Actyx Tech Challenges

Actyx Machine Park API

Providing real-world use-cases and data

Actyx provides technical challenges directly related to problems we solve day-to-day. The challenges are rooted in real-world use-cases and data.

The Actyx Machine Park API provides the necessary context and provides access to a machine park containing 243 industrial machines and a live industrial environment sensor. The park contains the following machines:

- 15 DMG Mori DMC 125 U duoBLOCK mills
- 96 DMG Mori DMU 40eVo mills
- 36 DMG Mori NTX 2000 turning centers
- 24 DMG Mori NZX-S 1500 lathes
- 24 KASOtec A7 saws
- 6 KASOtec A13 saws
- 9 Perndorfer WSS Portal water jet cutting plants
- 12 Trumpf TruLaser 3000 lasers
- 18 Trumpf TruLaser 7000 lasers
- 3 DMG Mori Lasertec 65 3D milling and laser deposition centers

The machine park also contains a RaspberryPi with a Bosch BME280 environmental sensor for tracking environmental factors such as barometric pressure, ambient temperature and humidity.

Accessible via API

The machines and the environmental sensor unit are accessible in a read-only fashion via the Actyx Machine Park API. Version 1 of the API is accessible at:

http://machinepark.actyx.io/api/v1.

The API provides access to a collection containing all of the park's machines, individual machines and the environmental sensor. Explore the API by accessing the endpoint provided above.

Note: rate-limiting was introduced on the 11th of December 2015 due to the enormous number of requests we have been receiving. The API will return HTTP status code 429 if the number of requests by a client becomes too high. Note that the permitted request rates are different for each endpoint. The environment sensor can, for instance, be accessed 3 times per minute, whereas machine detail requests are throttled to 80 requests per second.

Challenge 1: Power Usage Alert

Motivation

Increasingly networked production machines and the consequent ability to access real-time power usage data, provides an opportunity to increase energy efficiency through monitoring and optimization.

The goal of this tech challenge is the development of an application which monitors real-time power consumption data and sends out alerts in case of excessive power usage.

Using the API to retrieve real-time machine power consumption data

The Actyx Machine Park API provides access to the power consumption data of each individual machine. Requesting details about a certain machine will return a JSON payload containing, amongst other things, two name/value pairs related to power consumption:

- "current": current (in Amps) the machine is currently drawing

- “current_alert”: alert threshold (in Amps) at which an alert should be sent out

Example JSON payload with power consumption related name/value pairs in bold:

```
{
"name":"DMG NTX 2000 (MAPS) [#23]",
"type":"lathe",
"state":"working",
"location":"0.0,0.0",
"timestamp":"2015-11-13T16:04:53.128550",
"current":14.42,
"current_alert":18.0
}
```

Challenge

In order to complete this challenge you should develop an application which monitors the current being drawn by all machines in the Actyx Machine Park, and alerts a fictitious operator whenever this current goes above the machine specific alert threshold.

The actual alert could be in the form of an alert box on a web application, an SMS being sent to your phone, a notification in a mobile app, or anything else you can think of. The minimum sampling frequency should be 0.2 Hz, i.e. 1/(5 seconds).

Too easy? Then add this:

In the alert provide the operator with the average current the machine drew in the five minutes before it went above the alert threshold (hint: moving average filter).

See the general challenge guidelines below for administrative information.

Challenge 2: Environmental Correlation Analysis

Correlation Analysis

Motivation

The performance of production processes depends to some extent on the environmental conditions in which the process is taking place. Clean rooms are an answer to this challenge because they provide environments with very low levels of interfering pollutants such as dust, particles or vapors. Unfortunately they are very expensive and thus not an option for most manufacturers who must instead find other ways of dealing with changing environmental conditions.

Machine learning and data analytics provide an opportunity for adapting manufacturing processes according to external environmental conditions. In order to adapt, one must first, however, understand the impact environmental factors such as temperature, pressure or humidity have on the performance of different manufacturing processes.

The goal of this challenge is to analyse the impact external environmental changes have on the performance of the different machines available in the Actyx Machine Park.

Using the API to retrieve environmental data

The Actyx Machine Park contains an environmental sensor unit whose data is accessible via the API. The sensor unit provides measurements for three environmental factors:

- Ambient temperature (in degrees Celsius)
- Atmospheric pressure (in millibars)
- Relative humidity (in percent)

The sensor unit measures these value exactly every minute with, in all three cases, two-decimal-point precision. These measurements are accessible through the API and the sensor unit returns both the measured value and a UTC timestamp of when the measurement was taken (in ISO 8601 standard).

Example JSON payload as returned by the sensor unit:

```
{
"pressure":["2015-11-12T17:41:00",1001.97],
"temperature":["2015-11-12T17:41:00",21.83],
"humidity":["2015-11-12T17:41:00",86.56]
```

```
}
```

Using the API to retrieve real-time machine power consumption data

The process for retrieving power consumption data for each machine was described in the section discussing Challenge 1. The same approach should be used here.

Challenge

In order to complete this challenge you should develop an application that derives the correlation between the three environmental factors temperature, pressure and humidity, and the current drawn by the different types of machines available in the Actyx Machine Park.

This challenge is purposefully left relatively open so as to offer you the opportunity to experiment with the data accessible through the API and the different approaches one might take toward this challenge.

Remember that the motivation is to provide a data-basis which could then, for instance, be used to develop an optimization algorithm that uses environmental data to minimize energy usage by identifying time at which machine are cheapest to use. Feel free to be creative!

See the general challenge guidelines below for administrative information.

Guidelines

Technology

Feel free to use whatever technology you want to solve the challenges, although we would prefer solutions developed in Python, Java, Scala, C#, C++ or Haskell since those are the languages we are most familiar with. Regarding libraries and

external services, use anything you would like (we are always excited about learning about new technologies). Note that if you are completing the challenges as part of the Actyx hiring process we will need to understand you language and library choices.

Creativity

If you have any other cool ideas for using the Actyx Machine Park API data, don't hesitate to go for it. We are excited to see what cool things you can come up with.

Code of Honour

In order to keep these challenges challenging we ask you to keep your solutions to yourselves. We also ask you to develop the solutions yourself, i.e. no copy-pasting. Library usage is obviously fine, and, indeed, encouraged.

Submission

Please store your solutions in a repository on Github or Bitbucket so that we can easily look at them. For security reasons we will not be able to install and run any applications for testing locally, so ideally and if possible you can deploy your applications on an EC2 or Azure instance, or a cloud PaaS such as Heroku or Google AppEngine.

Support

If you are having difficulty understanding the challenges, accessing the API or anything else, don't hesitate to get in touch at support@actyx.io and we will get back to you as soon as possible.

Actyx AG
Edelsbergstr. 8
80686 Munich

Germany

Contact
T: +49 89 9439 7400
F: +49 89 9439 7402
joinus@actyx.io

Intranet
Publications
Legal Notice