

# INTELLIGENCE AT THE EDGE

Technica's Independent Research and Development (IR&D) organization—a component of Technica Labs—is a trailblazer in developing next-generation applications of Artificial Intelligence (AI)/Machine Learning (ML) for the Edge. We have conducted significant R&D on AI apps for tiny, resource-constrained Internet of Things (IoT) devices—delivered within a DevSecOps framework. Examples of Edge-based use cases are anomaly detection, battlefield communications prioritization, cave mapping, and autonomous resiliency for satellites in space.



We work with you from ideation to deployment and through sustainment in a manner that allows you to leverage IoT information from cameras, sensors, actuators, wearables, etc. for actionable insights that make sense from the ever-growing, vast sea of IoT data. Technica engineers the right AI to work with each device type for you to harness the power of your IoT data.

Technica's AI services for the Edge include:

## AI FOR THE EDGE

ML/Deep Learning (DL) model customization for edge devices, also known as TinyML. TinyML incorporates Size, Weight, and Power (SWaP) constraints and includes factoring in Denied-Disrupted, Intermittent, and Limited (D-DIL) communications environments.

## TINYML-ENABLED IoT DEVICE EXPERTISE

Cloud-based AI is very different than TinyML. Technica applies ML to the smallest microprocessors, using the least amount of power—all while striving for maximized results.

## IoT COMMUNICATIONS PROTOCOLS & ARCHITECTURES

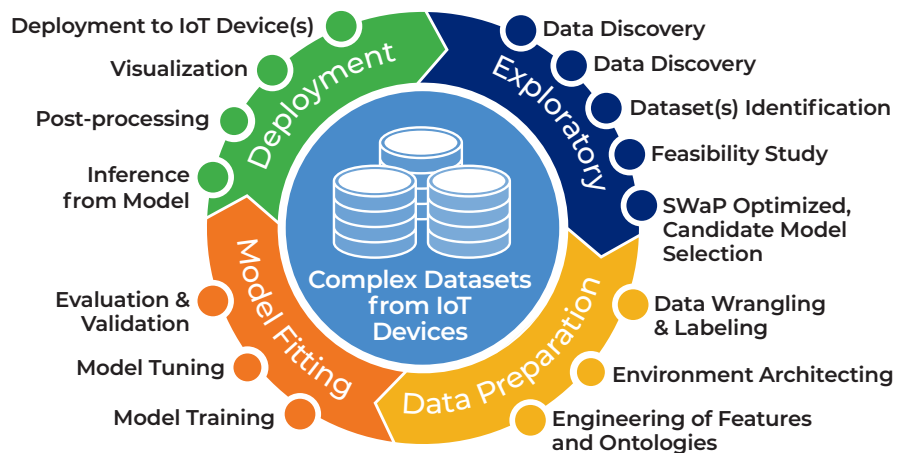
From the latest advances in mesh networking and MANET to the standards-based protocols such as MQTT, Technica securely connects devices leveraging resilient communications architectures.

## AI SOLUTIONS/IoT LIFECYCLE MANAGEMENT

Implementation of AI application lifecycle management incorporating IoT devices and Continuous Integration (CI)/ Continuous Delivery (CD), including working with Kubernetes to the Edge.

## TECHNICA'S INTELLIGENCE AT THE EDGE METHODOLOGY

Technica has developed an agile AI Methodology for Edge-based deployments. The process allows us to move from ideation to prototyping in weeks – not years. Technica's Intelligence at the Edge Methodology expands our traditional agile AI Methodology to allow us to incorporate the unique SWaP constraints of a given IoT device. It enables us to conduct sprints within each element of the loop to demonstrate success, early and often.



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Beginning with your complex IoT Device Datasets, we iteratively move through each phase that is tuned to your IoT device(s) of choice: Exploratory, Data Preparation, Model Fitting, and Deployment. As more data is collected, the process repeats.

## TECHNICA AREAS OF EXPERTISE

### Fog/Edge Processing

- Vast expertise with utilizing TinyML in D-DIL Environments
- Autonomously Prioritize D-DIL Communications with Most Important Information Shared First
- Expertise with IoT Protocols and Mesh Networking
- Lightweight ML Models for the Fog/Edge

### TinyML & TinyDL

- Image Detection/Processing
- Anomaly Detection for Signals Data, Like Network Traffic Data
- Ensuring Autonomous Resiliency and High-Availability of Microservices
- Blind Modulation Classification

### Neural Networks

- Transformer Attention, e.g., BERT
- Generative Adversarial Networks (GANs)
- Autoencoders
- Convolutional Neural Networks
- Recurrent Neural Networks (RNNs) including Long Short Term Memory (LSTM)
- Bayesian Networks

## EDGE INTELLIGENCE SOLUTION STACK

### Devices

- **Boards and Processors:** NVIDIA Jetson (Nano, TX2, & Xavier), Raspberry Pi (2,3,4, & Zero), Movidius, ESP32, Arduino, VIM3,
- **CPU Architectures:** ARM, RISC-V, MIPS, x86 (CISC)
- **CPU Vendors:** NVIDIA, Broadcom, TI, AMD, Intel, Espressif Systems
- **Low Level:** Hardware Design, Peripherals and Sensors Integration, Firmware Engineering

### Software Development

- **Programming Languages:** C, C++, CUDA, Java, Go, Python, MicroPython
- **Wireless:** WiFi, NFC, RFID
- **Embedded Linux:** Alpine, CentOS, Debian, Ubuntu
- **AI Libraries:** TensorFlow, Keras, Theano, PyTorch, TFLite, NumPy/SciPy
- **Protocols:** Kafka, REST, MQTT, Mesh Networking, MANET, Web Sockets, Push Notifications, Custom Protocols Design
- **API Design for Cloud Integration**

### Neural Processing Unit (NPU)

- **Amlogic:** Khadas VIM3 (NPU)
- **Rockchip:** RK3399Pro (NPU)
- **Kendryte:** K210
- **Intel:** Myriad X
- **Gyr Falcon Technology:** Lightspeur
- **Google:** TPU
- **Nepes:** NM500 (General Vision Tech)
- **Bitmain:** Sophon

### Concepts

- Embedded Programming
- Functional Programming
- Object-Oriented Programming
- Tactical Edge Architectures/Communications
- D-DIL
- Fog Computing
- Hybrid Cloud
- Microservices/Distributed Architectures
- DevSecOps
- Agile/Scrum Methodologies
- AI/ML/Deep Learning
- Natural Language Processing (NLP)

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Technica Corporation, founded in 1991, provides high-end system engineering services to Defense, Intelligence, Law Enforcement, and Federal civilian agencies. The company specializes in systems engineering; integration and testing; cybersecurity; and product development, deployment, and support. Technica invests heavily in R&D and is leveraging big data, machine learning, artificial intelligence, blockchain technology and high-performance computing to support its customers. For more information, please visit [www.technicacorp.com](http://www.technicacorp.com)

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