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TECSAR
Transformative Computer Systems and Architecture Research

Real-time AI
Lecture 3:Nvidia Jetson Nano

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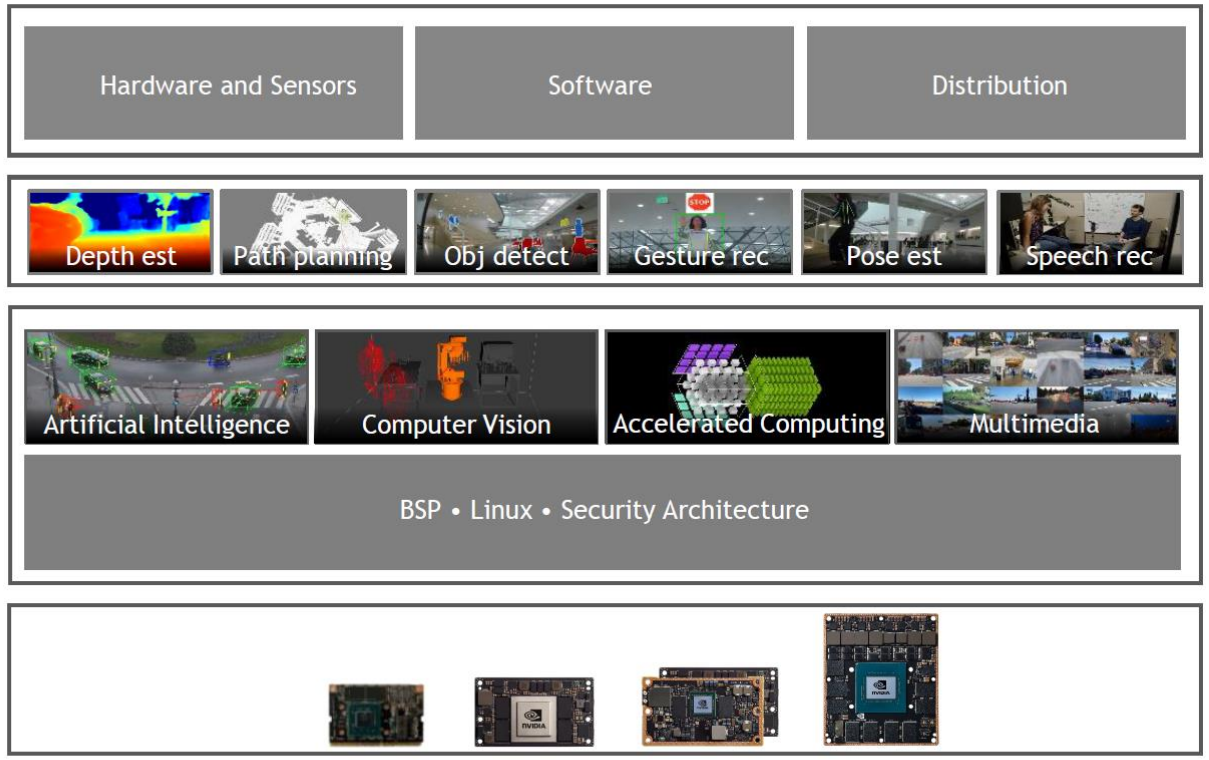
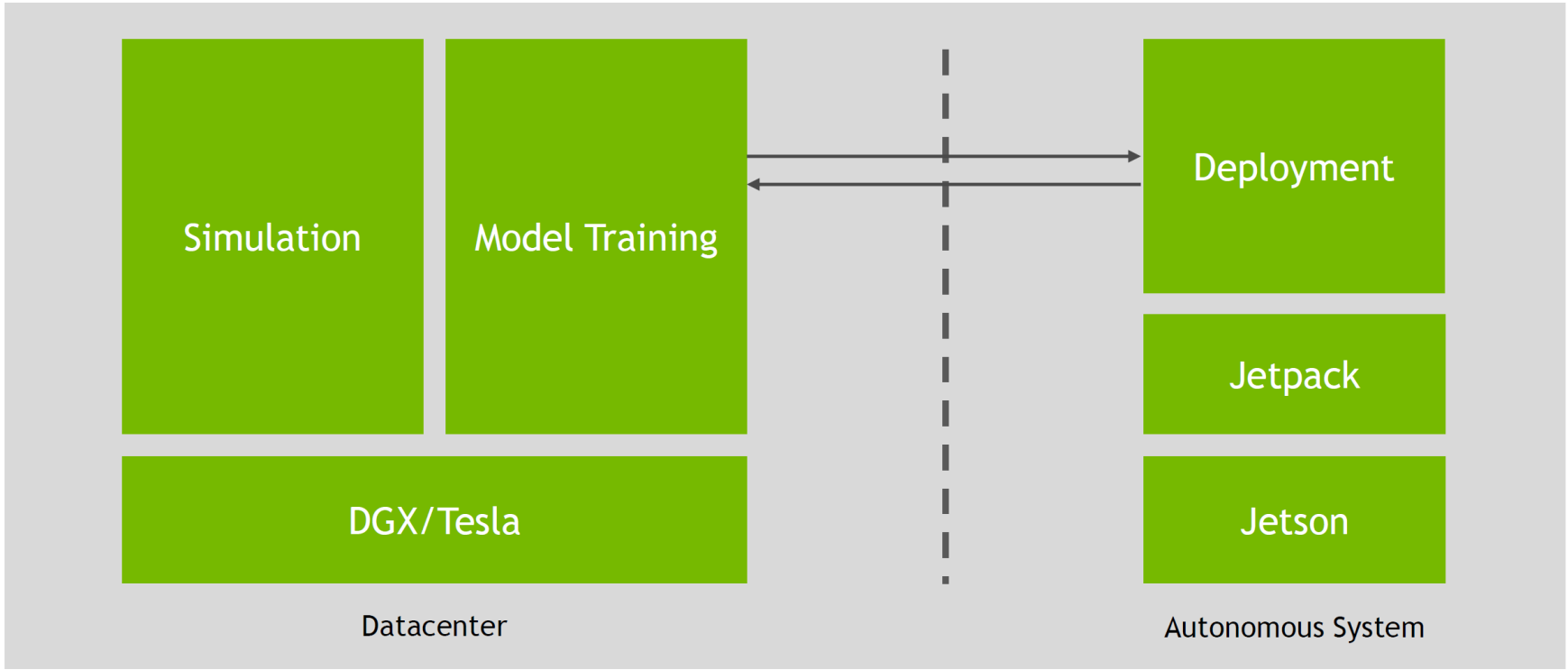
Nvidia Platform Overview for Real-time AI



From Data Center (Cloud) to Autonomous Systems (Edge)



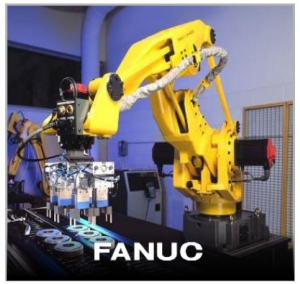
Assignment during Spring Break

- Set Up the Jetson Nano during Spring Break

https://developer.nvidia.com/embedded/learn/get-started-jetson-nano-devkit#prepare

Visit Hello AI world page and see what it has to offer: https://developer.nvidia.com/embedded/twodaystoademo#hello_ai_world

Application Examples



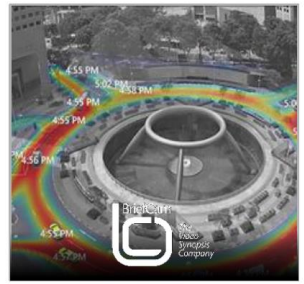
Industrial

Aerospace/Defense

Construction

Agriculture

Healthcare



Smart City

Retail

Logistics

Delivery

Inspection

Service

Collaboration

Mass Market Edge System for Rea-ltime AI

NETWORK VIDEO RECORDER
200 million 1080p streams

MACHINE VISION/AOI
1 trillion product units per year require visual inspection

HOME/SERVICE ROBOTS
175 billion hours per year on household chores (US)

AIOT
80% of Enterprise IOT projects will use AI by 2022

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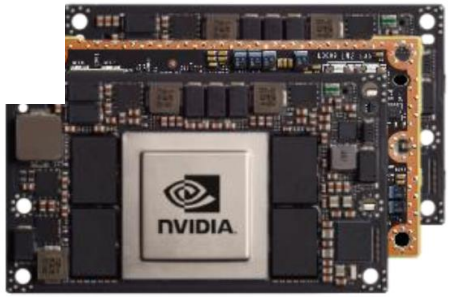
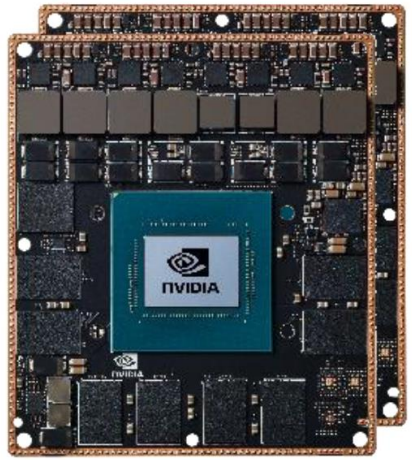
Jetson Families

JETSON NANO
5 - 10W
0.5 TFLOPS (FP16)
45mm x 70mm
$129



JETSON TX2 Series
(TX2, TX2 4GB, TX2i*)
7.5 - 15W*
1.3 TFLOPS (FP16)
50mm x 87mm
Starting at $249



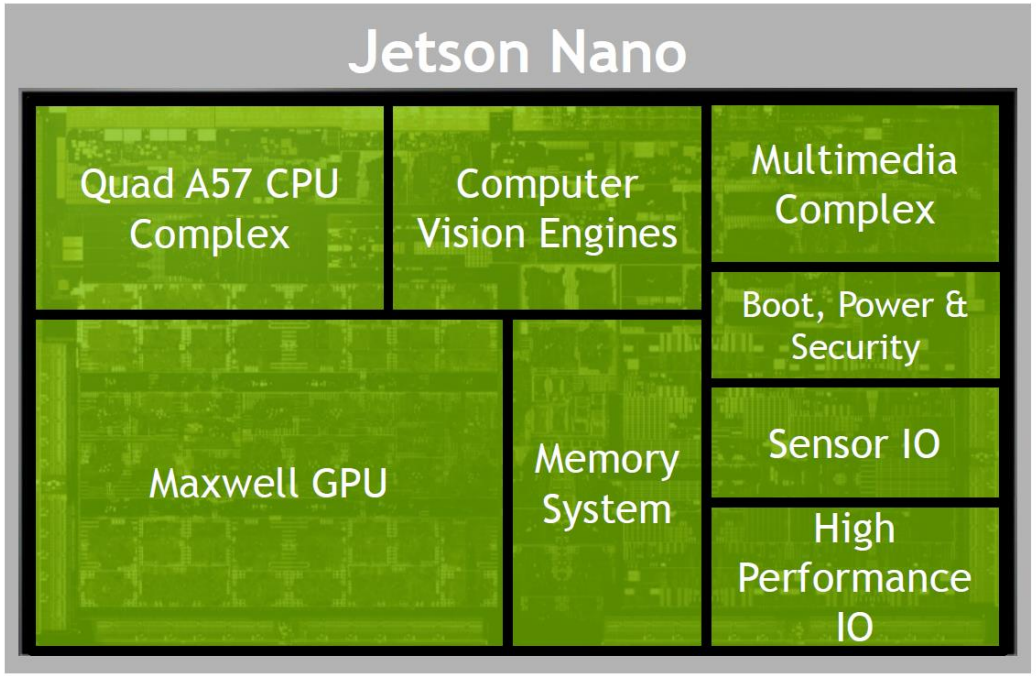
JETSON AGX XAVIER Series
(AGX Xavier 8GB, AGX Xavier)
10 - 30W
5.5 - 11 TFLOPS (FP16)
20 - 32 TOPS (INT8)
100mm x 87mm
Starting at $599

AI at the edge — Fully autonomous machines

System-on-Chip

Heterogeneous CPU Complex
Quad Cores A57 with 2MB L2
for multi-threaded operation
1.43Ghz

Maxwell Tensor Core GPU
128 CUDA Tensor Cores
472 GFLOPS (FP16)



Memory
4GB 64-Bit LPDDR4
Bandwidth 29.8GBps
16GB eMMC

Computer Vision Engines
ISP
Video Image Compositor

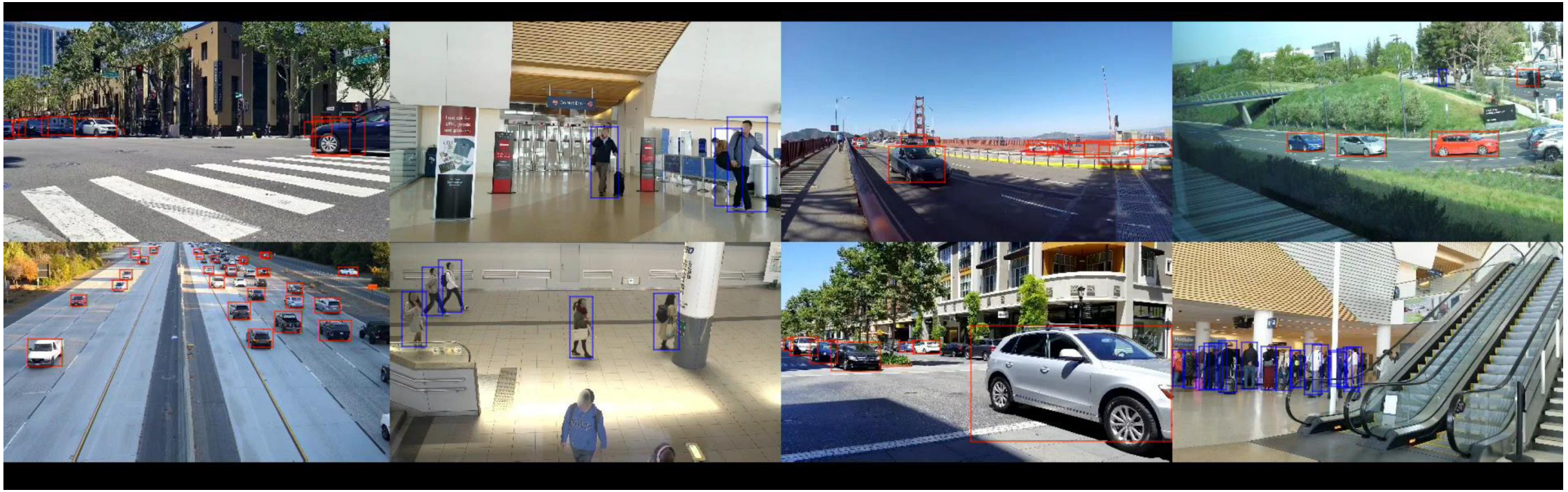
Multimedia Engines
Encode 4kp30, 4x1080p30, 9x720p30
Decode 4k60, 2x4k30, 8x1080p30, 9x720p30
JPEG encode & decode 250 and 500 MP/s
H.264, H.265, VP9, VP8, VC-1, MPEG-2
HDMI, DP and eDP Display support

Boot, Power & Security
Boot and power management
ARM TrustZone Secure

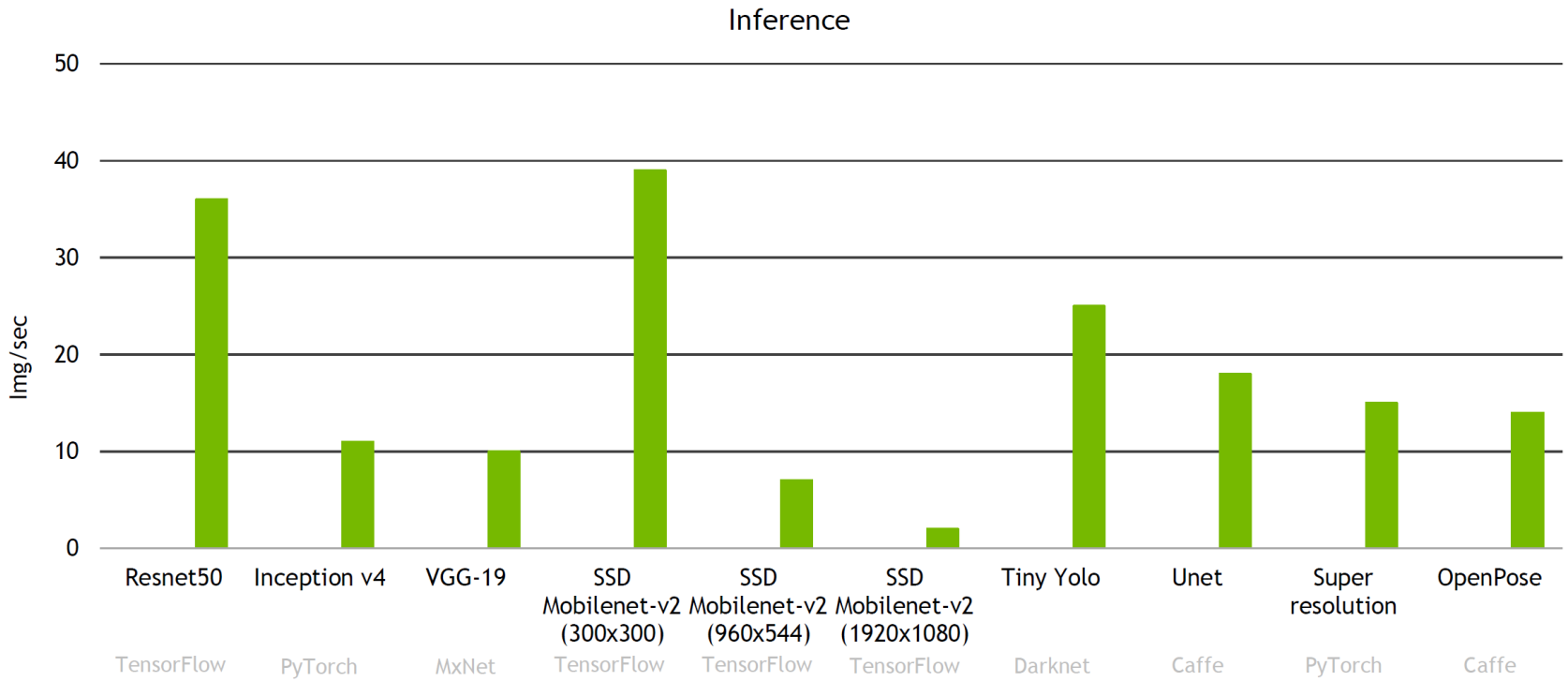
Industry Standard IO
GPIO, I²C, I²S, SDIO, SPI, UART
Support up to 12 CSI @1.5Gbps

Industry Standard High-Speed IO
PCIe Gen2 rootport x1 | x2 | x4
12 lanes MIPI CSI-2 (D-Phy)
RGMII Ethernet
USB 3.0 and 2.0
USB 3.0 Gen2 Host and Device

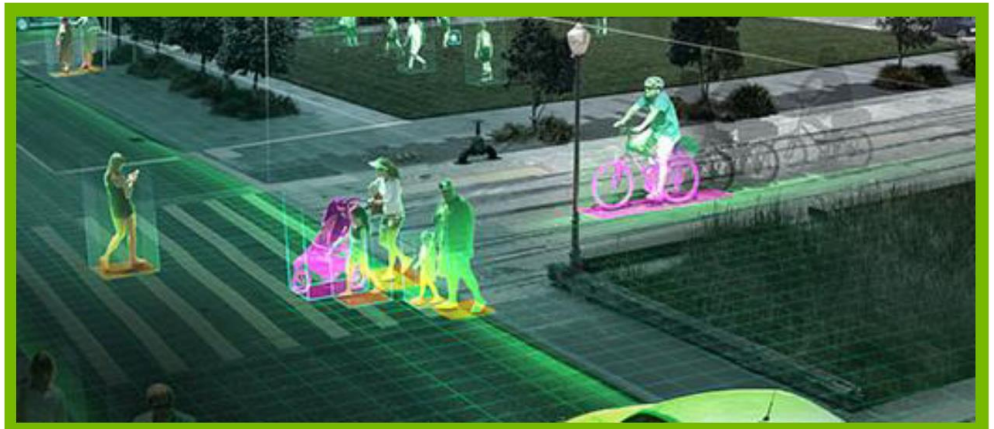
Killer Application: Real-time Computer Vision



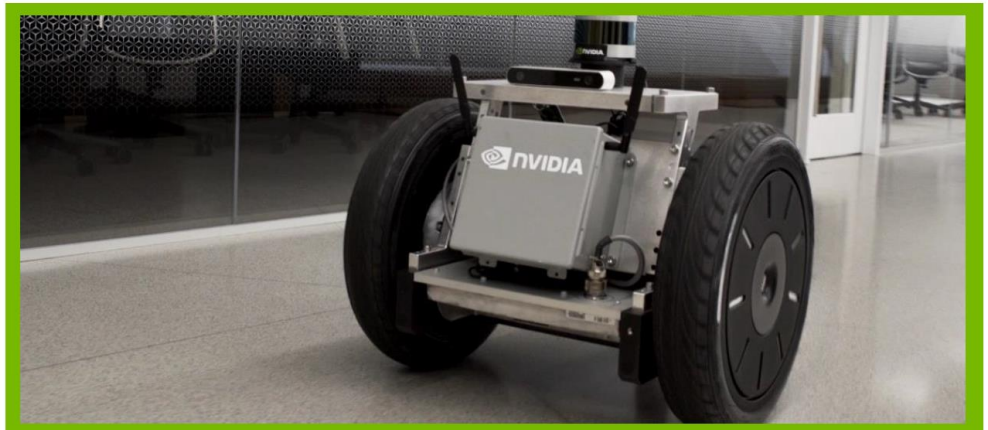
Performance and Benchmarking



Software SDK Voerview



DEEPSTREAM SDK
FOR VIDEO ANALYTICS



ISAAC SDK
FOR ROBOTICS

JETPACK SDK
FOR AI AT THE EDGE

JETSON NANO

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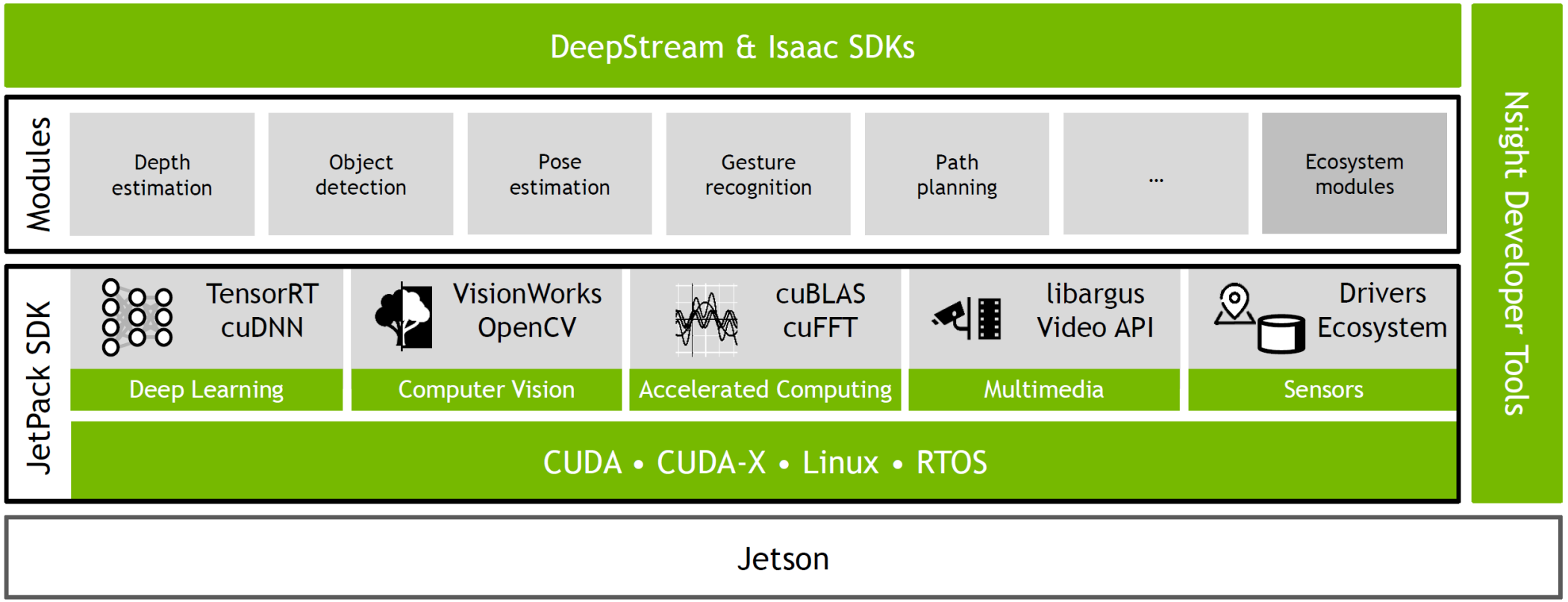
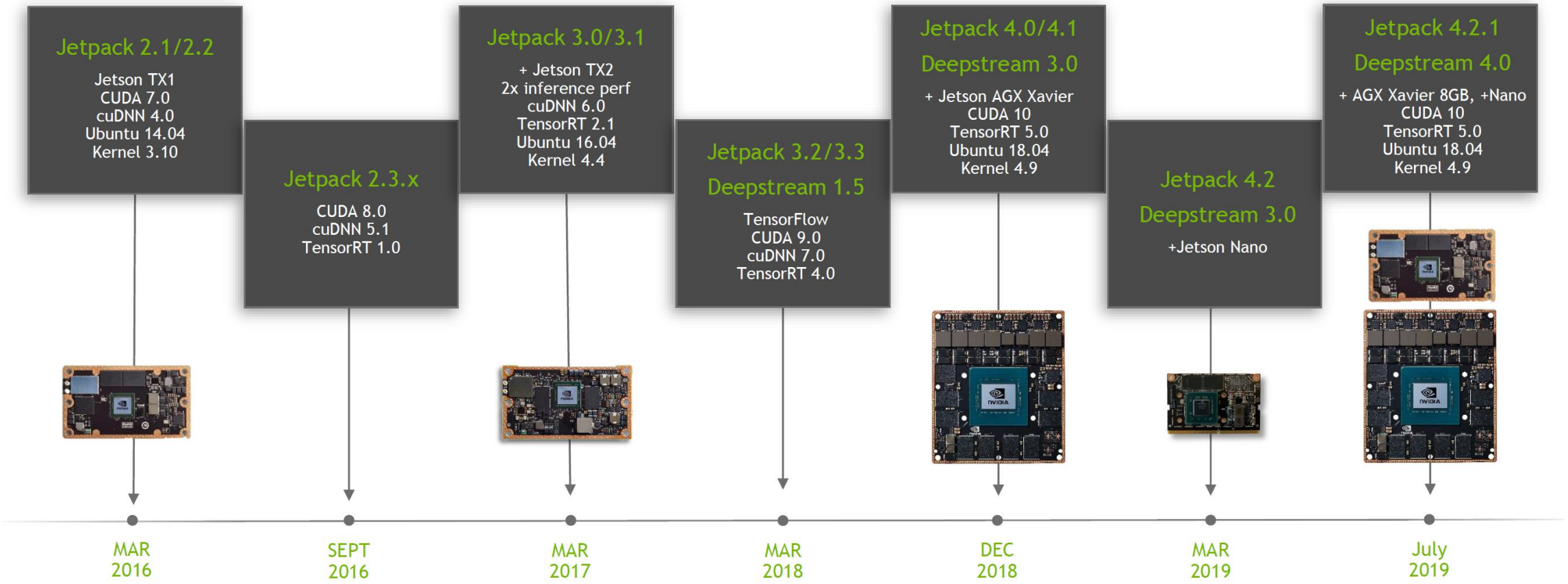
Software Stack





Included in the box

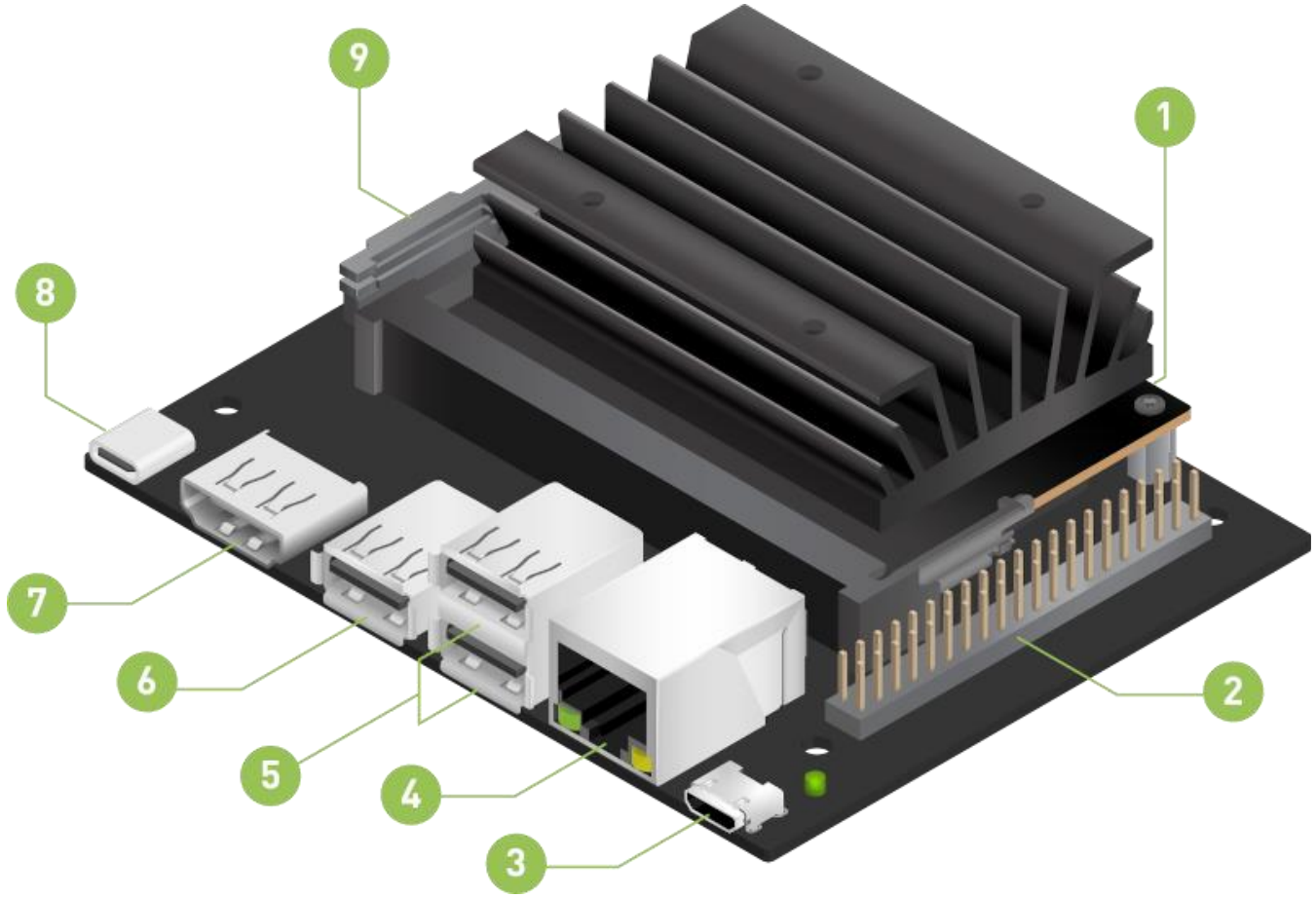
- Non-production specification Jetson module and reference carrier board

  A Jetson Nano 2GB Developer Kit includes a non-production specification Jetson module (P3448-0003) attached to a reference carrier board (P3542-0000). This user guide covers two revisions of the developer kit:

  - Part Number 945-13541-0000-000 including 802.11ac wireless adapter and cable
  - Part Number 945-13541-0001-000 NOT including adapter and cable

Schematic

1.microSD card slot for main storage
2.40-pin expansion header
3.Micro-USB port for Device Mode
4.Gigabit Ethernet port
5.USB 2.0 ports (x2)
6.USB 3.0 port (x1)
7.HDMI output port
8.USB-C for 5V power input
9.MIPI CSI-2 camera connector



Power

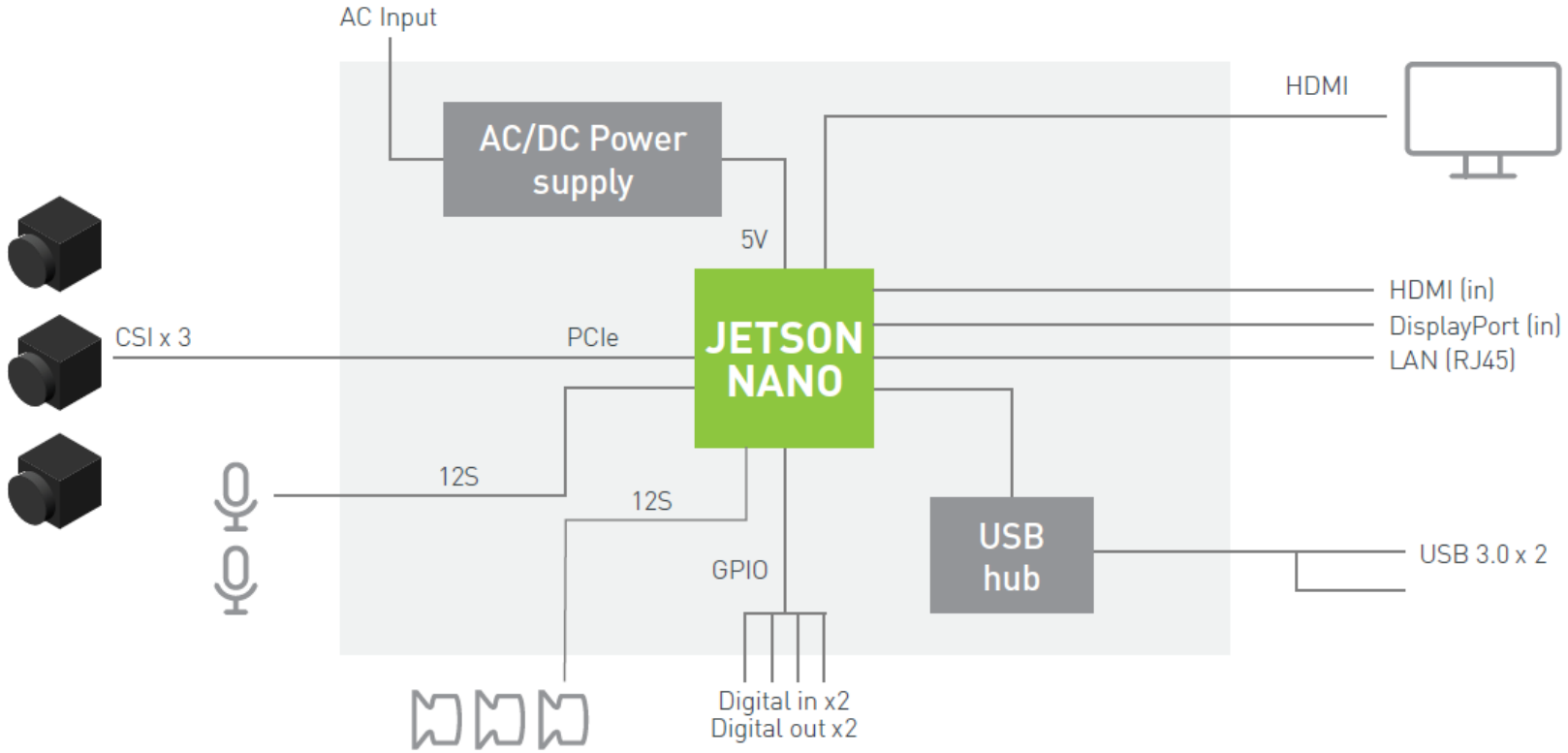
- The developer kit supports USB-C power supplies of 5V ± 5%, 3A. If your phone uses a USB-C power supply, there is a chance that it is enough to power the devkit. Check its specifications.
- If the voltage drops below 4.25V, the system will shut down.
- The developer kit's total power usage is the sum of carrier board, module, and peripheral power usage, as determined by your particular use case.
- There are two software-defined power modes for the Jetson module.
- The two module power modes are:
    - 10W - default mode for more performance
    - 5W - suggested for less energy use
- USB-C power bank for applications which require the developer kit to be run on a battery. Be sure to use a battery which can sustain voltage above 4.25V, else the system will shut down.

Networking

- The developer kit supports wired and wireless networking:

- **Wired** - Ethernet will be available as soon as a cable with network connection is plugged into the RJ45 port
- **WLAN** - Wireless networks will be available after plugging in a supported USB wireless networking adapter
- **WPAN** - Bluetooth will be available after plugging in a supported USB Bluetooth adapter
- Available networks can be discovered through the networking icon at the top right corner of the desktop or via System Settings. To change any default networking configurations please use the Settings page.
- Any wireless networking or Bluetooth adapter should be connected to the USB 3.0 port (the single USB port that is not stacked) for better performance. An extension cable is suggested in order to reduce EMI interference between USB networking adapter and the developer kit.

Jetson Nano in Action



Additional Information

- Please check here for additional information:

https://developer.nvidia.com/embedded/learn/jetson-nano-2gb-devkit-user-guide#id-.JetsonNano2GBDeveloperKitUserGuidevbatuu_v1.0-Introduction

https://developer.nvidia.com/embedded/learn/getting-started-jetson