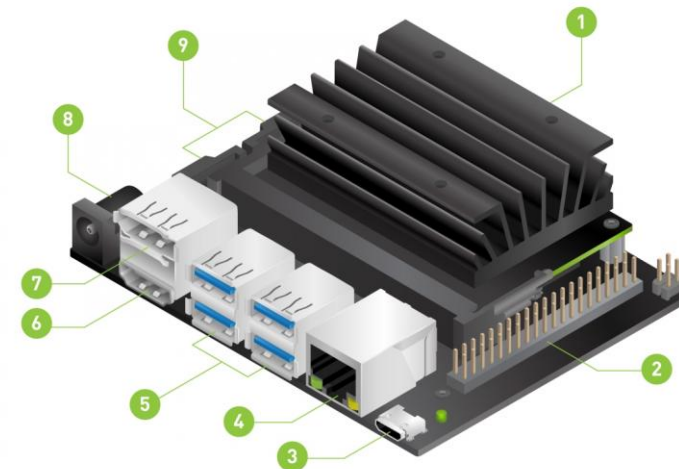


Intro to Edge AI & Jetson Nano – Why it's a game-changer!

NIELIT Chandigarh/Ropar



"AI at the edge. Power in your pocket. Jetson Nano."



AGENDA

1. Introduction to Edge AI & Jetson Nano
2. Setting up Jetson Nano
3. Deep Learning on Jetson
4. Hands-on Labs
5. IoT Integration
6. What Makes Jetson Nano a Game-Changer

What is Edge AI?

- AI running locally on edge devices (not cloud)
- **Key Features:**
 - Low latency
 - Real-time inference
 - Offline processing
- Examples: Smart cameras, voice assistants, robots

Traditional AI vs Edge AI

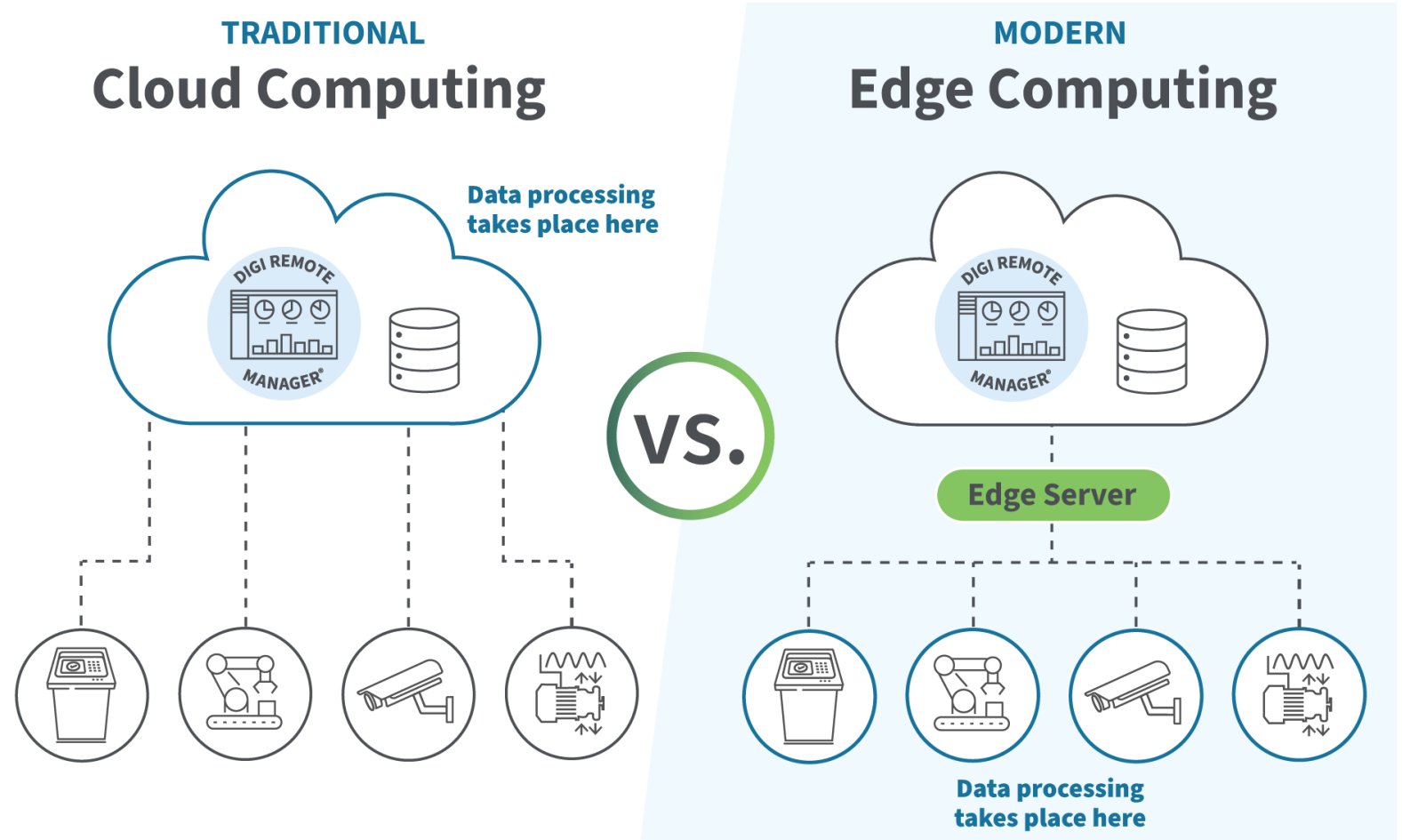
Feature	Cloud AI	Edge AI
Latency	High	Ultra-low
Connectivity	Always required	Often offline
Privacy	Data sent to cloud	Local processing
Cost	Higher (cloud ops)	Lower (on-device)

Why Edge AI Now?

- Growth in AI models (CNNs, RNNs)
- Affordable edge hardware (Jetson Nano, Coral, Raspberry Pi)
- Need for real-time decision making
- Privacy & bandwidth concerns

What is Edge Computing?

Edge computing brings computation close to data sources, reducing latency and bandwidth.



Key Benefits:

- Reduced Latency
- Lower Bandwidth Usage
- Enhanced Data Privacy and Security
- Greater Reliability
- Scalability and Cost Efficiency
- Supports Real-Time AI & ML
- Energy Efficiency

Meet Jetson Nano

- **From NVIDIA**
- A powerful mini-computer for AI at the edge
- Specs:
 - Quad-core ARM Cortex-A57 CPU
 - 128-core Maxwell GPU
 - 4 GB RAM
 - Runs Linux (JetPack SDK)

Why Jetson Nano?

Affordable and powerful edge AI device by NVIDIA.

Specs:

- ★ Quad-core ARM Cortex-A57
- ★ 128-core Maxwell GPU
- ★ 4GB LPDDR4 RAM
- ★ Supports CUDA, TensorRT, PyTorch, TensorFlow

Getting Started

1. Flash JetPack image to SD card
2. Boot Nano with peripherals
3. Setup Wi-Fi/SSH
4. Update system

What Makes Jetson Nano a Game-Changer

- Affordable (~\$99)
- Real-time AI capabilities
- Compatible with popular AI frameworks:
 - TensorFlow, PyTorch, ONNX, etc.
- Community support & tutorials
- Low power, high performance

Applications of Jetson Nano

- Smart surveillance systems
- Autonomous robots & drones
- Smart agriculture (plant disease detection)
- Retail (AI checkout, customer analysis)
- Industry 4.0 (machine monitoring)

Example Projects

- Face Mask Detection
- AI-based Object Tracking
- Real-time Sign Language Interpreter
- AI-powered Smart Doorbell



Jetson Inference Library

- Clone and build the repo:
- `$ git clone --recursive https://github.com/dusty-nv/jetson-inference`
- `$ cd jetson-inference && ./docker/run.sh`
- Run object detection:
- `$ detectnet.py --camera=/dev/video0`

Hands-On Lab

- Real-time object detection
- Face mask detection
- People counting
- Custom model deployment

Use PyTorch/TensorFlow with TensorRT optimization.



IoT + Jetson Nano

Integrate with cloud using:

- MQTT
- HTTP APIs
- Dashboards (Node-RED, Grafana)

Example: Send object detection logs to cloud.

Comparison: Jetson Nano vs Raspberry Pi

Feature	Jetson Nano	Raspberry Pi 4	Raspberry Pi 5
CPU	Quad-core ARM Cortex-A57 @ 1.43GHz	Quad-core Cortex-A72 @ 1.5GHz	Quad-core Cortex-A76 @ 2.4GHz
GPU	128-core NVIDIA Maxwell	Broadcom VideoCore VI	Broadcom VideoCore VII
RAM Options	4 GB LPDDR4	1 / 2 / 4 / 8 GB LPDDR4	4 / 8 GB LPDDR4X
AI Performance (INT8)	0.5 TOPS (Tensor Cores)	No native acceleration	No native acceleration
Storage	microSD	microSD	microSD, PCIe SSD via HAT
Camera Interface	1x MIPI CSI-2	2x CSI-2	2x CSI-2
Display Output	HDMI 2.0, DP over eDP	2x micro HDMI (4K)	2x micro HDMI
USB Ports	4x USB 3.0	2x USB 3.0, 2x USB 2.0	2x USB 3.0, 2x USB 2.0 + PCIe
Networking	Gigabit Ethernet	Gigabit Ethernet, optional Wi-Fi	Gigabit Ethernet, PCIe for faster NICs
Power Supply	5V/4A (barrel jack or micro-USB)	5V/3A USB-C	5V/5A USB-C
AI Frameworks Support	Native support for TensorRT, PyTorch, TF	Limited, runs TF Lite	Better with Pi 5, still CPU-only
Power Consumption	5W–10W	5W–7W	5W–10W
Price (Board Only)	~\$99	~\$35–\$75	~\$60–\$85

Jetson Orin Nano vs Jetson Nano Comparison

Feature	Jetson Nano	Jetson Orin Nano
Launch Year	2019	2022
AI Performance (INT8)	0.5 TOPS	Up to 40 TOPS
CPU	Quad-core ARM Cortex-A57 @ 1.43 GHz	6-core ARM Cortex-A78AE @ 1.5 GHz
GPU	128-core Maxwell	512/1024-core Ampere (w/ 16–32 Tensor Cores)
RAM	4 GB LPDDR4	4 GB / 8 GB LPDDR5
Memory Bandwidth	~25.6 GB/s	~68 GB/s
Storage (Default)	microSD	microSD (Dev Kit), eMMC (some modules)
Camera Support	1x CSI-2 (4 lanes)	2x CSI-2 (4 lanes each)
Display Output	HDMI 2.0, DP 1.2	HDMI 2.0
I/O Interfaces	GPIO, I2C, I2S, SPI, UART, USB 3.0	GPIO, I2C, SPI, UART, USB 3.2, PCIe Gen3
Networking	1 Gbps Ethernet	1 Gbps Ethernet
Expansion	M.2 Key E (via adapter)	Native M.2 Key E (Wi-Fi/BT support)
Power Consumption	5W – 10W	Configurable: 7W or 15W
JetPack SDK Version	JetPack 4.x (L4T Ubuntu 18.04)	JetPack 6.x (L4T Ubuntu 20.04)
Security	Basic	Secure Boot, Hardware Crypto (TPM-ready)
Form Factor	100mm x 80mm (Dev Kit)	100mm x 79mm (Dev Kit)
Price (Dev Kit)	~\$99	~\$199 (4GB), ~\$249 (8GB)

Resources

- NVIDIA JetPack SDK
- jetson-inference GitHub
- NVIDIA DeepStream SDK
- [NVIDIA Jetson Nano Dev Page](#)
- [Jetson Community Projects](#)
- [JetPack SDK](#)
- Forums: forums.developer.nvidia.com

Wrap-Up

Jetson Nano is ideal for Edge AI learning and prototyping.

Explore further:

- Jetson Xavier NX
- DeepStream SDK
- Robotics with ROS