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Virtual Coffee
Mantenimiento Predictivo: La Inteligencia Artificial al servicio de IoT
Microsoft
17/4/2020
10:00 (GMT+02)
Duración: 30 min

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According to NASA, failure patterns that are age related only apply to 18% of the assets

NASA

Complex Items

Sources: RCM Guide, NASA, Sept. 2008, and U.S. Navy Analysis of Submarine Maintenance Data 2006.

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¿Quiénes somos?

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Predictive maintenance

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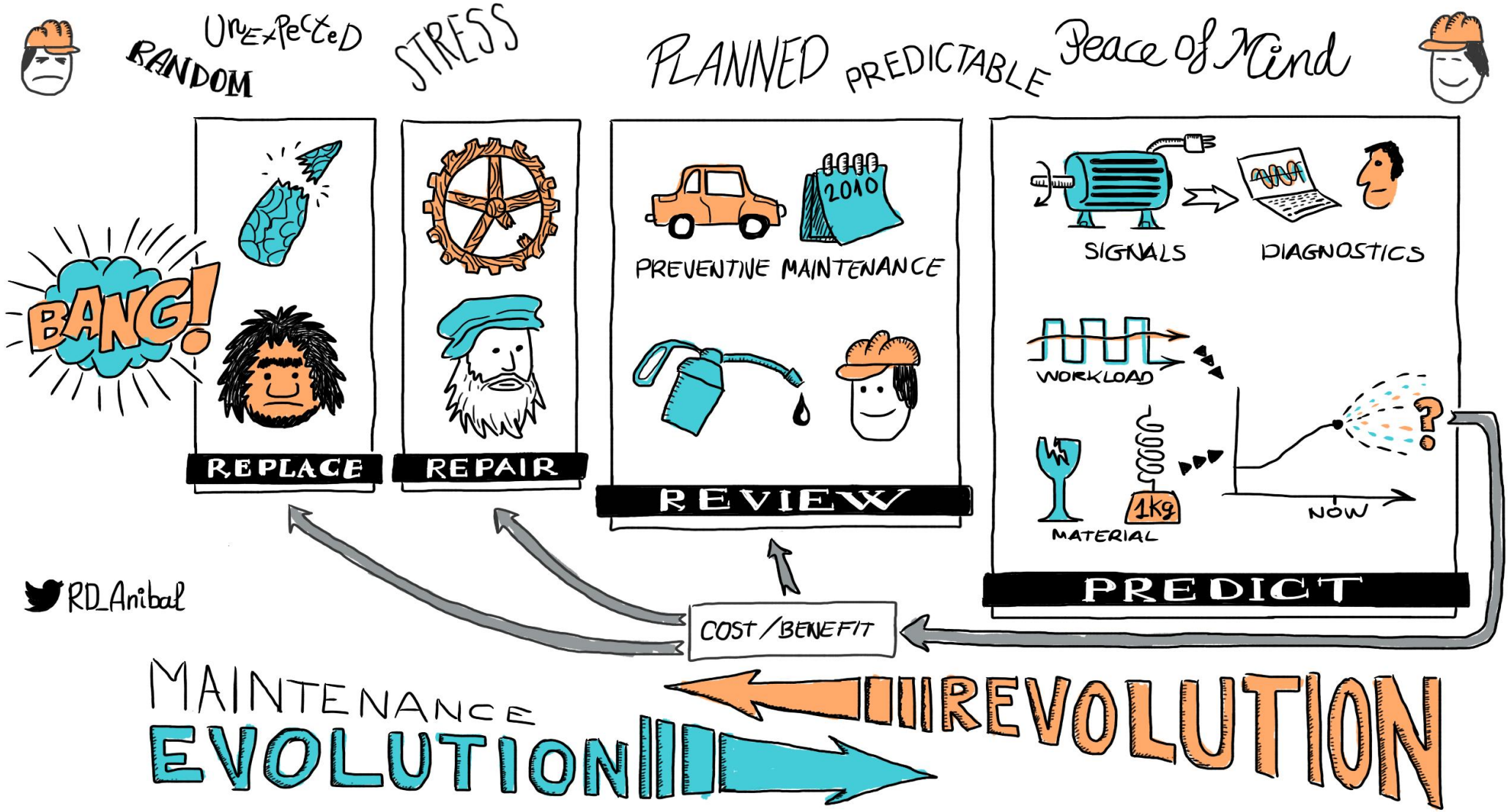

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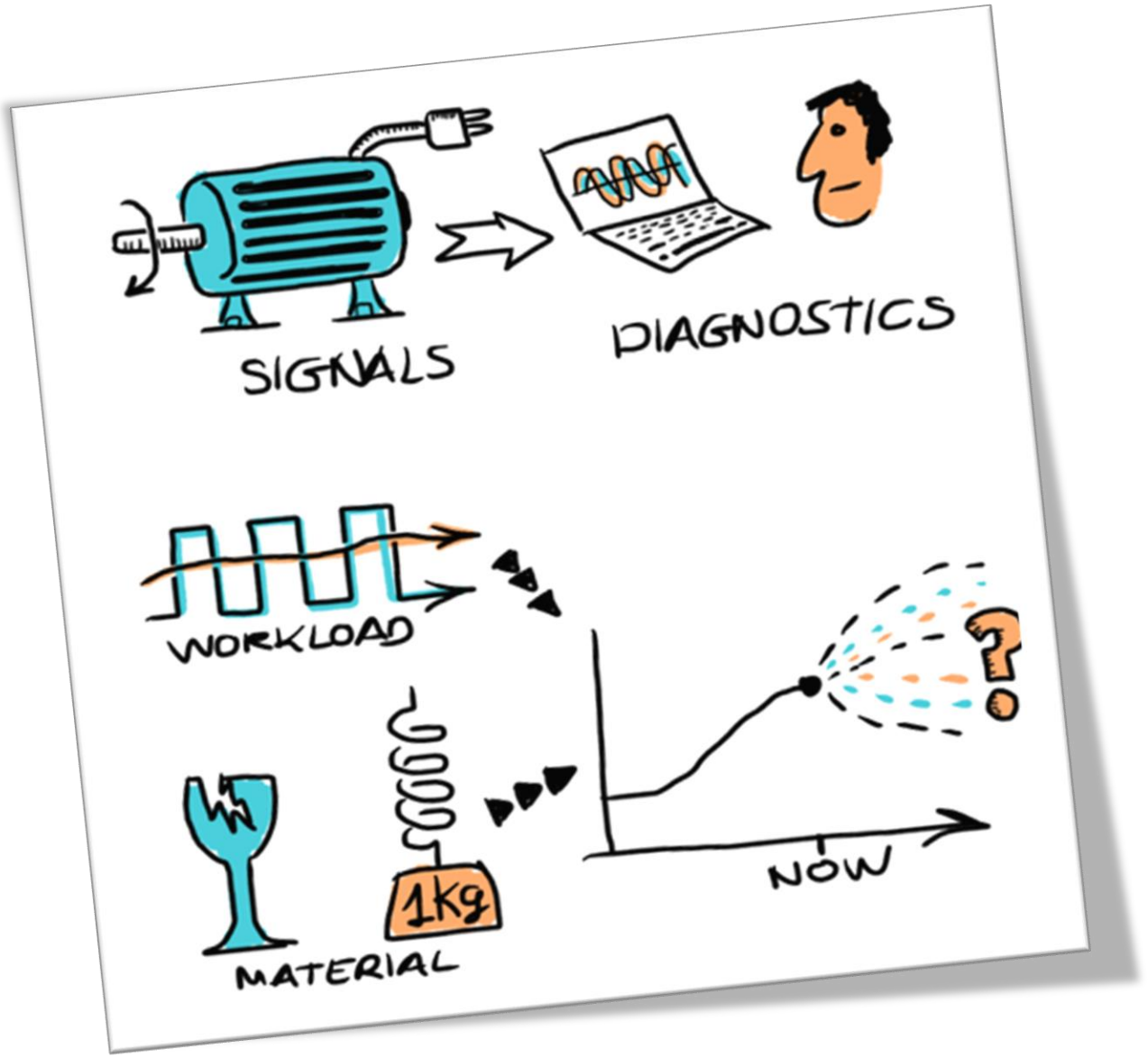
Predictive maintenance

Goals

- **Prevent failures** → Avoid unplanned reactive maintenance.
- **Eliminate the costs** →Related to unnecessary preventative maintenance

How?

- Using machine **sensor data** and **predictive models**



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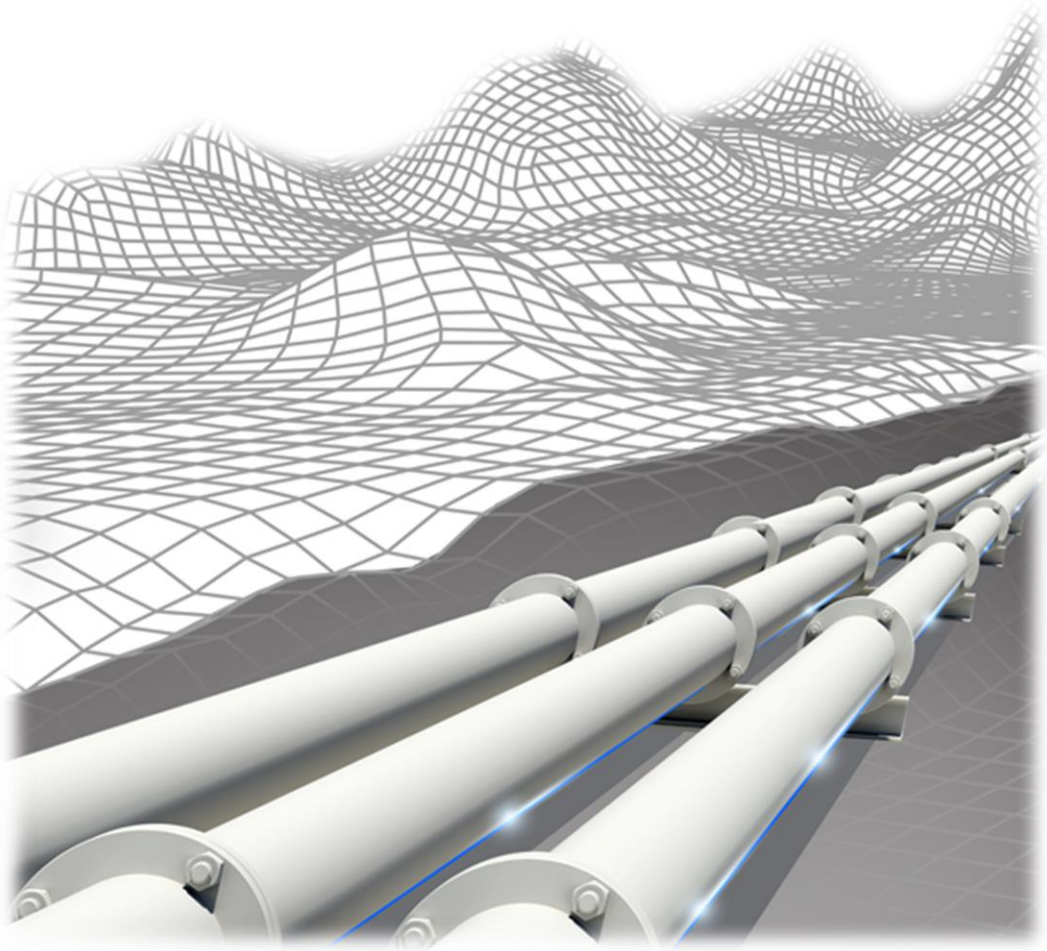
Hydraulic system maintenance

Failure prediction

For every predefined period of time (cycle) predict if the cooler system is close to failing using different temperature sensors :

- Close to total failure
- Reduced efficiency
- Full efficiency



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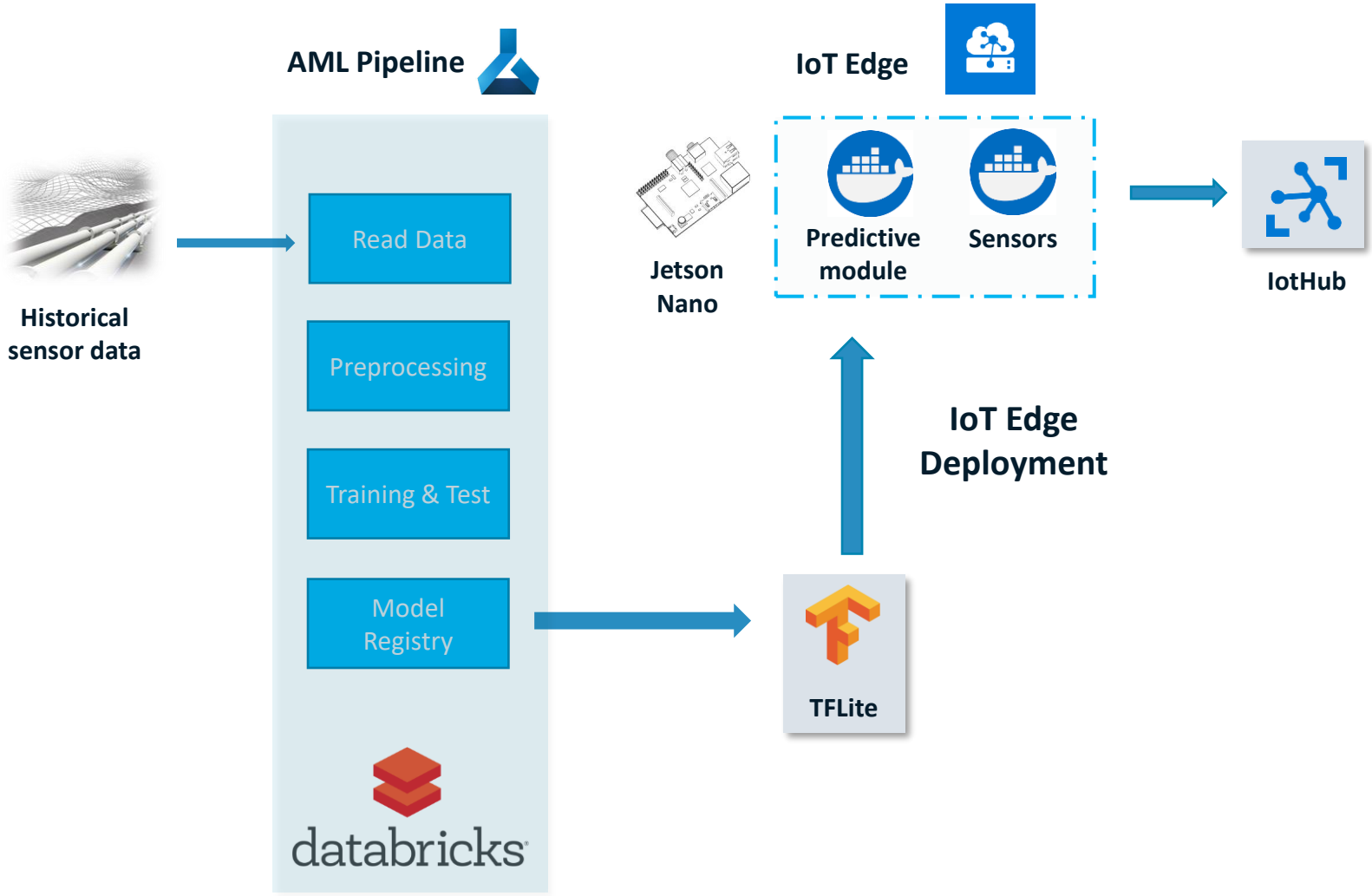
Architecture



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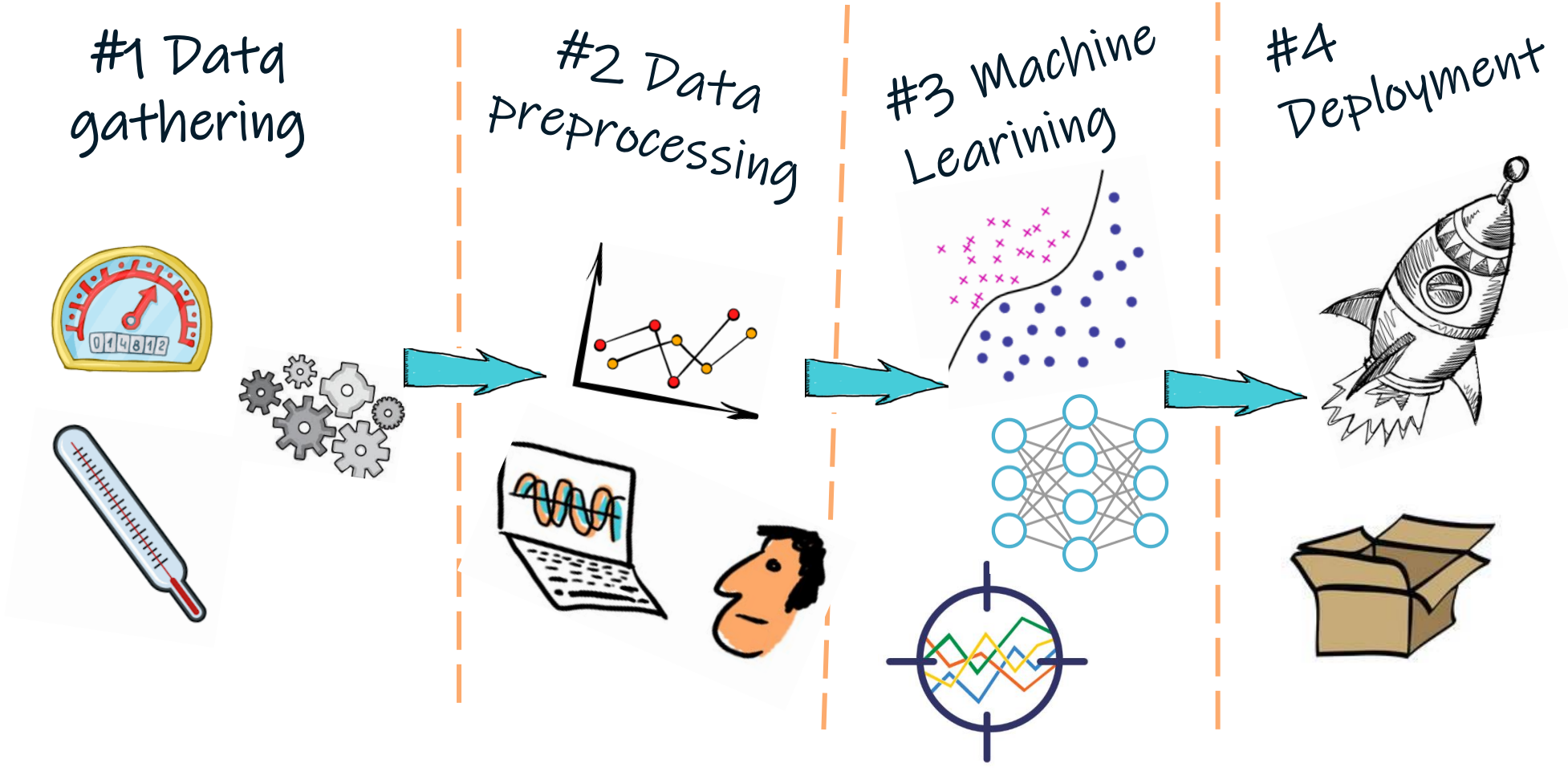
Predictive maintenance



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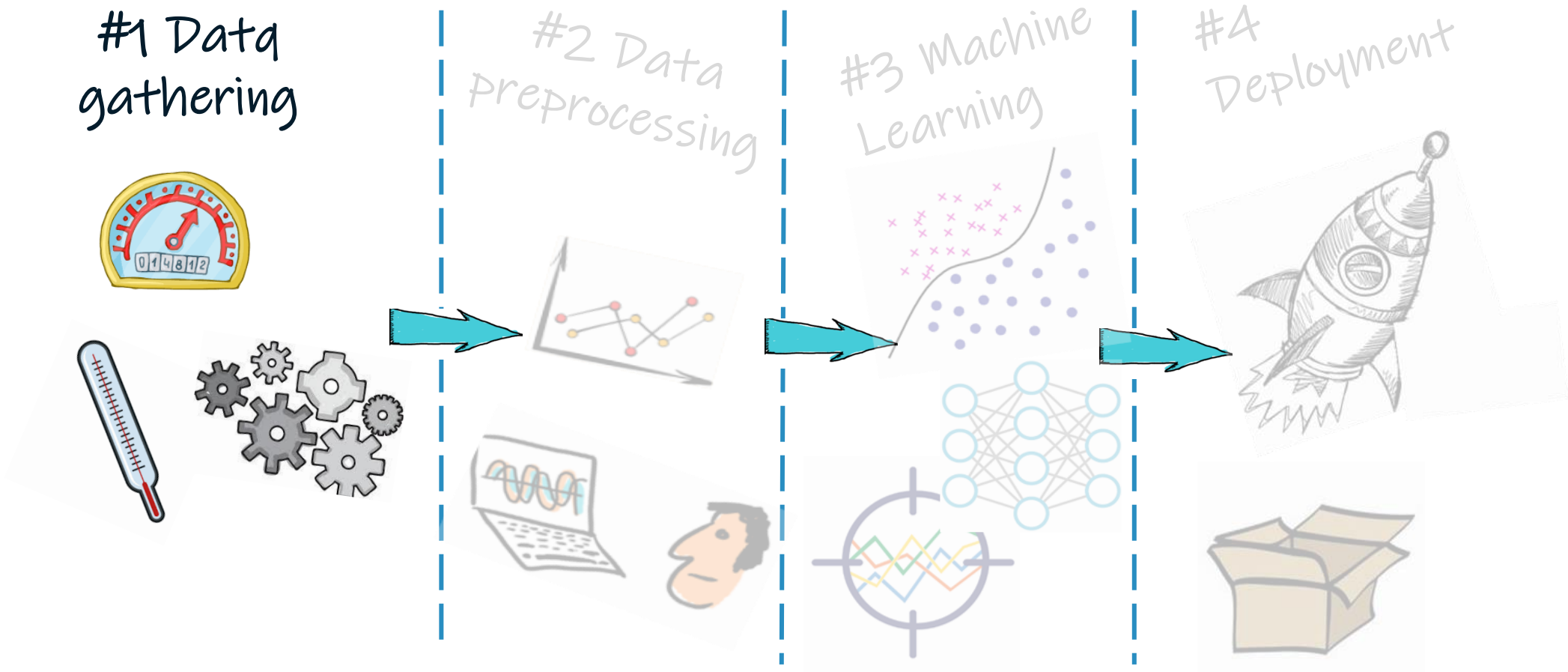
Predictive maintenance



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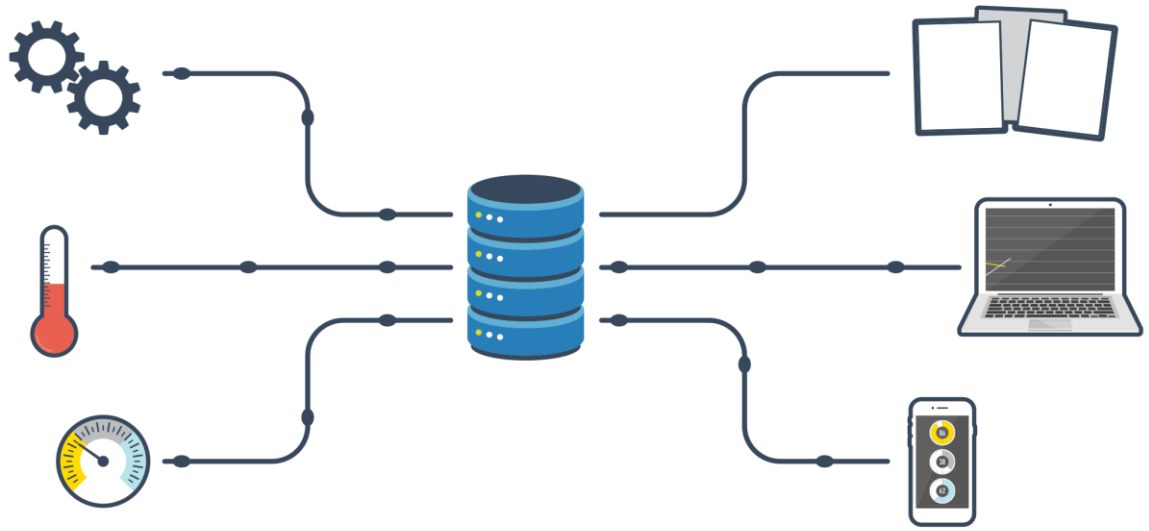
#1 Data gathering

Using sensors to gather data from the different components of the machinery: temperature, humidity, pressure, speed, etc.

How?

→ IoT devices: circuit board + sensors + Wi-Fi chip



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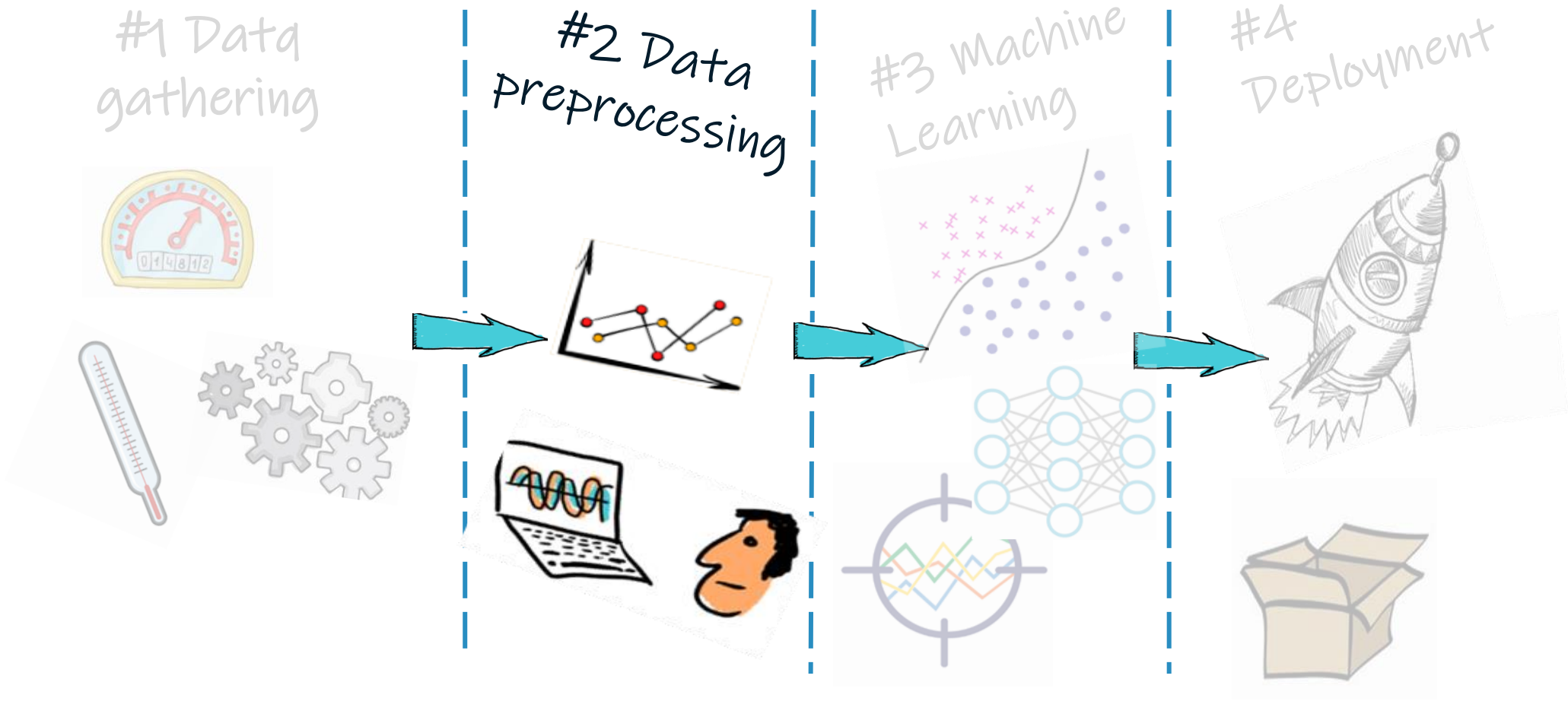
Predictive maintenance



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#2 Data preprocessing

Sensor data can be obtained from different sources and it can have missing values, noise, etc.

Tasks:

- Data cleaning
- Merging different sources.
- Data transformation
- Feature selection

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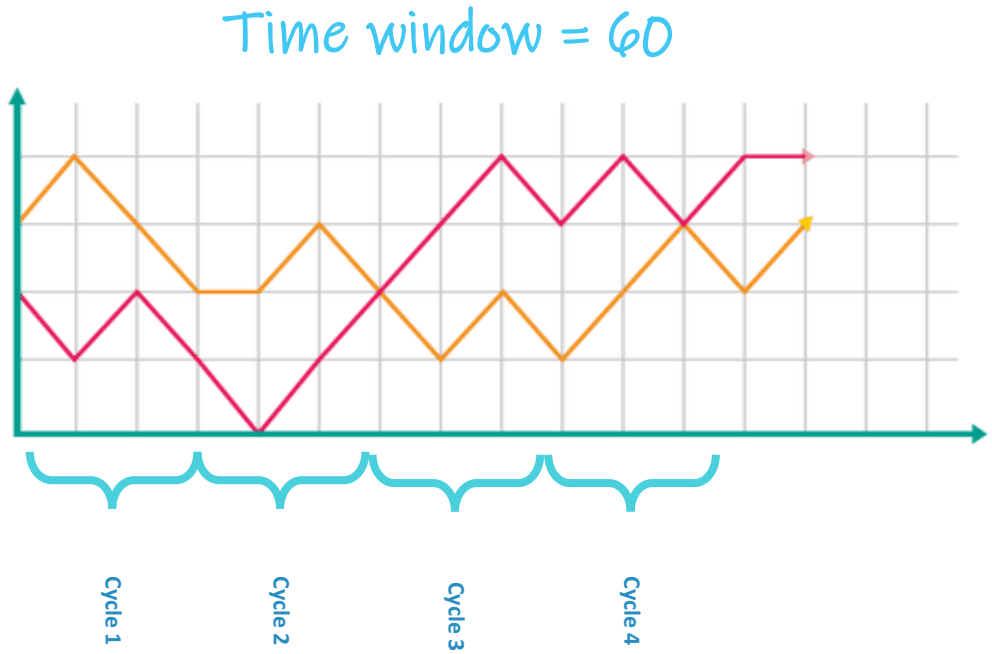
#2 Data preprocessing

Sensor data is split in predefined periods of time → Cycles.

60 observation for every single cycle.

We are interested predicting failures but also want to know if the efficiency has been reduced or if its still 100% efficient.



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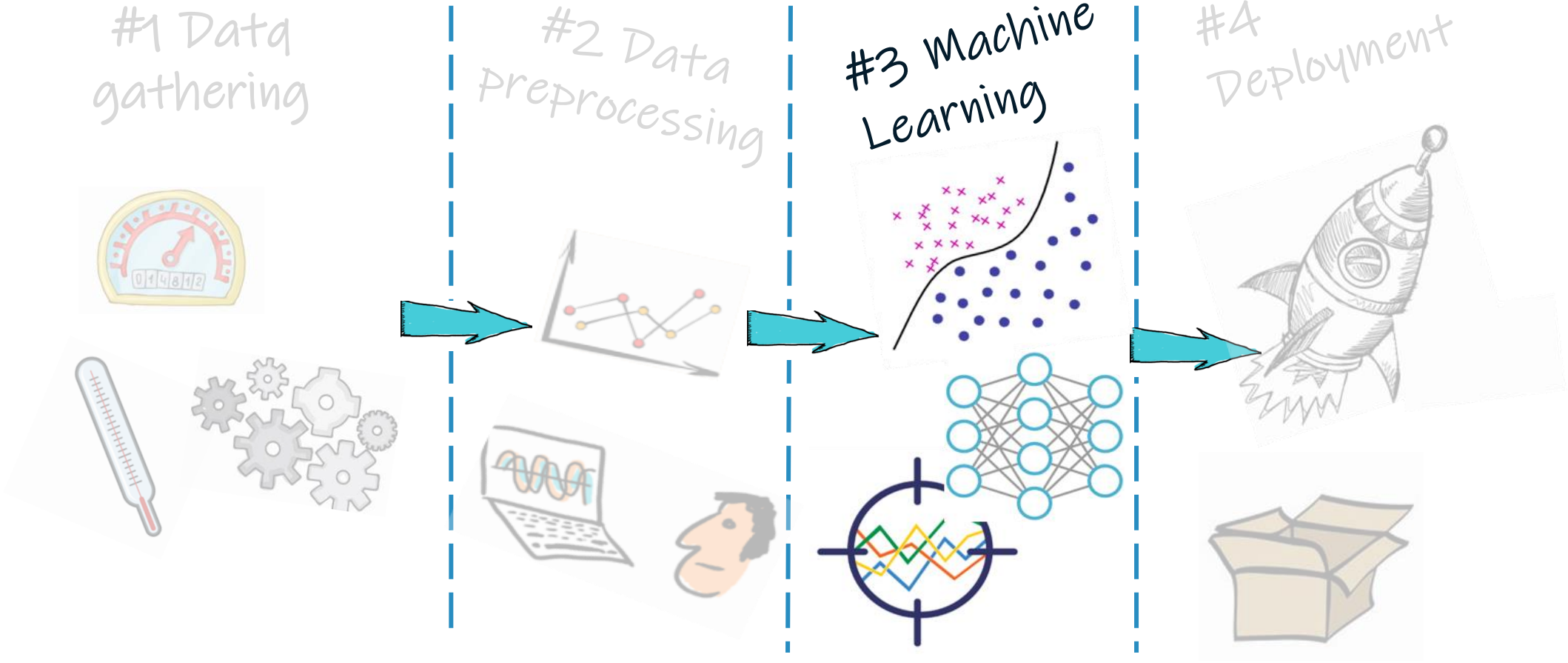

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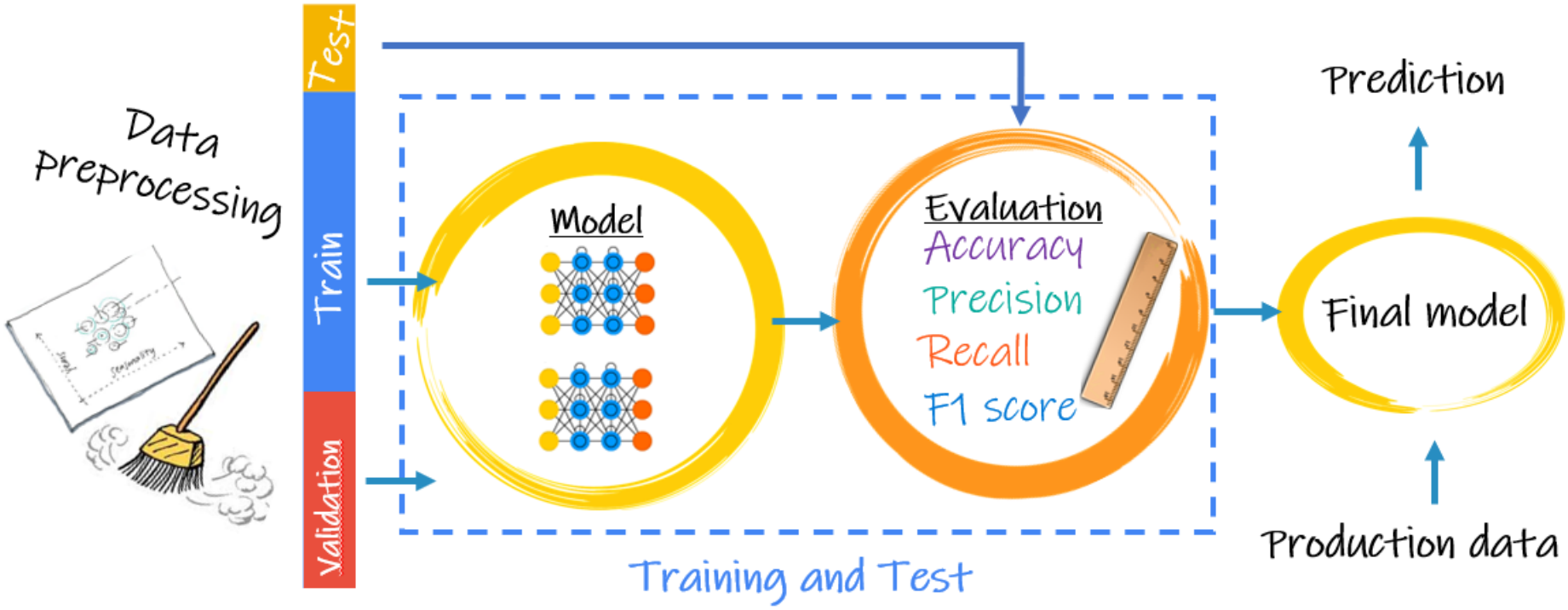
#3 Machine Learning

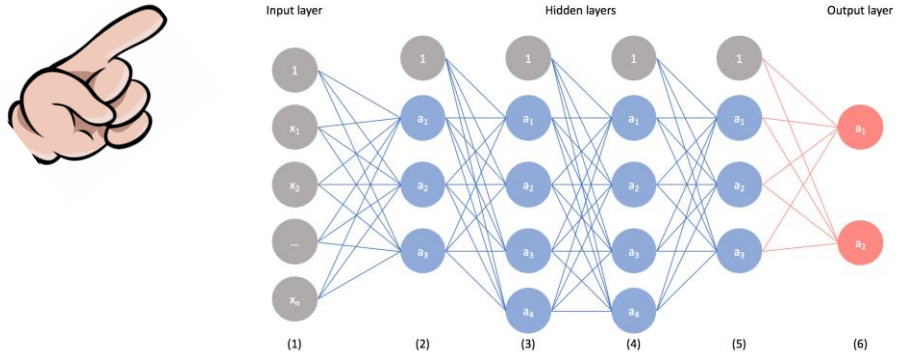


#3 Machine Learning

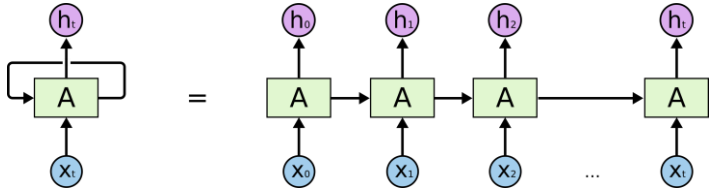
Select the best model:

- ✓ That fits the data: sequential data
- ✓ That can identify time dependencies→ providing early warnings for potential failures
- ✓ the location of the feature within the segment is not of high relevance.

CONV 1D



LSTM Neural Networks



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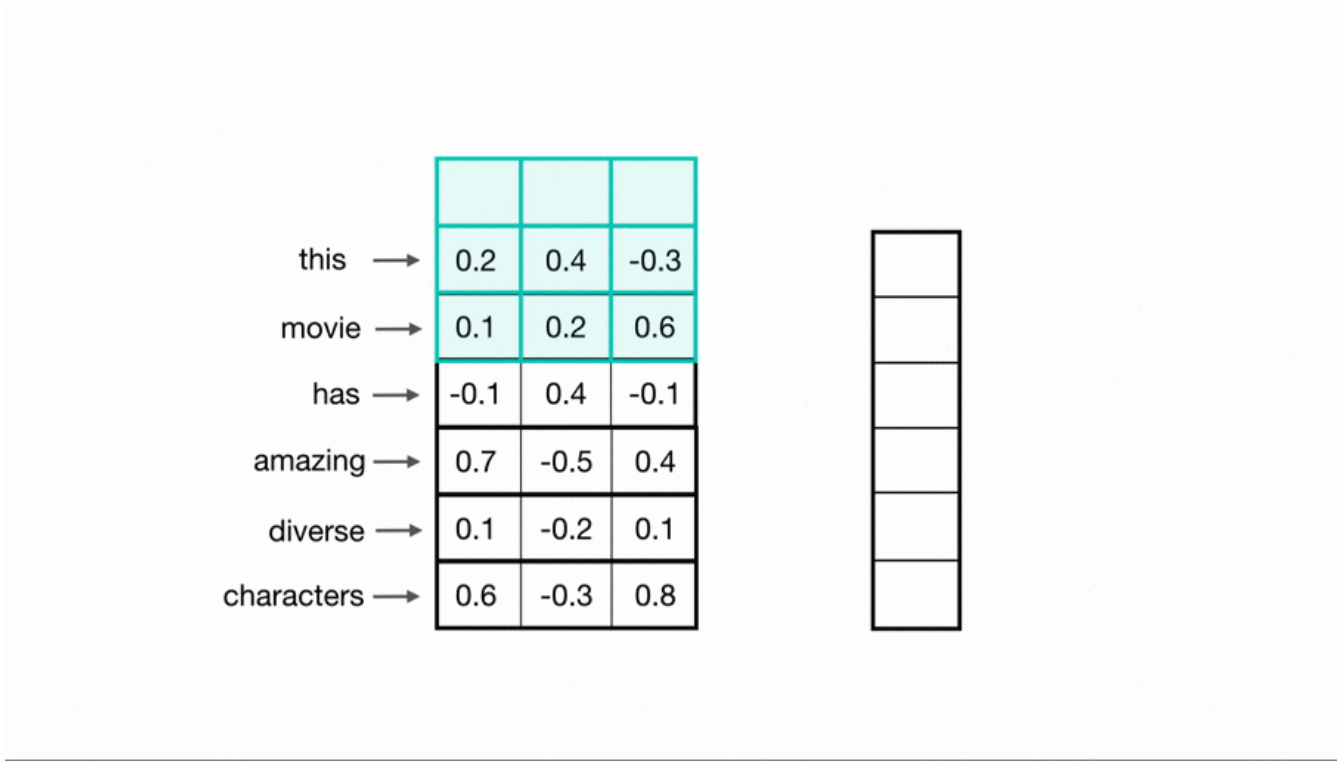
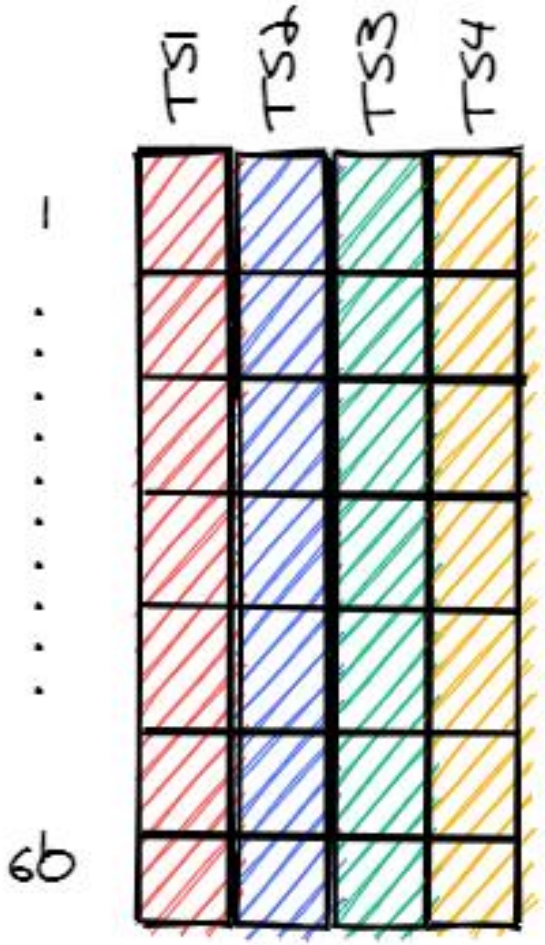
#3 Machine Learning

1D Convolution





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Databricks demo

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IoT

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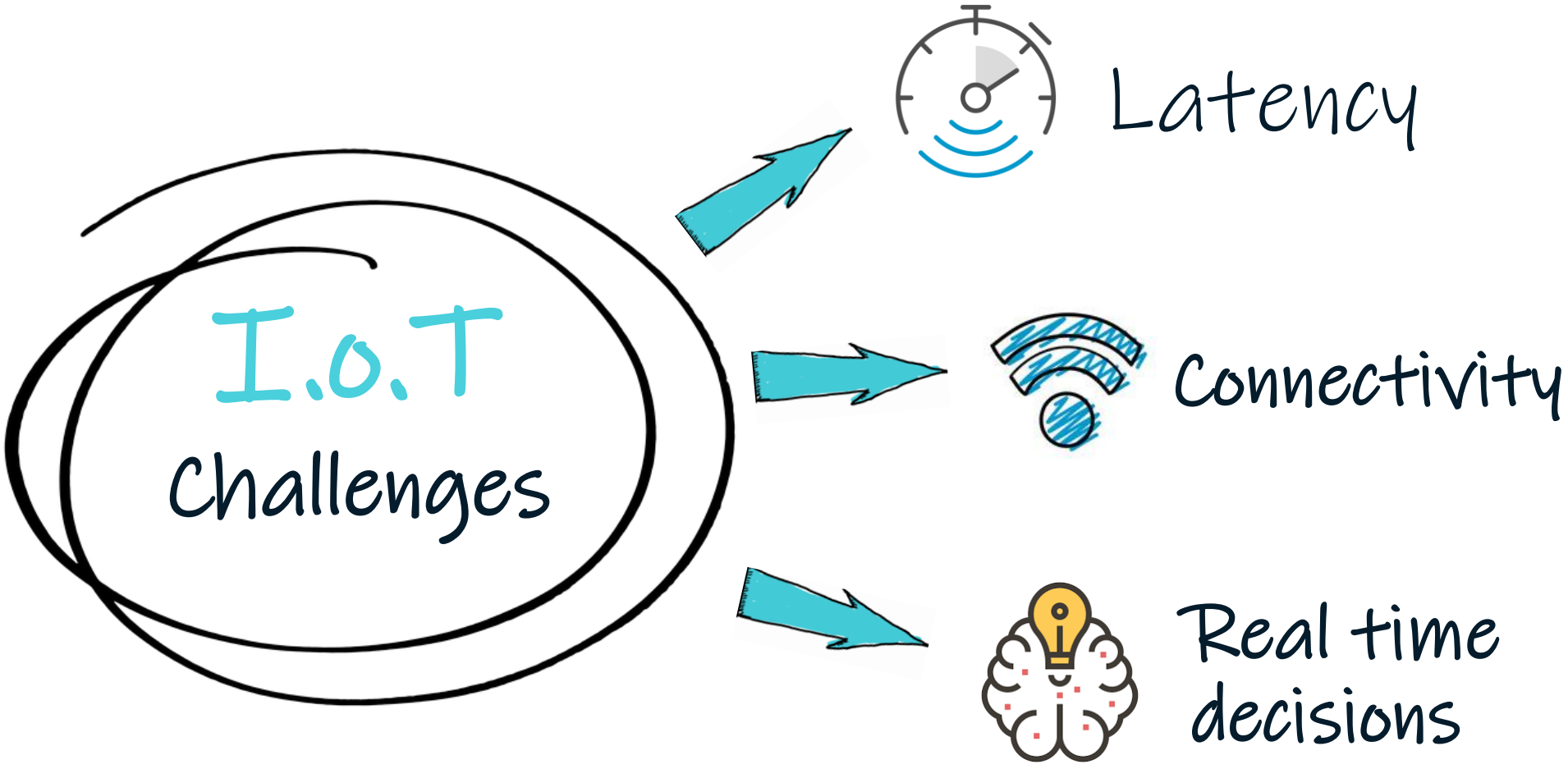

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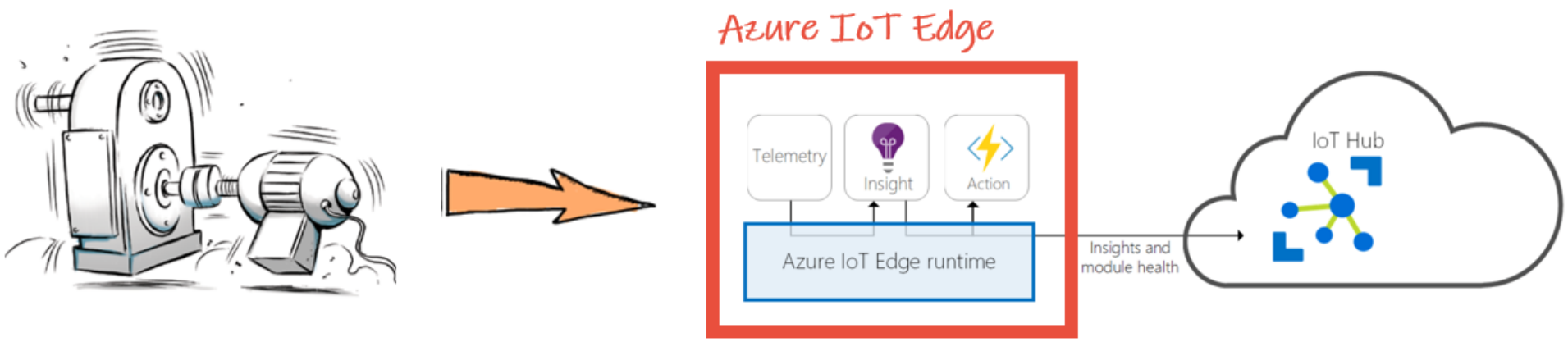
IoT Edge

Solution:

- Enable decision making at the point where the devices are connected to the network → **Edge**.
- Azure IoT Edge extends complex processing, and machine learning algorithms to the IoT devices



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IoT Edge

Jetson Nano

Device with an ARM architecture. That can be connected to different type of machinery sensors.

It is very flexible, it can be used in many different scenarios.

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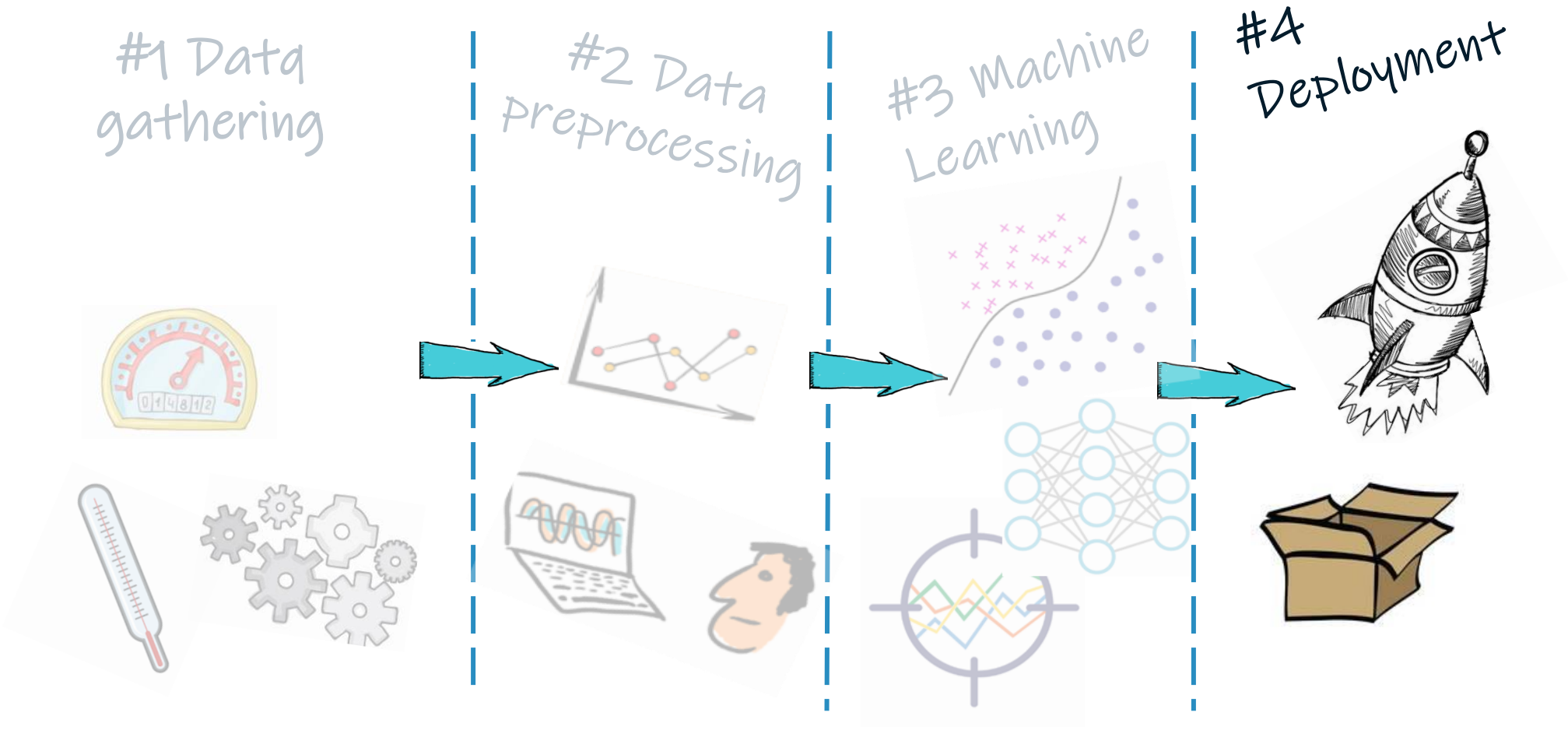
Predictive maintenance



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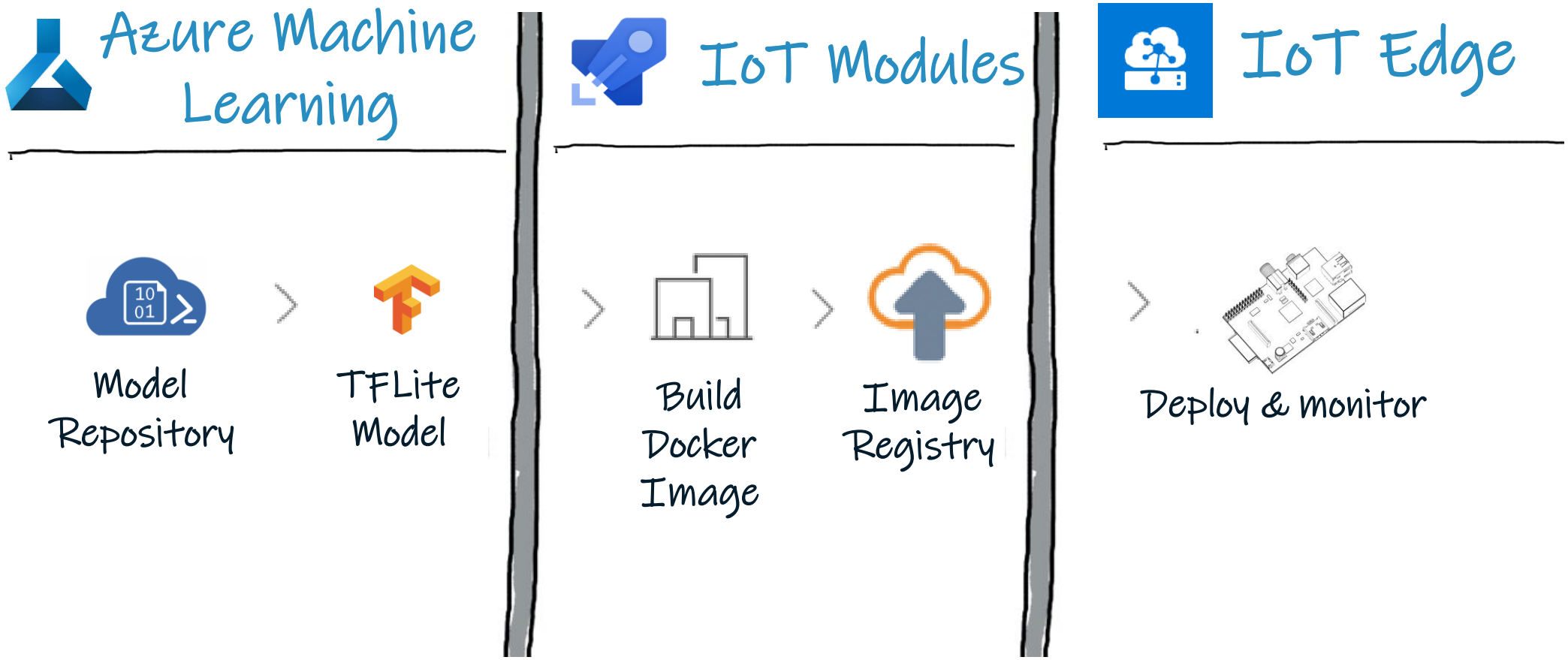
#4 Deployment



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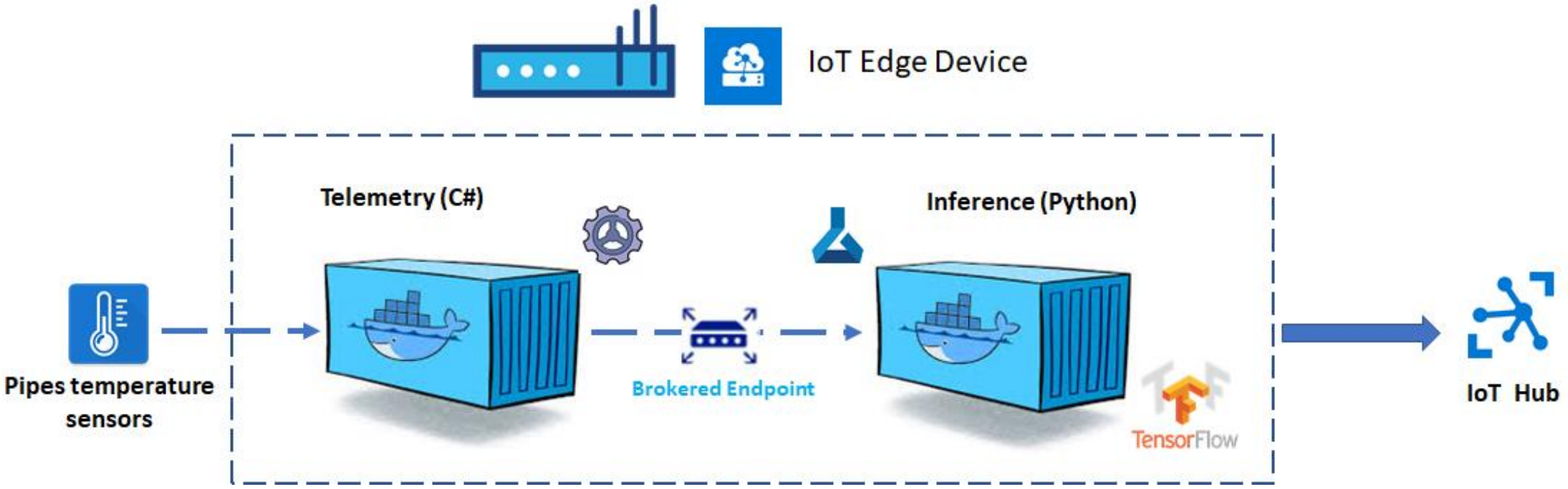
#4 Deployment

IoT Architecture



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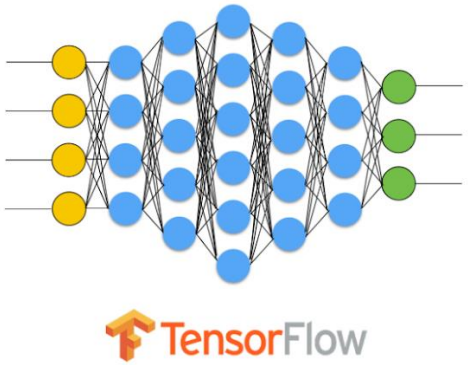
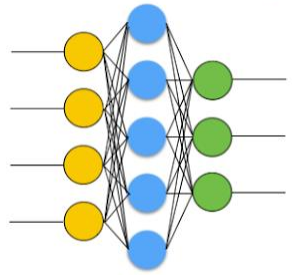
#4 Deployment

Tf-Lite→ It is a light version of TensorFlow framework. It is designed to perform machine learning on mobile and IoT devices



Convert a TensorFlow model into a compressed flat buffer



Take the compressed .tflite file and load it into the IoT device

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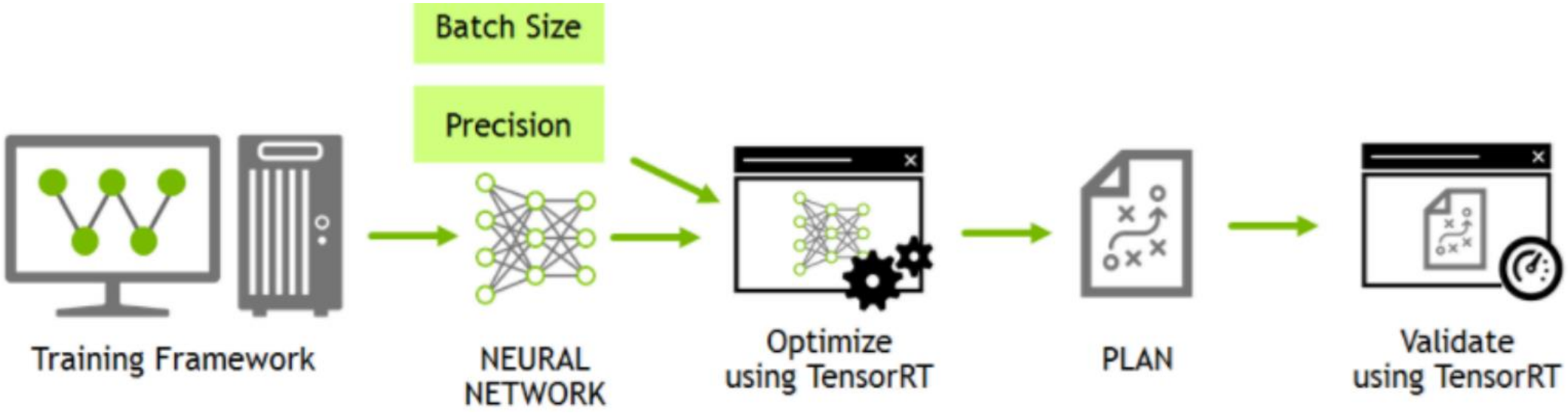
#4 Deployment

TesorRT→ it is an SDK for high-performance deep learning inference. It includes a deep learning inference optimizer and runtime that delivers low latency and high-throughput for deep learning inference applications



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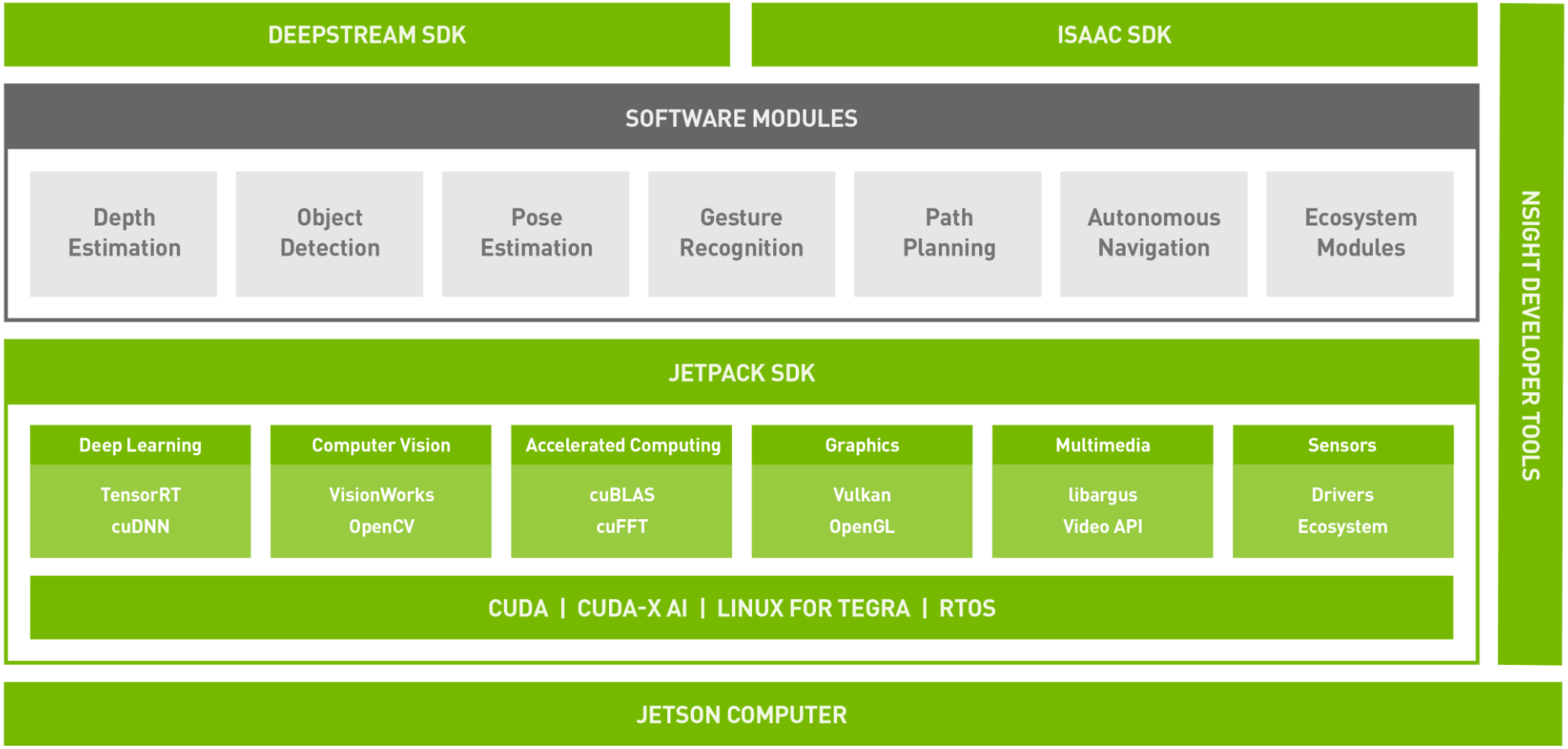
#4 Deployment



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DEMO

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