Supported with interoperable ecosystem of plug-and-play components

MFX-1
IoT EdgeX Computing Gateway

Developed on Solid Run HummingBoard Carrier Board for iMX6 SOM

Based on Linux Foundation EdgeX Foundry open source framework

EDGE X FOUNDRY™

LINUX FOUNDATION
COLLABORATIVE PROJECTS

MAINFLUX
Internet of Things Solutions

Mainflux MFX-1 IoT EdgeX Gateway

MFX-1 IoT Edge Gateway is Linux Foundation EdgeX Foundry compliant IoT gateway developed on the optimized hardware platform for industrial IoT edge computing solutions.

EdgeX Foundry is an open source framework for edge computing hosted within a full hardware-and OS-agnostic reference software platform that unifies the marketplace and accelerates the deployment of IoT solutions.

Mainflux Mfx-1 IoT edge gateway can be used as part of Mainflux IIoTSystem which enables remote management of MFX-1 gateways with EdgeX GW management appliacation.
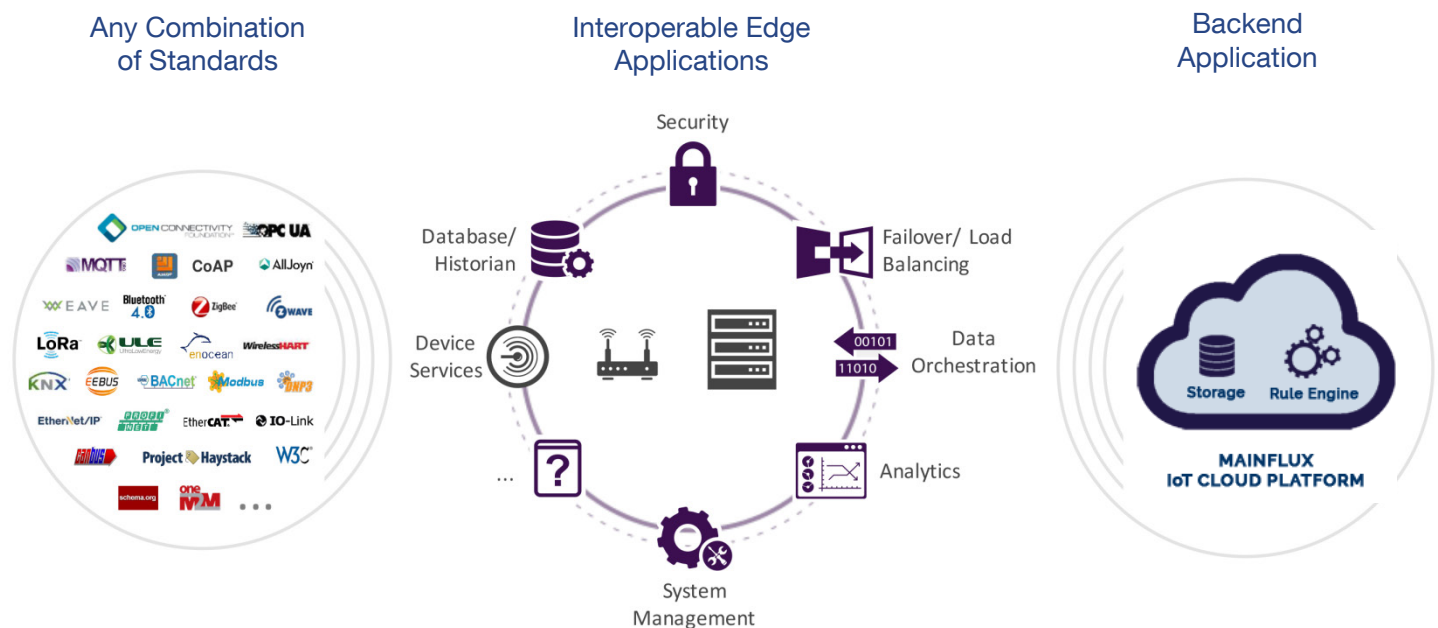
EdgeX Foundry

Over 75 member companies across the IoT space including Dell, AMD, Analog Devices, Toshiba and Samsung.

Project objective: Build a vendor-neutral, flexible, highly-scalable and industrial-grade open source edge software platform supported by a rich ecosystem of plug-and-play components.

Mainflux at EdgeX Foundry

Chairman position and memeber at large position at Technical Steering Commitee.

Community Contribution Award for Exemplary Leadership Innovation and Award for Extensive Technical Contribution.

Any Combination of Standards

Interoperable Edge Applications

Backend Application

# EdgeX Foundry Platform - Open Source Software

Technical specification

- Microservices architecture supports the use of any combination of heterogeneous components plugged into a common interoperability foundation.

- Agnostic to any hardware CPUs (x86, ARM), OS (Linux, Windows, Mac OS), and app environment (Java, JavaScript, Python, Golang, C/C++ to work together through the common APIs

- Allow services to scale up and down to highly-constrained *devices,* based on device capability and use case

- Support for any combination of device interfaces to normalize connectivity protocols (both IP and non-IP) into a common API

- Functionality across multiple edge hardware nodes or across processors within a given node

- Optional microservices (e.g., northbound message bus, rules engine, database) can be quickly replaced with preferred open-source or proprietary alternatives

- Industrial-grade security, manageability, performance, and reliability while still maintaining extensibility.

- Drop-in replacements of microservices or entire subsections with more performant versions without requiring architectural changes

Features

- Interoperable Ecosystem: Makes it easy to integrate service offerings from many sources into a unified IoT edge

- Security: A pluggable unified security model that makes secure solutions development easy in any context.

- Scalable: Builds on industry models (IIC, OpenFog, OCF, etc)

- Flexible: Enables rapid deployment without technology lock-in

- Integrating: Unifies existing standards with proprietary solutions

- Generative**:** Creates a marketplace/ecosystem of plug-and-play components to quickly scale up or down fueling higher-level market innovation

- Performant versions without requiring architectural changes

EdgeX Foundry Platform - Open Source Software

Microservice Platform Architecture Connected to Mainflux IoT Platform
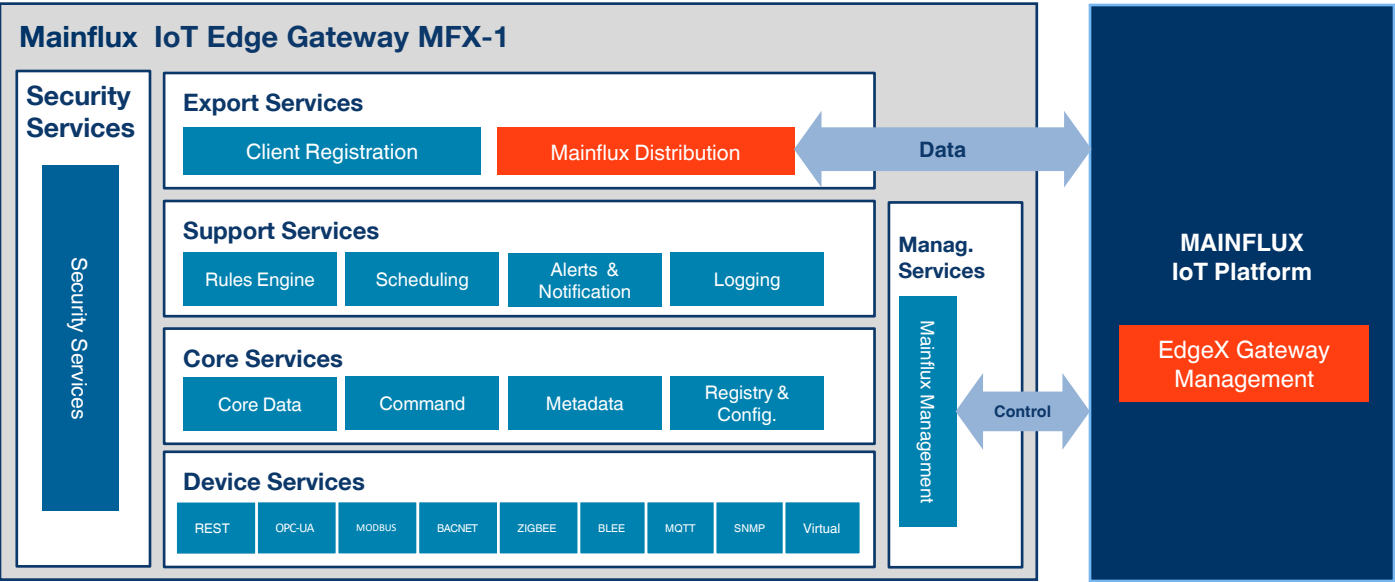
The architecture supports communications "north, south, east and west" as needed in the IoT "fog" and can be deployed on a variety of edge nodes in a tiered computing architecture. The deployment of combinations of different plug-and-play microservices simply depends on the use cases and capability of the host device.

Mainflux Distribution is the component which will control data flow between MFX-1 and Mainflux IoT Platform.

MFX-1 IoT Edgex Gateway - Hardware

Mainflux- MFX-1 IoT EdgeX Gateway is implemented on Solid Run HummingBoard-Edge hardware platform.

HummingBoard-Edge is the ideal M2M platform, it was developed to meet the B2B market demand for a high performance, reliable and innovative device. The brand new HummingBoard-Edge includes a whole new set of features such as eMMC (4GB), mPCIE (Half or Full Size) , wide range input (7V-36V) , optional metal enclosure and much more.

Features

- Low memory footprint (RAM)
- Small size binaries
- Low Latency
- Hi Performance
- Deploy only microservices you need

- Based on NXP's iMX6 Single to Quad Core
- Up to 2GB DDR3
- Optimal IoT platform
- Feature rich
- Industrial Temp. (-40° to 85° C)
- Physical radio connectivity: WiFi, BLE
- Cellular connectivity: GSM/GPRS/LTE/ CAT-M/NB-IoT, LoRa, 6LoWPAN/Zigbee
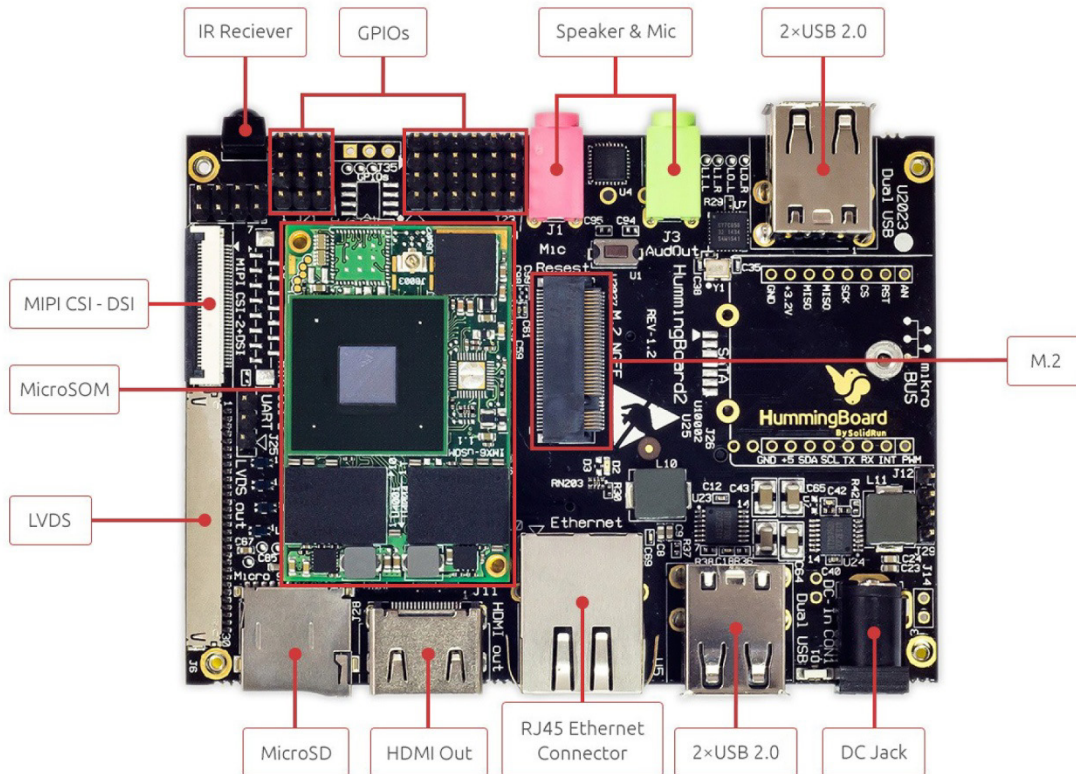
System Specification

| HummingBoard Edge	
SOM Model	i.MX6 based Solo to Quad Core SOM
Memory and Storage	Up to 2GB DDR3 uSD eMMC (8GB) M.2 (2242)*
Connectivity	1×RJ-45** 4×USB 2.0 mPCIE with SIM card holder
Media	HDMI-Out MIPI-CSI-2 and MIPI-DSI Parallel Camera (on GPIO header) LVDS Analog Audio
I/O	Reset Button 36 pins GPIO Header RTC with battery IR
Power	7V-36V, 5.5mm in (Twist and Lock mechanism)
Software	Linux
Dimensions (WxL)	102mm×69mm
Enclosure	Optional Metal Enclosure

Interfaces

Top View

Bottom View
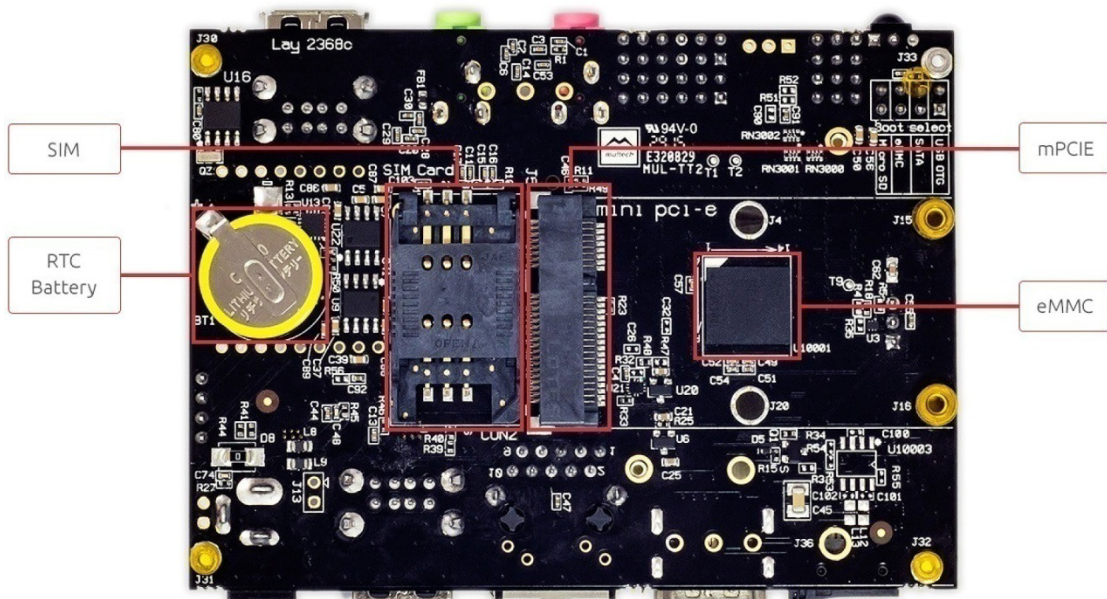
Mainflux IIoT System

Full turn-key Internet of things system composed of highly-performant IoT Cloud platform and edge computing gateway supported with ecosystem of plug and play components that significantly accelerates and simplifies deployment of IoT solutions across a wide variety of industrial and enterprise use cases.

The turn-key system is designed for scale, performance, operational efficiency and the ability to create intelligent products and value-added services across the range of industries.
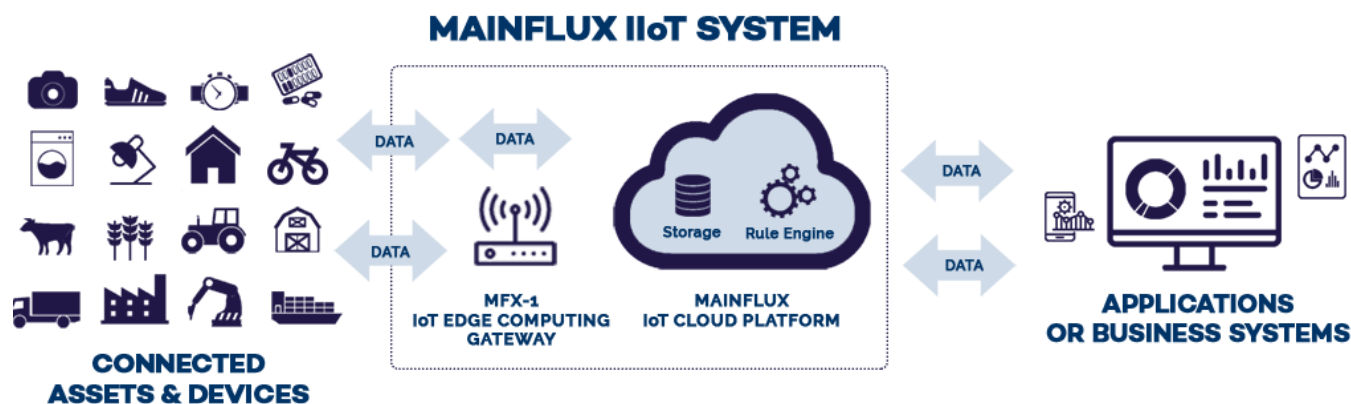
Mainflux IoT Platform

Mainflux is an open source, comprehensive, full-scale IoT platform with capabilities that only the top 14% of existing platforms on the market can match.

The core capabilities of the platform are shown below:
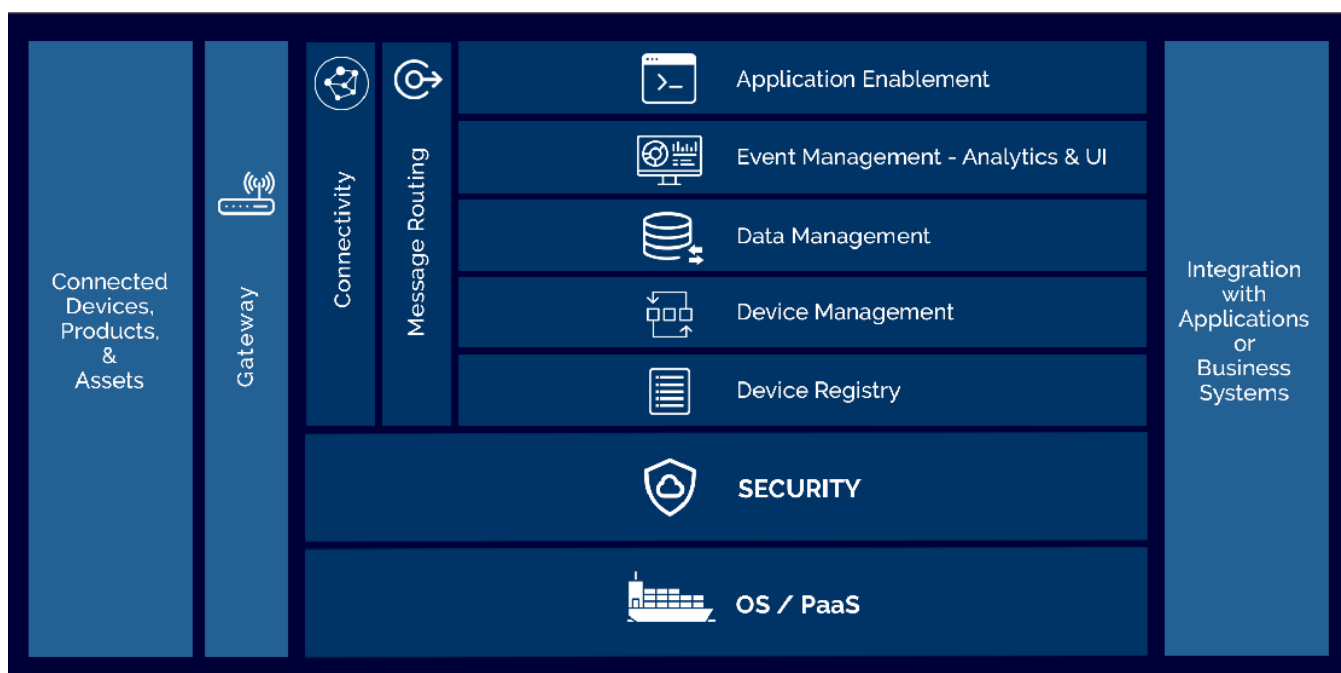
Mainflux IIoT System

Mainflux IoT Platform within the IIoT system

IoT Platform servers as a remote control of the IoT Edge Gateway, management, storage, advanced analytics and learning, acting as meta-instance of more immediate processing data needs.

For this full functionality, special middleware connectors are created both on the IoT Platform and IoT Edge Gateway side and additional original EdgeX gateway management application.

EdgeX Gateway Management Application

Application with user-interface which enables remote management and the control of the MFX-1 gateway (fleet management, grouping,) and the whole IIoT System.

Mainflux IIoT System Architecture
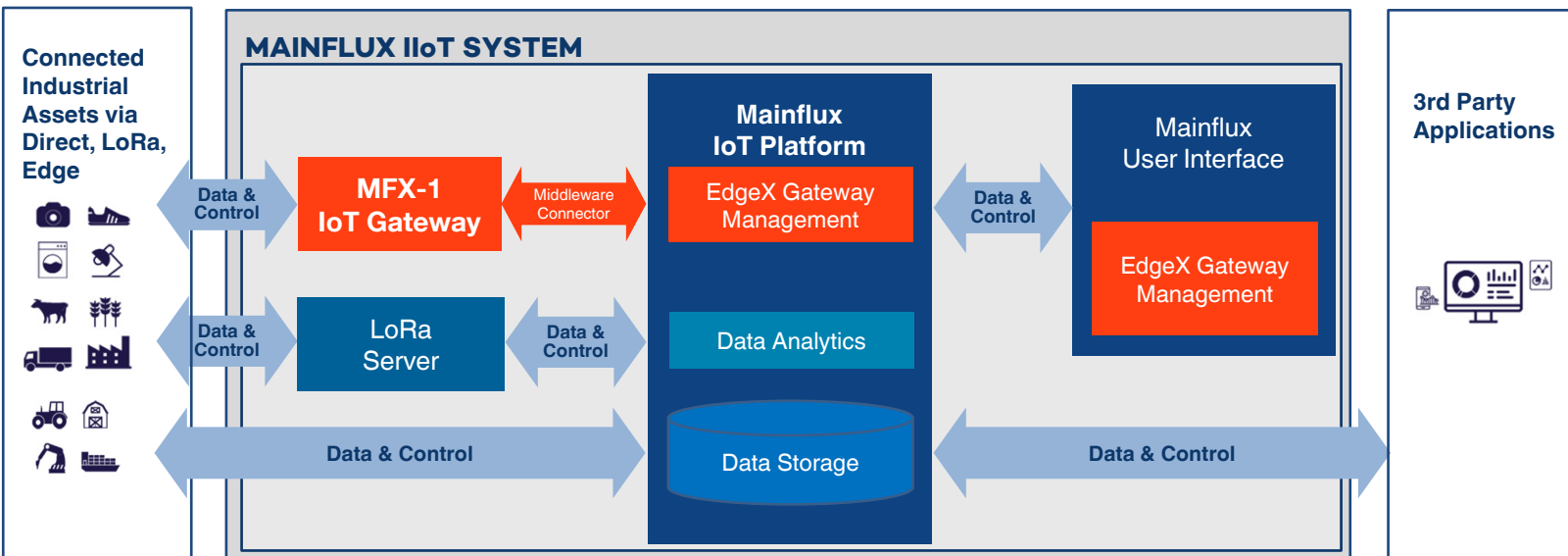
Recognition

Thought Leadership

Due to the leading edge design, architecture and implementation of the Mainflux IoT Platform, the Linux Foundation invited Mainflux to participate as a founding member of it's EdgeX Foundry Project alongside companies such as Dell, AMD, Analog Devices, Toshiba and Samsung.

Mainflux CEO Janko Isidorovic was elected to the EdgeX Technical Steering Committee and currently chairs the EdgeX Application Workgroup, and Drasko Draskovic as the member At Large.

Furthermore, Mainflux founder Draško Drašković received two awards from the community and Governing board: Community Contribution Award for Exemplary Leadership and Innovation Award for Extensive Technical Contribution.

Conference Presentations

The Mainflux team has presented its IoT Platform at some of the world's largest conferences: Fosdem 2016 Amsterdam - Premier European open-source conference; IDC Forum 2016 Belgrade; Linux Foundation's Open Networking Summit 2017 Santa Clara and Pargue; ITNEXT Summit - 2017 Amsterdam; O'Reilly-SW Architecture Conference 2017 London; Codemmotion 2017 Amsterdam; Open Networking Summit 2018 - Portland.

Publications

O'Reilly Media published an IoT book with 40 pages dedicated to the Mainflux IoT Platform: "Scalable Architecture for the Internet of Things". Recently the Linux Format magazine dedicated a several page interview with Mainflux founder Draško Drašković.

Investment

The Government of Serbia Innovation Fund, supported by European Union and World Bank technology innovation programs, has awarded Mainflux a significant funding grant for the continued development of its two main systems, the core IoT Platform and the EdgeX Gateway.

Contact Mainflux

Mainflux is a technology company providing full-stack, open-source IoT platform,
IoT edge computing gateway and consulting services for all IoT technology stack layers.

Technically diverse our cross-functional team covers hardware expertise, embedded-
software development, IT operations and management, software and web application
development, distributed systems, data science and blockchain development.

From the initial phase and strategic planning, PoC stage, to data analytics after rollout, we
are providing professional services and support to ensure success of your IoT development.

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Mainflux at Belgrade Science Park