Octonion

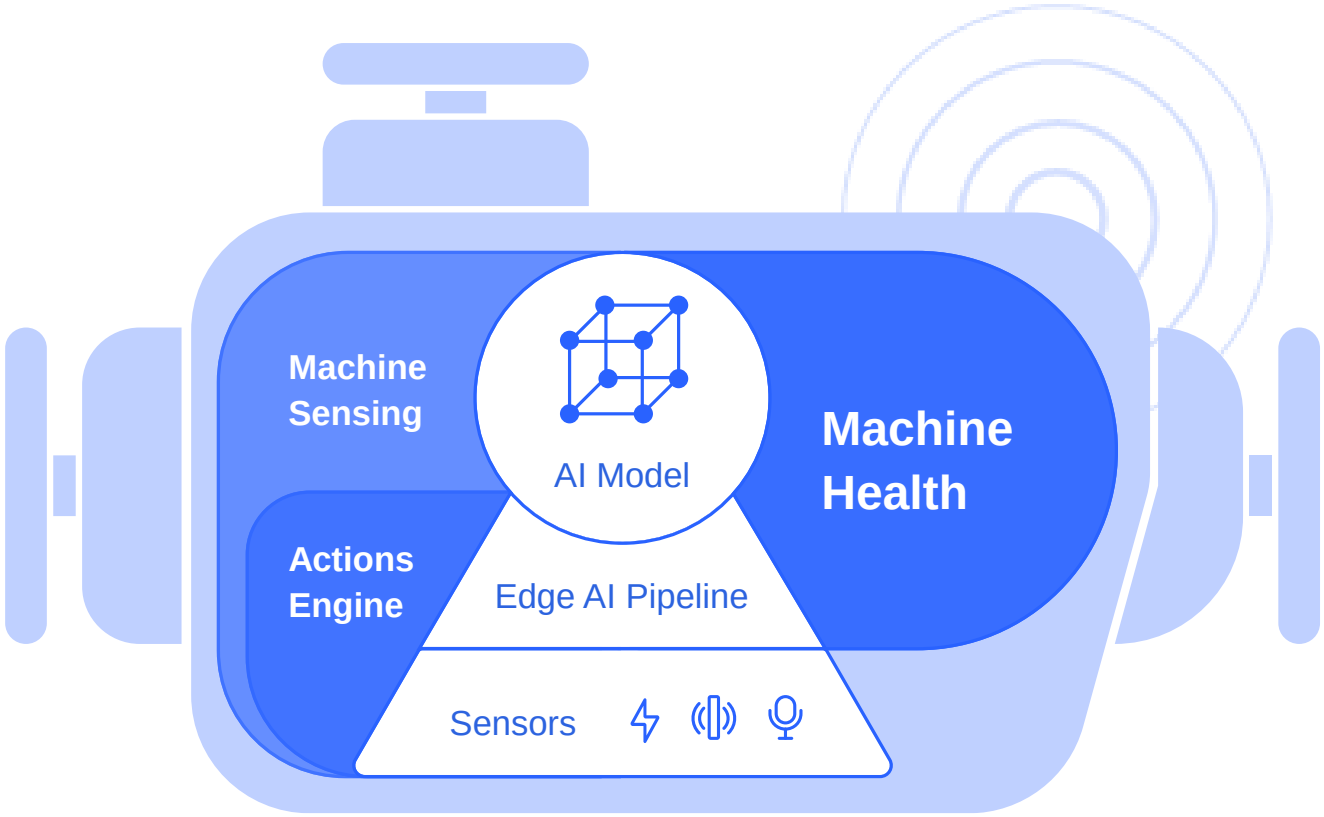
Octonion product overview

Industrial machine diagnosis on the edge, providing real-time data on-prem with existing IoT infrastructure

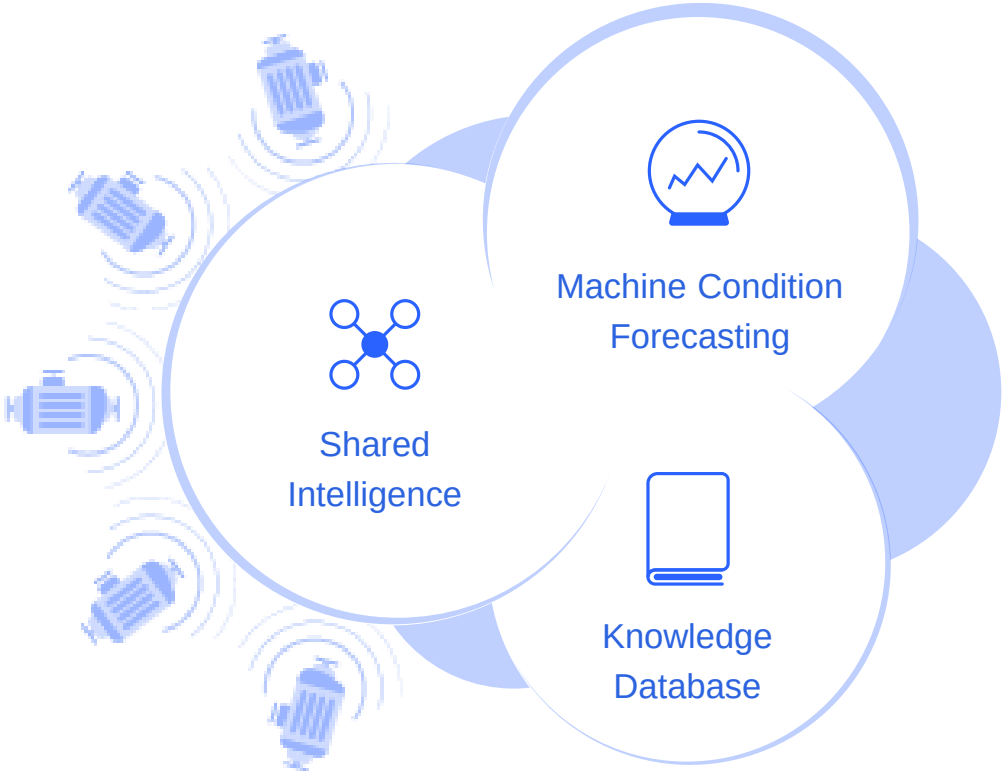
September 2020

Product overview

Octonion is **Machine Intelligence Software powered by Edge AI** engine that inspects and forecasts health of Industrial IoT equipment to unlock innovative solutions creation faster and at lower cost.



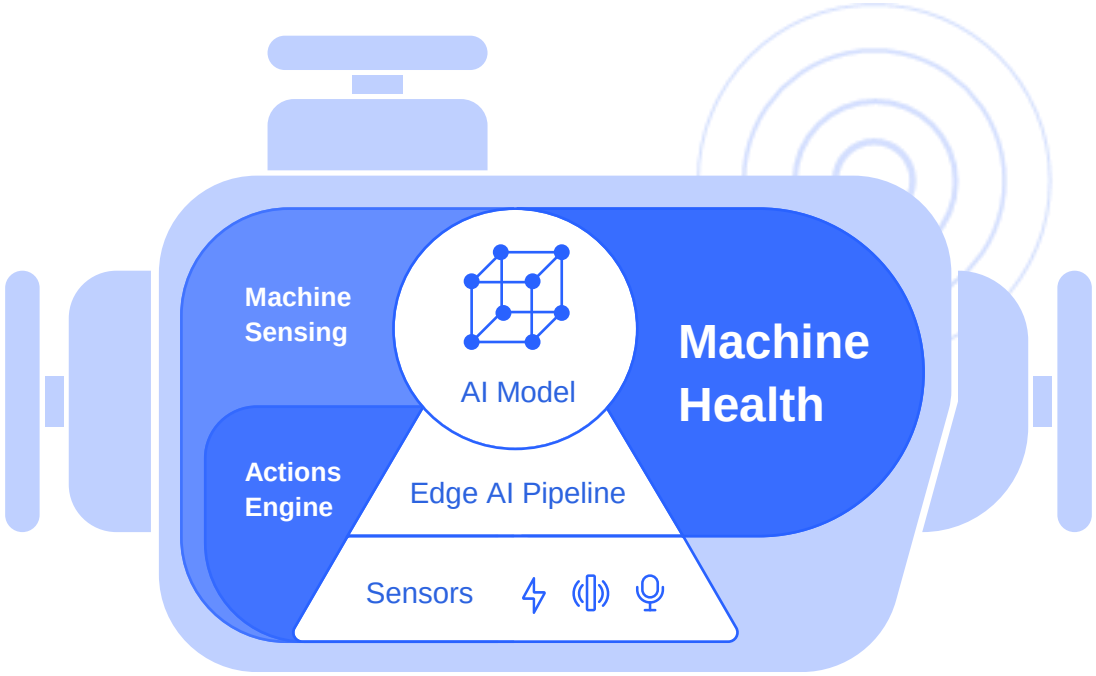
Machine Intelligence inside the industrial equipment

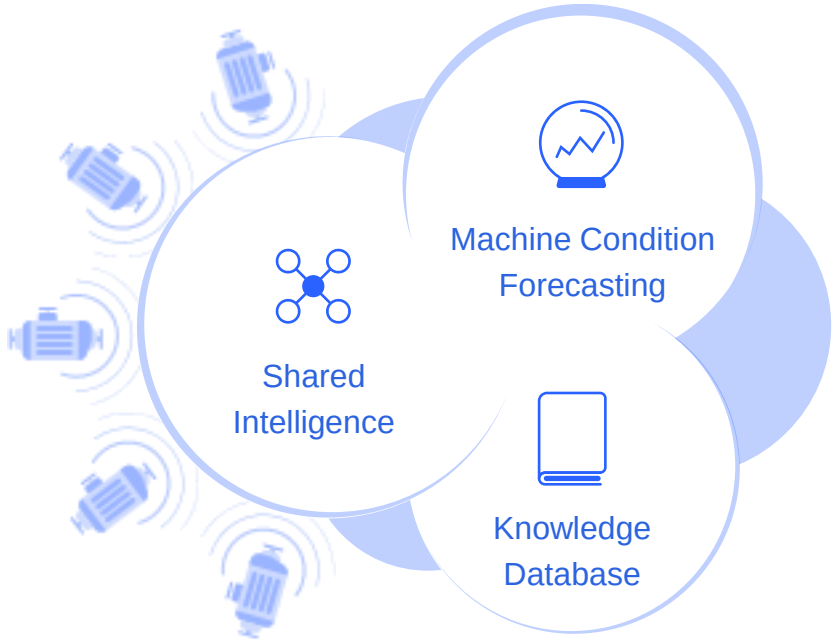


Machine Intelligence in the Cloud

Octonion

Product features overview





Edge AI engine brings machine self-diagnosis inside of equipment by continuous transformation of physical sensors data to knowledge about machine behavior and its state - Machine Health Record (MHR©).

Edge AI engine detects anomalies / unwanted states with self-learning capabilities in real time.

In the cloud, Octonion accumulates complete history about each monitored machine and builds shared knowledge base for the fleet of machines.

By leveraging fleet intelligence it allows to replicate knowledge from one machine to another in easy way and perform advanced forecasts of industrial equipment health.

Octonion

Feature: Machine sensing

Octonion performs day-and-night diagnosis of the machine, monitors its key metrics and identifies changes in machine behavior. Knowledge continuously generated through the sensing cycle, provides meaningful insights into the machine state.

Feature Overview

- Detect machine states
- Continuously self-learn based on an unsupervised approach
- Highlight abnormal behavior
- Detect anomalies
- Assess key machine metrics and analyze their trends

Value

- Get insights into equipment usage patterns
- Track changes in machine behavior over time
- Gain access to machine-level metrics in real-time

Octonion

Feature: Machine health

Machine health is a cumulative measure that describes overall machine condition and helps to anticipate its degradation.

The Health Metric is easy to understand and use since it is represented as the value on the 0 to 1 scale, where 1 is excellent, and 0 is an unacceptable condition of the machine.

Octonion evaluates machine health in real-time and observes noticeable changes in machine condition to identify faults at an early stage and avoid unplanned downtime.

Feature Overview

- Provide real-time visibility on machine health
- Provide machine health history and trends
- Monitor changes in machine health and provide insights what drives these changes
- Configure and personalize health metric to specific use case by adding contextual knowledge inside the machine or user input

Value

- Highlight degradation trends of the machine to estimate the criticality state and evaluate the intervention

Octonion

Feature: Machine condition forecasting

Machine condition forecasting is a Cloud AI-based feature that provides robust insights into future equipment condition. Forecasting is built on the top of historical data and in-situ analysis of the key machine metrics trends.

Features

- Forecast Machine Health to proactively predict equipment failure
- Forecast key machine metrics value changes

Value:

- Facilitate predictive maintenance through key metrics forecasting
- Build correlation between forecasted machine health and remaining useful life of specific equipment

Octonion

Feature: Actions engine

Actions Engine is a component of machine intelligence that enables converting business logic into equipment-level actions.

Feature Overview

Trigger alerts and actions on premise:

- On Health metric value and it's change
- On detected Anomalies
- On detected Abnormal machine behavior
- On detected Machine State (known and unknown)
- On detected Key metrics values and their change

Value

- Be alerted about the substantial events to stay up to date
- Contribute to equipment autonomy by empowering the machine to act locally. Thereby reduce human interaction.
- Reduce response time on the event to handle latency-sensitive use cases
- Integration with manufacturer's ERP and CMM systems allows smooth incorporation into existing value chain

Octonion

Feature: Shared intelligence

Octonion manages intelligence in the entire manufacturer ecosystem by letting machines talk to each other.

It performs learning of possible equipment conditions from multiple machines owned by manufacturer and accumulates collected knowledge to the shared AI model. This knowledge then exchanged back with a range of assets ensuring that each machine has complete expertise locally.

Feature Overview

- Build a knowledge database of machine states and issues for a given type of machine

Value

- Increase the speed of creating solution and cut costs by replicating knowledge from one machine to another

Octonion

Product outcomes

Machine health record (MHR©) is a digital representation of machine behaviour and its state that accumulates knowledge about the **past**, continuously monitors the **present** and **forecasts the future** of the machine

Knowledge of Past

Historical observation of machine behavior over time

- Machine states history
- History of machine health and key machine metrics
- Anomalies history
- Trends of metrics change over time
- Timeline of events
- Action Engine alerts triggered

Knowledge of Present

Continuous monitoring of the machine condition in real-time

- Real-time Machine Health
- Current operation state
- Vibration metrics

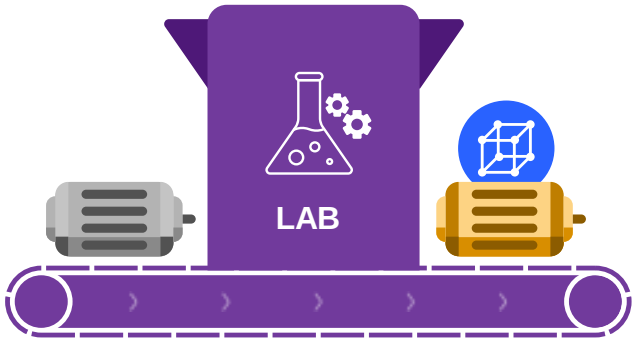
Knowledge of Future

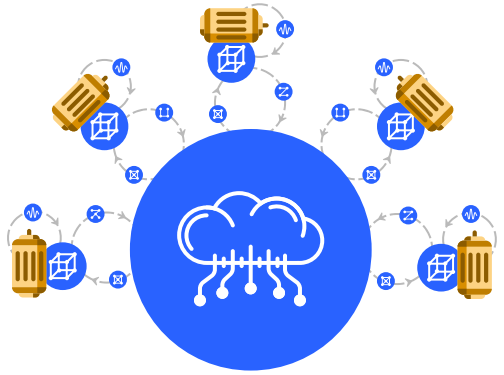
Insights into future condition of the machine

- Forecasts of machine health
- Forecasts of machine key metrics

Octonion

Customer journey: lab environment





Intelligence personalization

In the lab environment, personalize intelligence based on equipment-specific sensors data, use case, and desired product outcomes

Intelligence validation

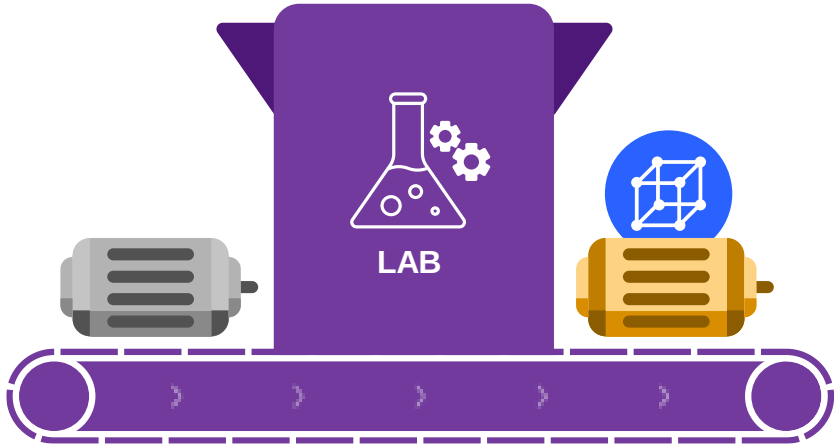
Deploy personalized AI model on the field to diagnose machine health and validate its consistency with a visible condition of the machine

Intelligence augmenting

Replicate AI model to multiple machines of the same type to augment lab intelligence by detecting states and issues for a fleet. Start building a shared knowledge base

Octonion

In the lab: Intelligence personalization



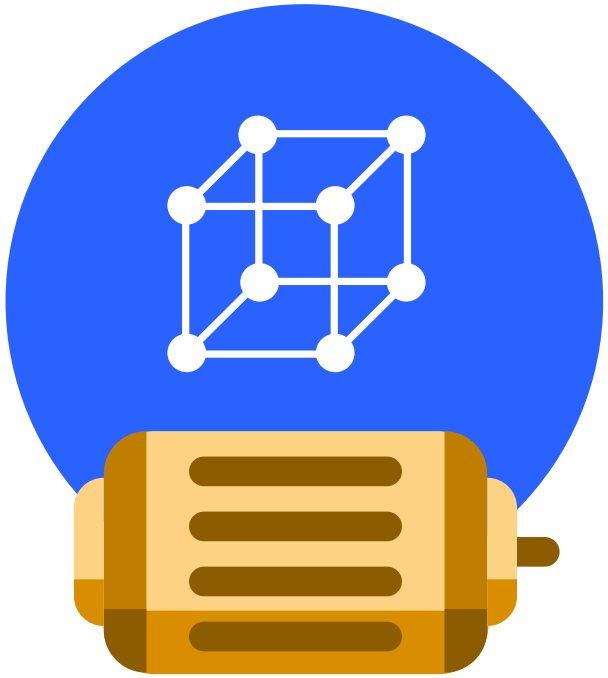
Use **Octonion Discovery Kit** for immediate start of intelligence personalization for a specific equipment in the lab environment

Customer steps to personalize the intelligence:

1. Pick and choose a compatible hardware device from Octonion's partners that fits a given use case and the specific equipment
2. Setup the set of Octonion tools for sensors data collecting and dataset management
3. Record or enter a reference dataset for the equipment expressing its typical behavior
4. Personalize the intelligence with cloud-based **Octonion AI Lab** application
    - Visualize insights of the dataset
    - Use a preset of ready-to-use AI algorithms that fits a wide range of industrial equipment
    - Benchmark results to identify the most suitable AI algorithm and parameters
5. Receive a personalized AI algorithm that is ready for seamless integration to compatible hardware and deployment on the field

Octonion

In the lab: Intelligence validation



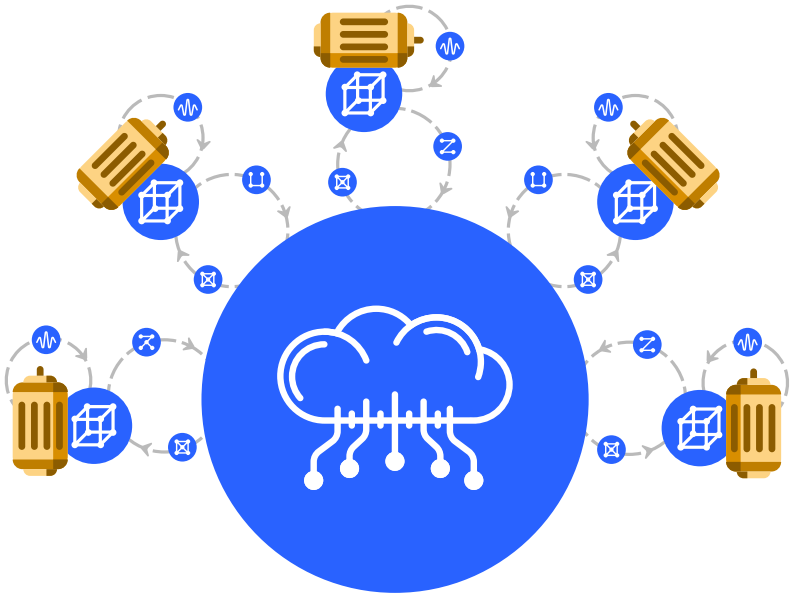
Use **Octonion Discovery Kit** to explore and validate intelligence running in the field

Steps to validate the intelligence:

1. Take a compatible hardware with integrated version of personalized AI model and deploy it on the field where intelligence will continue to self-learn
2. Observe typical behavior of the equipment to get a baseline for further monitoring of equipment deviations
3. Setup your machine in your test condition to validate the expected result of the AI

Octonion

In the lab: Intelligence augmenting



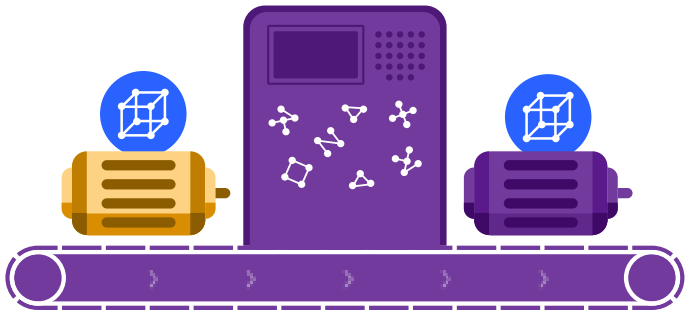
Use **Octonion Discovery Kit** to augment the intelligence by running on a fleet of machines

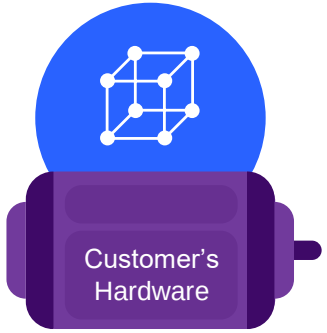
Steps to augment the intelligence:

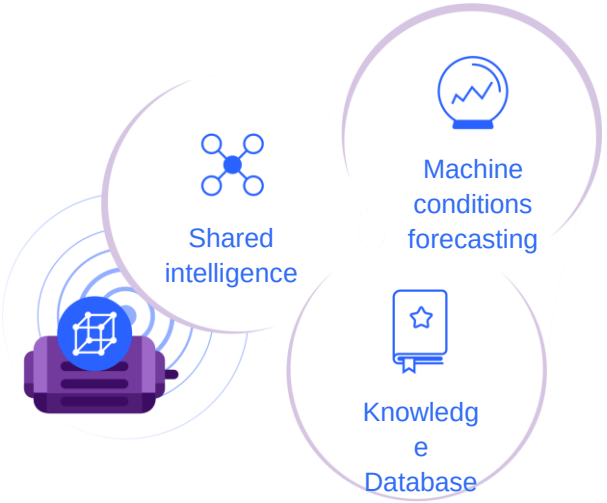
- Deploy personalized AI model to multiple units of the same equipment type
- Observe recognition of normal patterns for a fleet
- Simulate issues and see them recognized on another machines

Octonion

Customer journey: industrial environment







Tune intelligence for customer's hardware

Perform final tuning of intelligence based on characteristics of the hardware integrated inside the machine

Built-in intelligence inside the machine

Deploy tuned machine intelligence software into equipment to enable self-care machine inspection

Integration with customer's IIoT solution

With cloud-based features in place build knowledge base for a fleet of machines and perform machine health forecasts

Octonion

Unique Value Summary

- Octonion's IoT solution requires neither prior knowledge of the industrial equipment nor an existing dataset for the given machine.
- Machine health diagnosis and machine KPIs tracking occur inside the industrial equipment, thereby being autonomous and secure by nature.
- The autonomous AI engine continuously builds an AI model at the equipment level without any human supervision.
- AI engine and machine health module are easy to integrate into existing equipment on the market.
- Once deployed in the field, Octonion Machine Intelligence provides outcome from day one.

Octonion

High-level product requirements

At the Edge

- Octonion is easy to integrate into existing equipment thanks to out-of-box compatibility with Cortex-M microcontrollers. It fits the constraint environments thanks to low power and low resource requirements - running as low as dozens of kilobytes in memory.
- For diagnosis of machine behavior, Octonion relies on the following sensors:
  - Vibration sensors: MEMS and piezoelectric accelerometers
  - Sound sensors: digital and analog MEMS microphones

In the Cloud

- At the cloud level, Octonion has the containerized architecture and seamlessly integrates into existing microservice-friendly applications in Cloud or on-premise.

Octonion

Some shorts on Machine intelligence

- **Octonion Machine Health at the Edge (demonstration with ON Semi device):** https://www.youtube.com/watch?v=SPH_3hLCkPQ
- **Monitor and Diagnose your Machine Health (explaining calibration, evaluation and deployment):** https://www.youtube.com/watch?v=TrCzisAzuUY
- **Octonion Machine Intelligence: ventilation system case study (video with Weidmuller device):** https://www.youtube.com/watch?v=K_7MpgSYQv0
- **STMicroelectronics STM32 in action with Octonion and Wilo:** https://www.youtube.com/watch?v=T4D1mjs385E
- **Federated learning with Octonion Embedded AI for Predictive Maintenance:** https://www.youtube.com/watch?v=et1F-vdOu2k
- **Predictive Maintenance and Machine Health Demo Powered by Octonion Edge AI Engine:** https://www.onsemi.com/video/predictive-maintenance-and-machine-health-demo-powered-by-octonion-edge-ai-engine