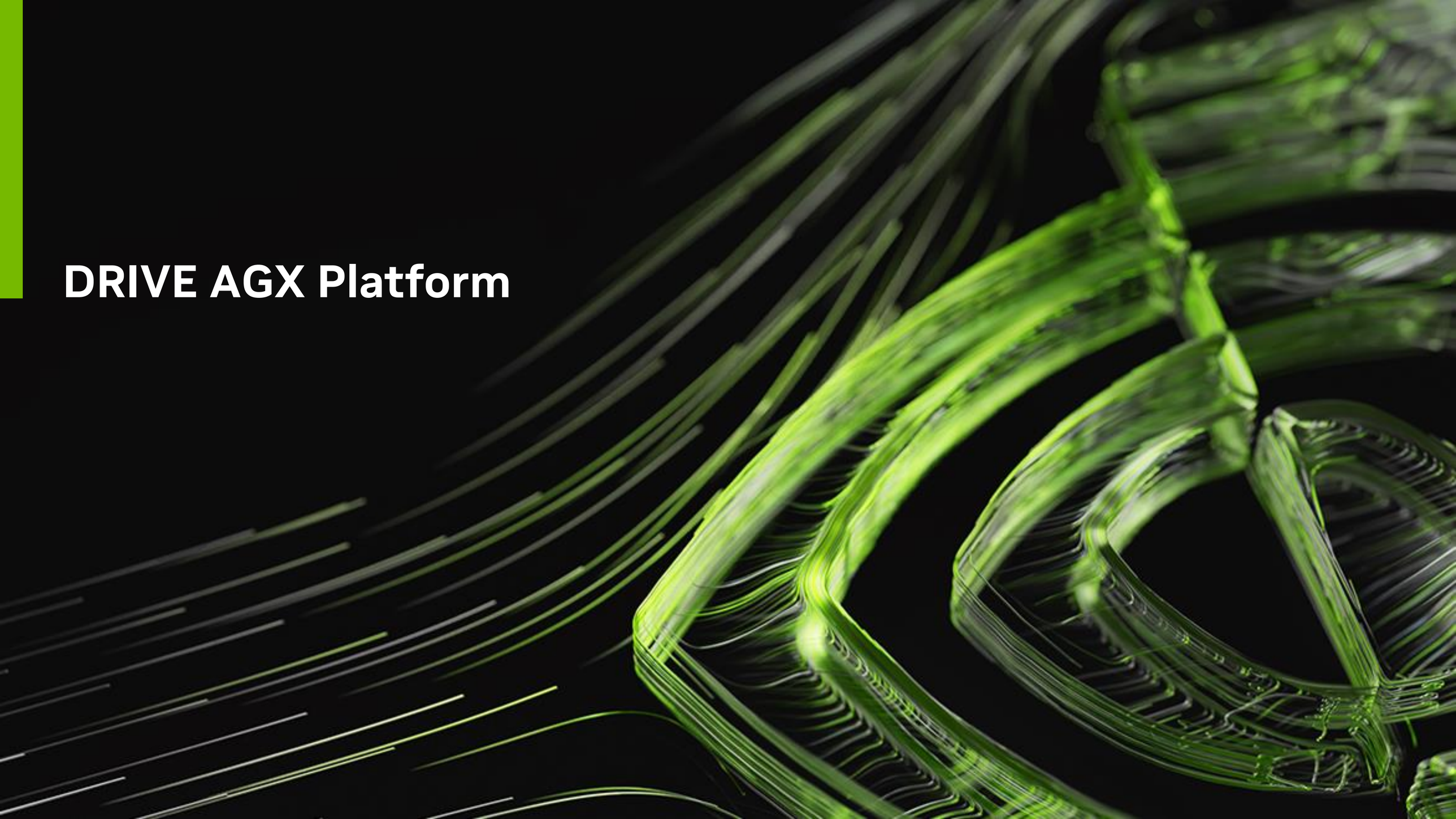
October 2024

Overview

- DRIVE AGX Platform
- DRIVE OS

Link to Latest Online PDF Version

DRIVE AGX Platform



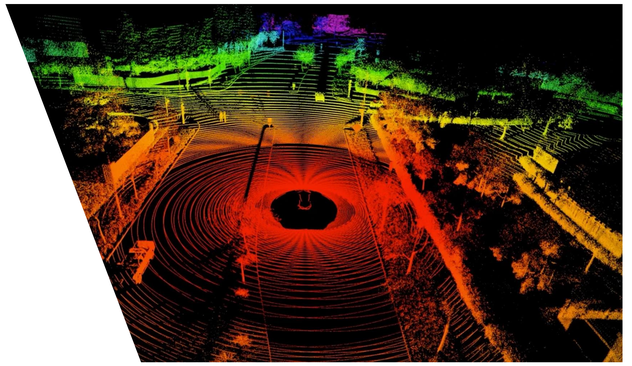
NVIDIA DRIVE End-to-End Solutions for Autonomous Vehicles

DRIVE AGX Orin-X SoC

Software-Defined Platform

DRIVE AGX Orin DevKit

High-Performance
Development Platform



DRIVE OS

AV Software Foundation
OS, CUDA & DriveWorks

DevKits are available for purchase at
DRIVE AGX Autonomous Vehicle Development Platform

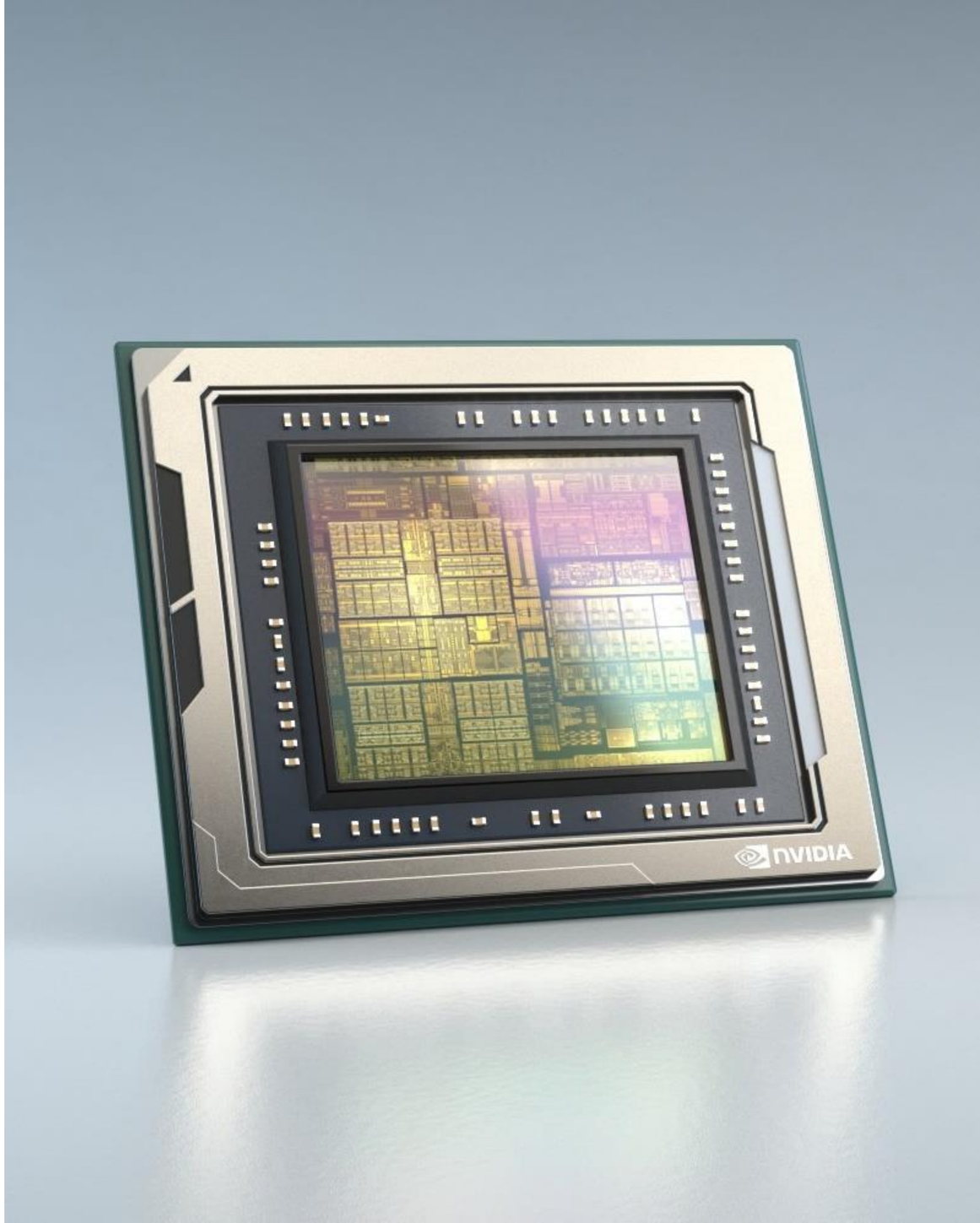
Download the DRIVE OS SDK by joining the
DRIVE AGX SDK Developer Program

DRIVE AGX Orin-X SoC

Advanced, software-defined platform for autonomous vehicles

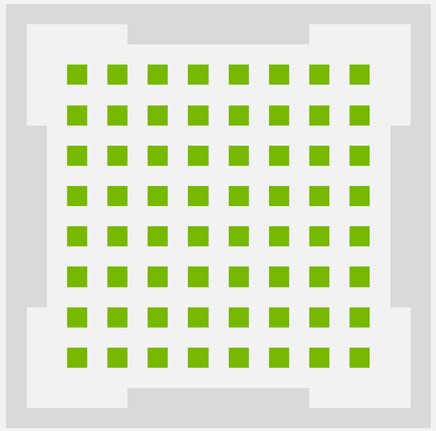
- **254 INT8 TOPS - CUDA Tensor Core GPU + DLA**
- 12 A78 (Hercules) ARM64 CPUs
- 205 GB/s memory bandwidth
- 4 R52 Lock-step Pairs Integrated Safety Island ASIL-D
- ISO 26262 (FUSA) ASIL-B Chip | ASIL-D Systematic

- Hardware Accelerators:
  - Deep Learning Accelerators (DLA)
  - Programmable Vision Accelerator (PVA)
  - Optical Flow Accelerator (OFA)



DRIVE AGX Orin Hardware Accelerators

Optimal efficiency for diverse workloads



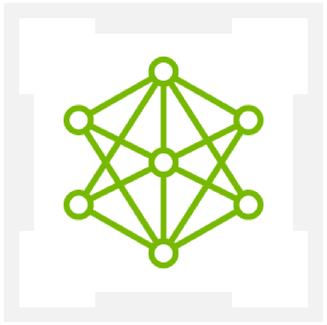
Ampere GPU

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

*Accessible via DriveWorks Image Processing Library

Automotive Hardware And Software Platform

Open & scalable platform purpose built for automotive

DRIVE AGX Orin DevKit

DRIVE OS – AV SW Foundation
Automotive Silicon & IO
254 TOPS | 200W

Available Now

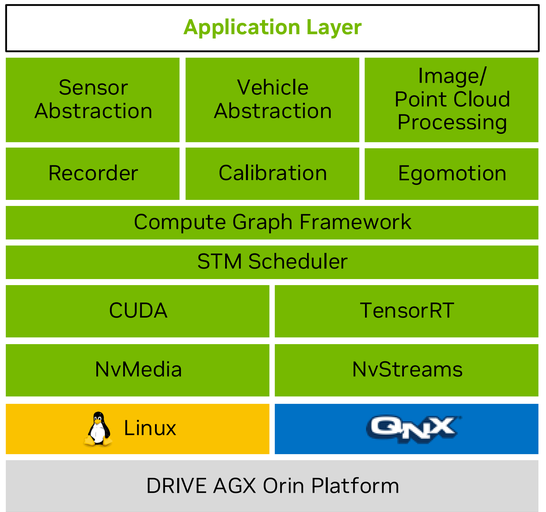
Directly from NVIDIA and
Authorized Distributors Like Arrow

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

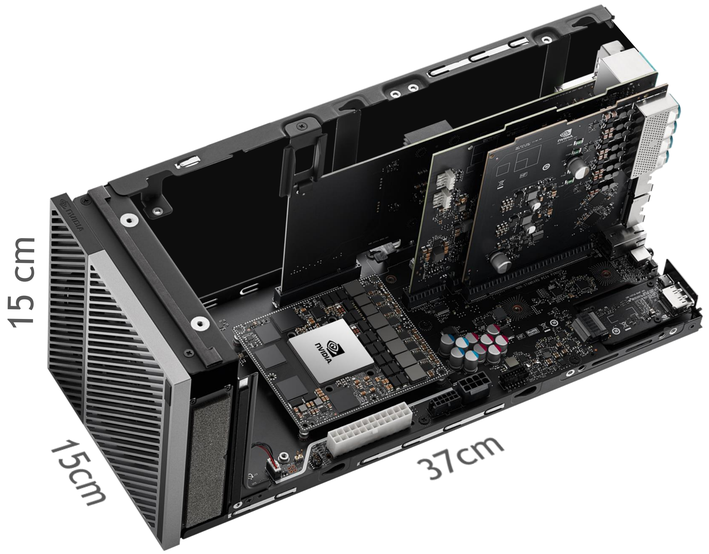
- DRIVE OS with DriveWorks
- Middleware, tools and algorithms
- ISO 26262 safety certifiable DRIVE OS
  QNX, drivers, and platform APIs



Safe and Performant Compute Platform

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

DevKit Specifications



Components		
Orin-X 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
Vehicle Harnesses		Additional Accessories

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)

DevKit 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	MATE-AX 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	
Vehicle Harnesses (Opt. Accessory)	6x	CAN*	Vehicle Harness Connector DB9	
	1x	LIN*		
	1x	FlexRay*		
	12x	USS*		

*Automotive connectors **Can be used to connect Orin DevKits

Supported Sensors

DRIVE AGX Orin

- For a rich set of sensors supported for ecosystem developers, see DRIVE AGX Orin Sensors and Accessories
- Sensors are provided by third-party vendors who must be contacted for the hardware, software, and associated support.

Ecosystem Sensor Vendors

Cameras

- Entron
- Leopard
- Omnivision
- On Semiconductor
- Quanta
- Sekonix
- Smartlead
- SONY

Lidars

- AEVA
- Hesai
- Innoviz
- Luminar
- Ouster
- Velodyne

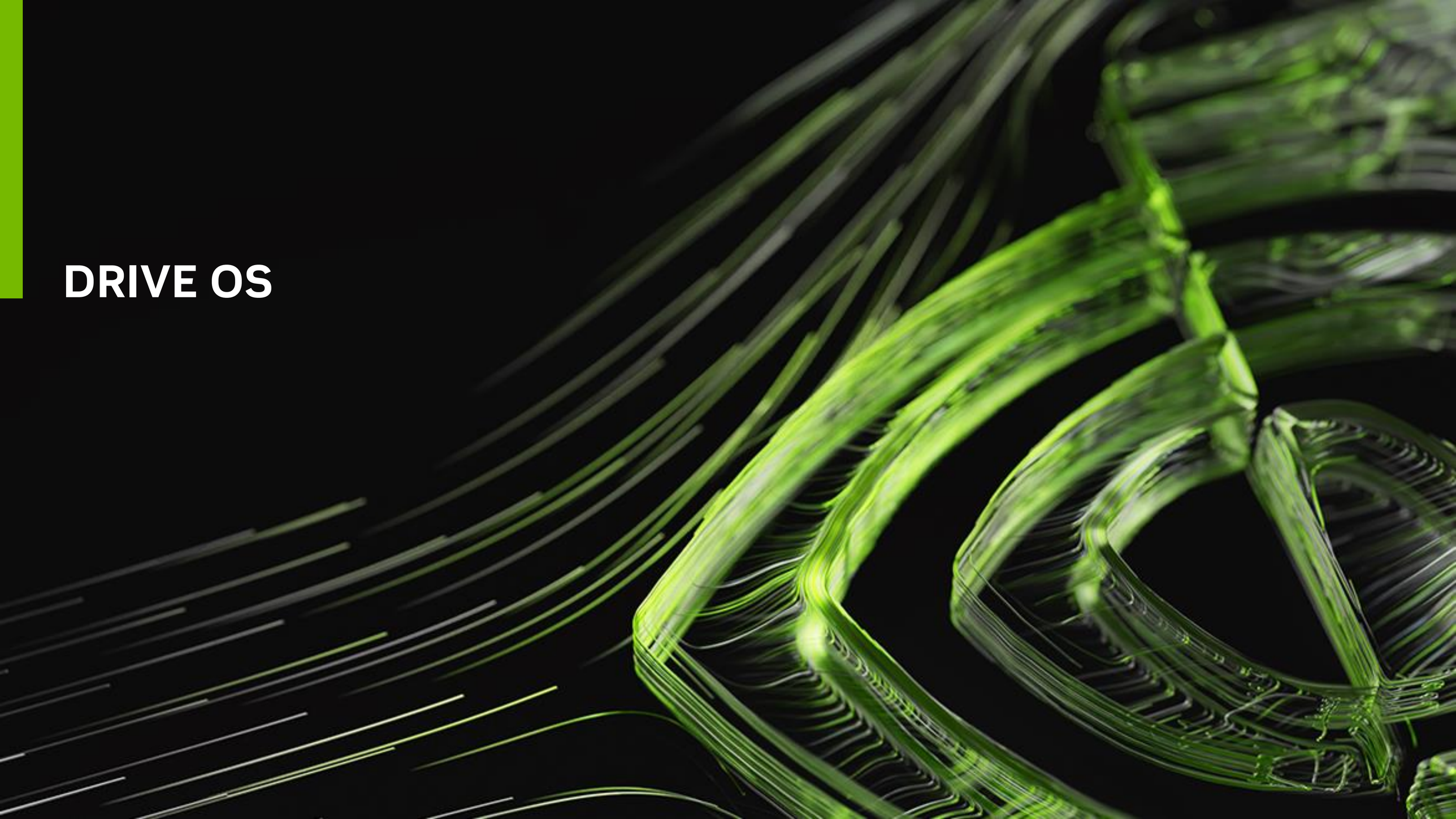
Radars

- Arbe
- Continental
- Lunewave

IMU / GNSS

- NovAtel
- OxTS
- U-blox

DRIVE OS

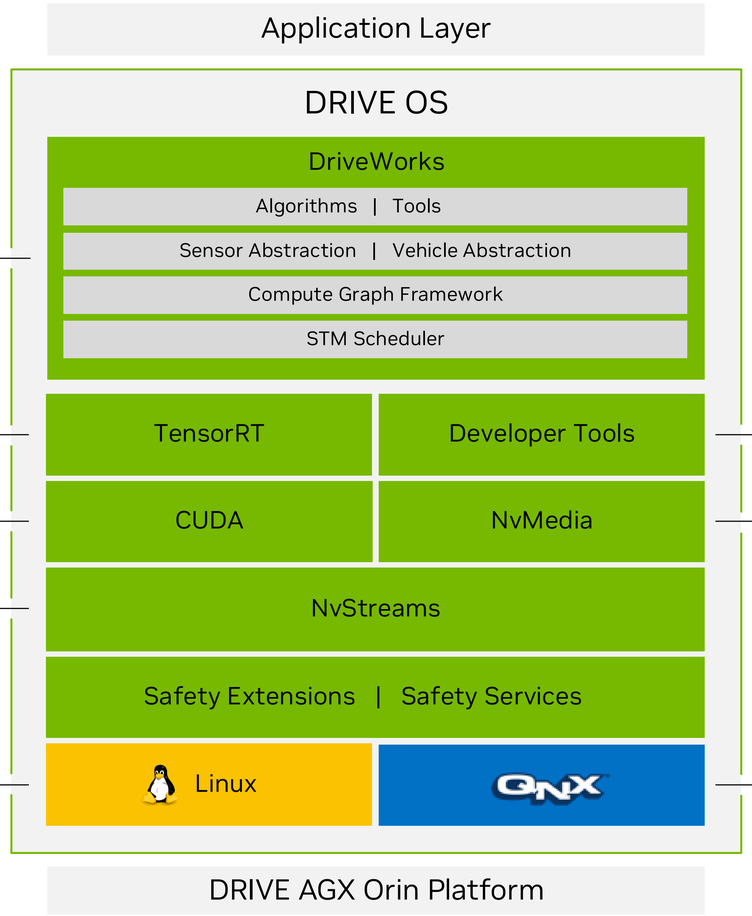


DRIVE OS – NVIDIA's AV Software Foundation

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

Automotive Standards Compliance		ISO 26262 & ASPICE Compliant (QNX) ISO / SAE 21434 Compliant
Support for Complex, High-performance AV Software Stacks		Optimal Utilization of Orin's HW Accelerators Minimal Data Copies via NvStreams
Ease of Programming		Smooth transition from X86 to DRIVE OS Linux Safety-compliant CUDA and TensorRT

DRIVE OS Components



Automotive Middleware
Accelerated Algorithms
Versatile Tools

High-Performance Deep Learning Inference

GPU-Accelerated Programming

High-Speed Data Transport between Threads, Processes, VMs
Efficient Buffer Sharing Minimizes Copies

Eases Transition from X86

Nsight Visual Studio Code Edition – IDE
Nsight Systems – System Tracing
Nsight Compute – Compute Profiling & Debugging
Nsight Graphics – Graphics Debugging & Profiling

Direct Access to Imaging Sensors and HW Accelerators

Safety Certifiable
APIs Consistent with Linux

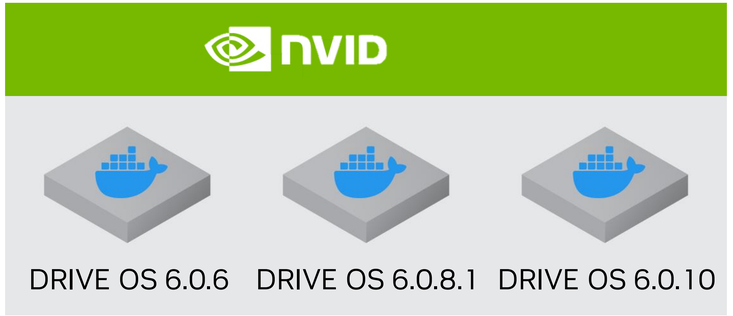
[1] For development only

New with DRIVE OS 6 for Orin

Smoother development experience | All-new middleware features

DRIVE OS 6 Features

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

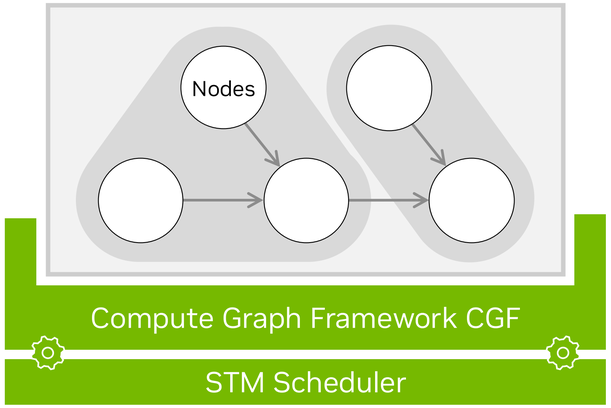


NGC is NVIDIA's Portal of Enterprise Services, Software, and Support for AI, Digital Twins, and High-Performance Computing

DriveWorks 5 Features

DriveWorks becomes a full-fledged automotive 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[1]	
Linux Kernel[1]	**5.15**
Blackberry QNX SDP[2]	**7.1.1**
Blackberry QNX QOS[2]	**2.2**
QCC Toolchain	**8.3**
GCC Toolchain	**9.3**
C++ Feature set	**14**
DriveWorks[3]	**5**
CUDA Toolkit	**11.4**
NVIDIA UDA CUDA Driver[1] (x86)	**r470**
TensorRT	**8**
cuDNN	**8**
Vulkan	**1.3**
Wayland[1]	**1.18**
PKCS#11	**Y**

[1] Linux only, not available on QNX
[2] QNX only, not available on Linux
[3] For development only

Why QNX for Safety?

Safety OS key selection criteria

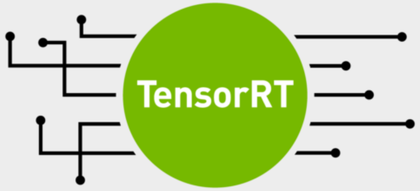
- ISO 26262
  - ASIL D certified RTOS
  - TCL3 qualified toolchain
- POSIX PSE52 standards certification
  - Requirement for CUDA support
- Common Unix heritage with Linux
  - Rich dependent library support

Hardware Accelerated Compute Engines

Open | Scalable | Seamless | End-to-end

CUDA

Parallel computing model for compute intensive applications

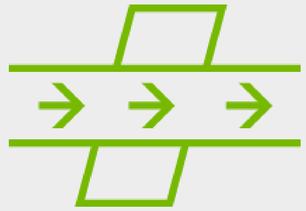


TensorRT

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

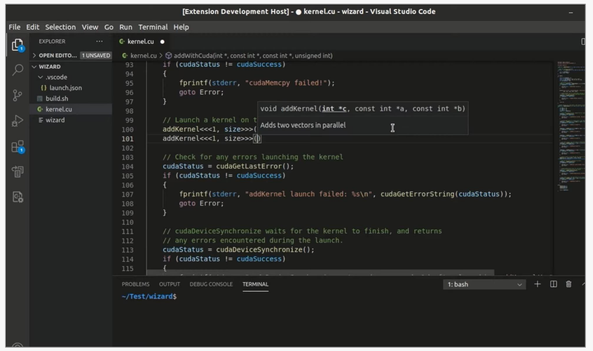


NvStreams

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

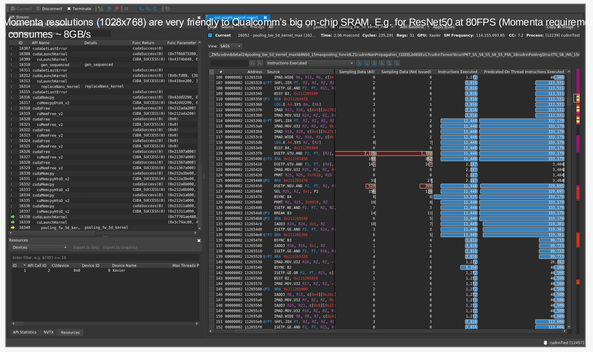


Nsight Visual Studio Code Edition

IDE GPU application development

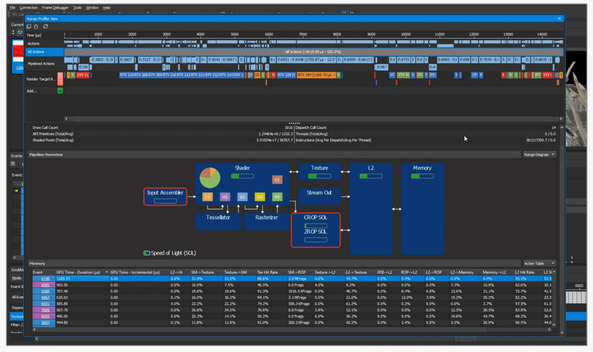
Nsight Systems

System trace



Nsight Compute

Compute profiling



Nsight Graphics

Graphics debugging & profiling

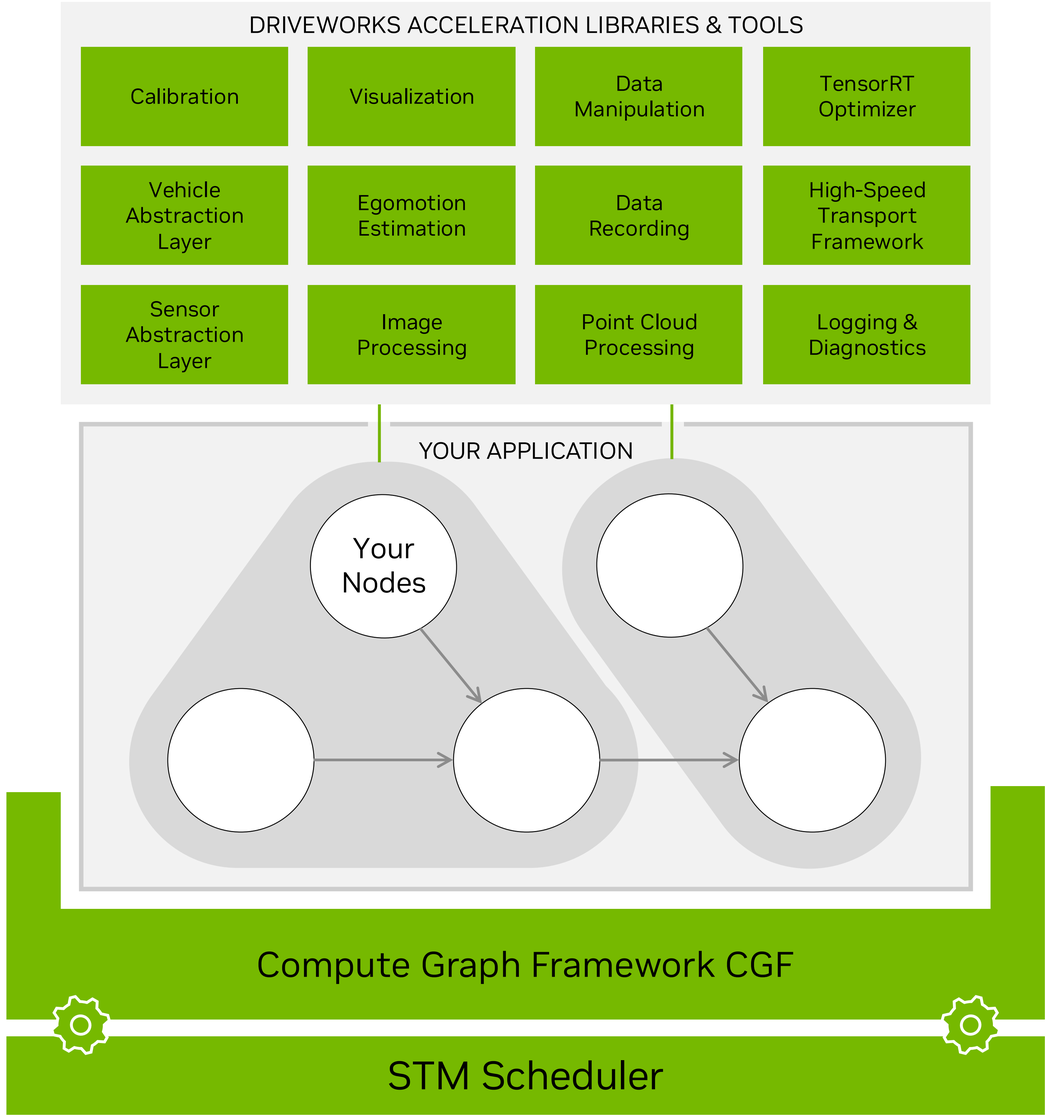
Maximized with NVTX source code instrumentation NVIDIA tools extension

NVIDIA

DriveWorks — Comprehensive Middleware Solution

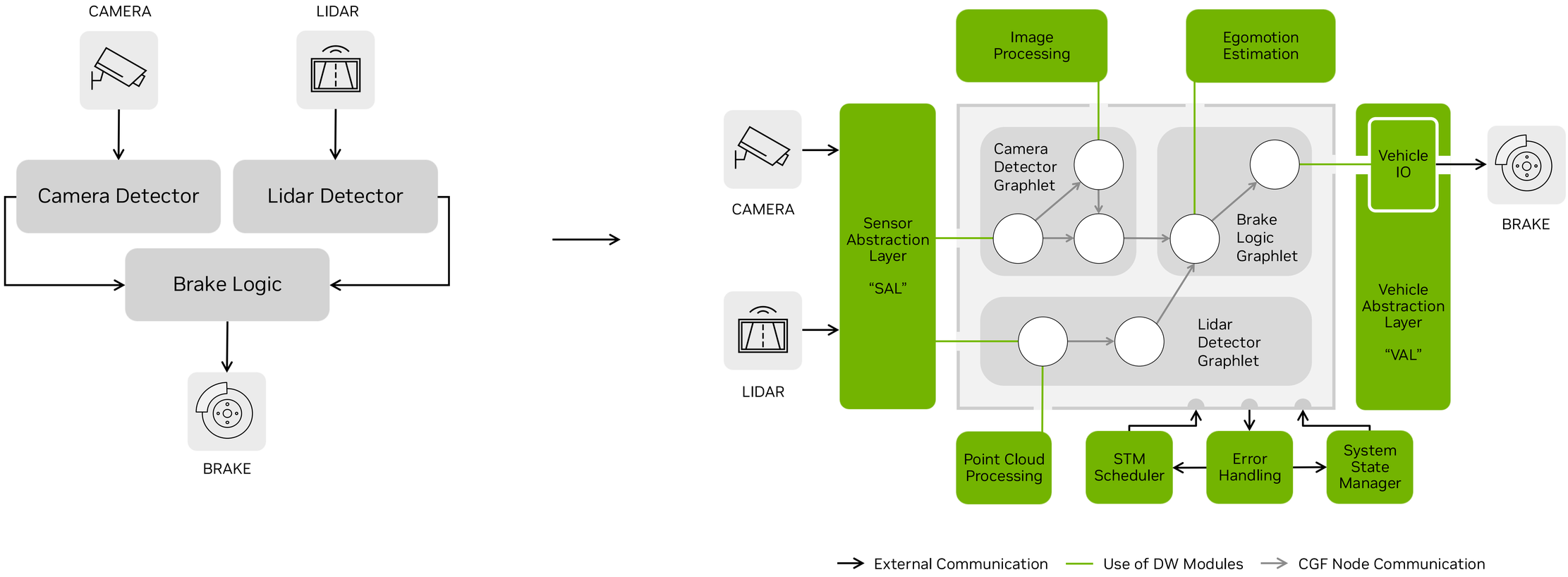
Rich Library of Algorithms and Tools
to accelerate your applications

Compute Graph Framework
to leverage deterministic scheduling



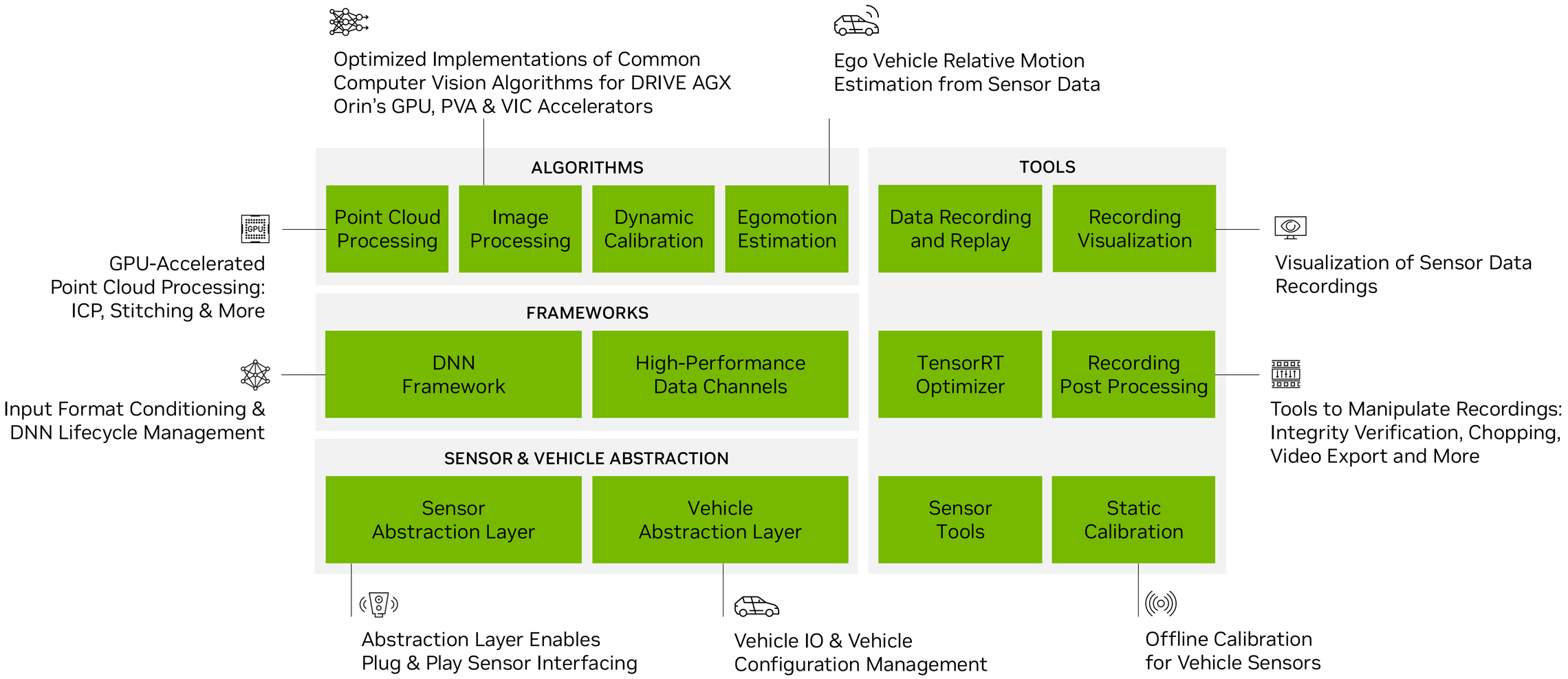
Exemplary Application as a Compute Graph

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 AGX Orin, DRIVE OS SDK and DRIVE AGX Orin supported Sensors

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

Contact Us

- Contact your distributor or the NVIDIA Automotive Team