EDR™ MEDESO

Analytics for IoT

Feature Set

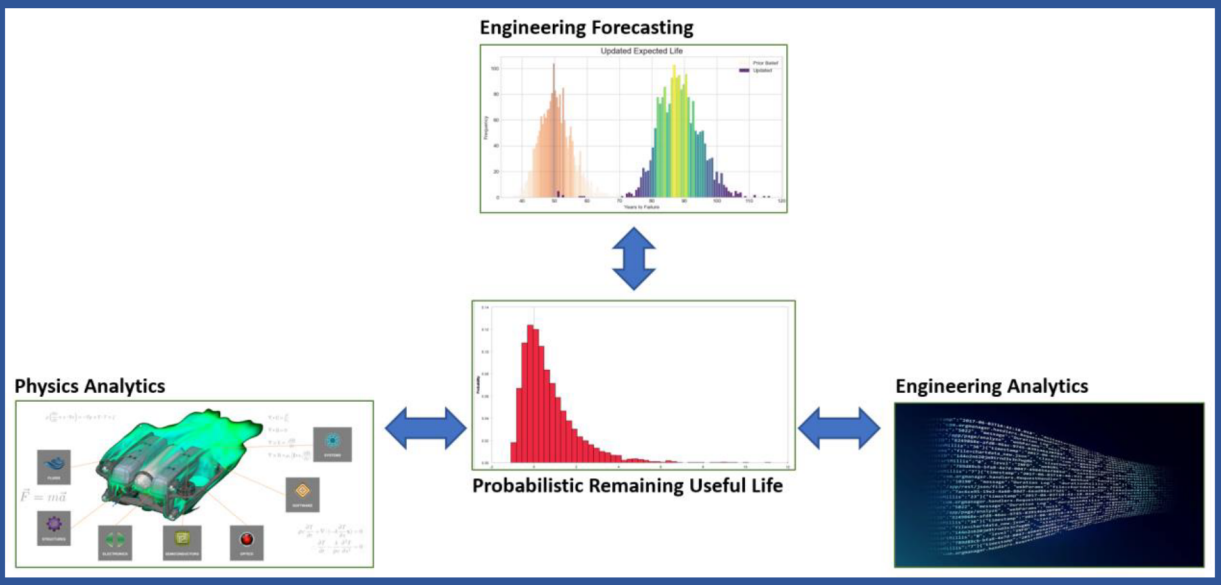
Gartner says 70% of organizations will shift their focus from big to 'small-and-wide' data

by 2025

https://www.gartner.com/en/newsroom/press-releases/2021-05-19-gartner-says-70-percent-of-organizations-will-shift-their-focus-from-big-to-small-and-wide-data-by-2025

A Flexible and Composable Solution

The IoT Analytics Suite from EDRMedeso offers Engineering Technology-based analytics in an accessible form. The capabilities described are provided as a set of services residing on our analysis platform in the Cloud. The entire range of analytics services can be accessed through an API and connected to any data- or IoT platform your company is currently using:



With such an approach you can develop your analytics solution in a modular manner by selecting the most appropriate solution for each critical failure mode. The platform contains three main elements that you can use as building blocks in your solution:

Engineering Analytics – a ready-to-consume service that allows you to calculate damage of common industrial components such as bearings, gears, welds, electrical equipment etc.

Physics Analytics – a service that allows you to consume your simulation models or engineering calculation and utilize them as analytics services.

Engineering Forecasting – a service that delivers continuously improved and updated forecasts based on both engineering insight into assets and collected data.

The ‘Small-Data’ Approach

One solution to the big-data challenge (finding facts in a ‘big sea’ of data), is to enrich and improve the predictive power of data, by incorporating a greater variety of techniques, such as a small-data approach. Small- data approach is the application of analytical techniques that require less data - but still offer useful insight.

Engineering technology offers the opportunity to deliver reliable predictions with limited data. The insight that is embedded into engineering technologies such as numerical modelling, simulation, normative and handbook calculations, can enable us to replace much of the missing data with product specific and application insight.

Designing an IoT Analytics solution, for example for predictive maintenance, is all about enabling the prediction of a set of critical failure modes based on the information we have at hand. Simply put, the task is to connect the problematic failures with the data we can collect from the assets. The case of an IoT- connected hydropower plant can be illustrated as below:

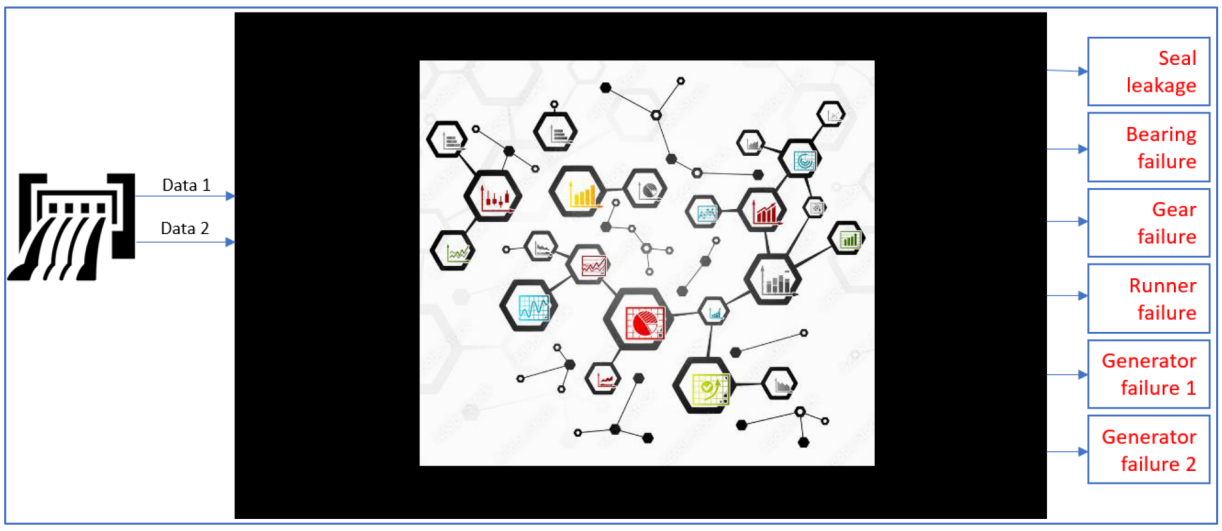


Figure 1: 'Small Data' being used to run FMU/ROM file for a Large Mechanical Construction, delivering multiple output data

Several failure modes have been identified, ranging from bearing failure, through to runner failure and onwards to several generator failure modes. The analytics engineering task is to connect available data with available models in combinations that deliver the needed predictive capabilities, i.e. filling in the black box.

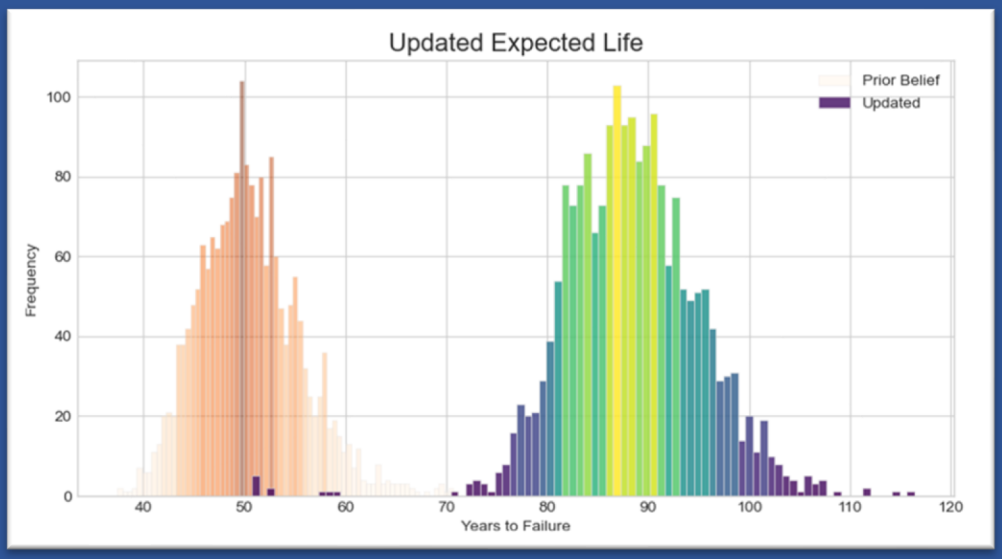
Truly Agnostic: A ‘Any Model’ solution

Analytics for IoT can run any model from your preferred Design and Simulation Tool – this is what we call *Model Agnostic*.

This means that whatever deterministic model you have built, it can be uploaded and run in Analytics for IoT as long as you are able to deliver it as a Functional Mock-up Unit (FMU), Functional Mock-Up Interface (FMI), Reduced Order Model (ROM) or a .twin file

Engineering Forecasting – Adding Predictive Capability

In the Engineering Forecasting we take the design assumption for usage, damage progression and the resulting design life as the initial forecast. Then data of the actual usage and damage is collected and calculated when the asset is put into operation. These data insights are used to continuously improve and update the forecast of the remaining useful life. As seen in the illustration below, the distribution to the left is the life expectancy for a hydropower generator when it was put into production. The most likely life was 50 years. However, the utilization of the generator is not as harsh as expected by the designers, so the damage is evolving slower than initially assumed. On the right-hand side of the graphics we can see the updated forecast based on a combination of both the design insight and the collected data. The most likely remaining useful life is 87 years.



Features list

- Roller Bearings
- Gear
- Generator – Insulation
- Fatigue
- Bayesian Statistic
- Model Agnostic
- 3D Digital Twins

Roller Bearings

Physical background:

- ISO 281:2007 – Roller bearings *

Inputs:

- Dimensions
- Operational loads

Outputs:

- Damage
- Remaining Useful Life (RUL)

* https://www.iso.org/standard/38102.html

Gear

Physical background:

- ISO 10300:2014

Inputs:

- Dimensions
- Material specification
- Operational loads

Outputs:

- Damage
- Remaining Useful Life

Generator /Motor– insulation

Physical background:

- Literature study *.
- Based on chemical deterioration and polymer degradation of insulation.

Inputs:

- Material data
- Operational temperatures

Outputs:

- Remaining Lifetime in hours

* *Rothe, R., and K. Hameyer. "Life expectancy calculation for electric vehicle traction motors regarding dynamic temperature and driving cycles." 2011 IEEE International Electric Machines & Drives Conference (IEMDC). IEEE, 2011.*

Fatigue

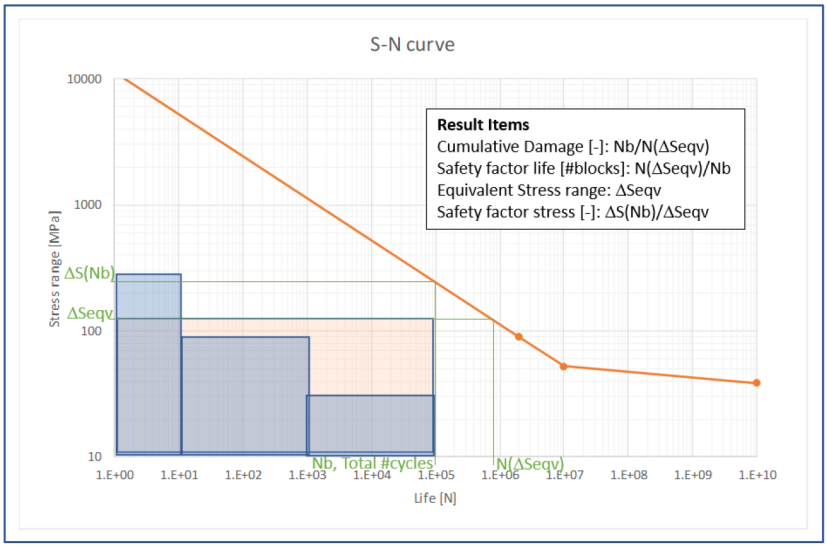
- SN-curve calculations from IIW, DNV, EC3, etc.

Inputs:

- Stress data
- SN-curve

Outputs:

- Cumulated damage
- Safety factor
- Equivalent stress

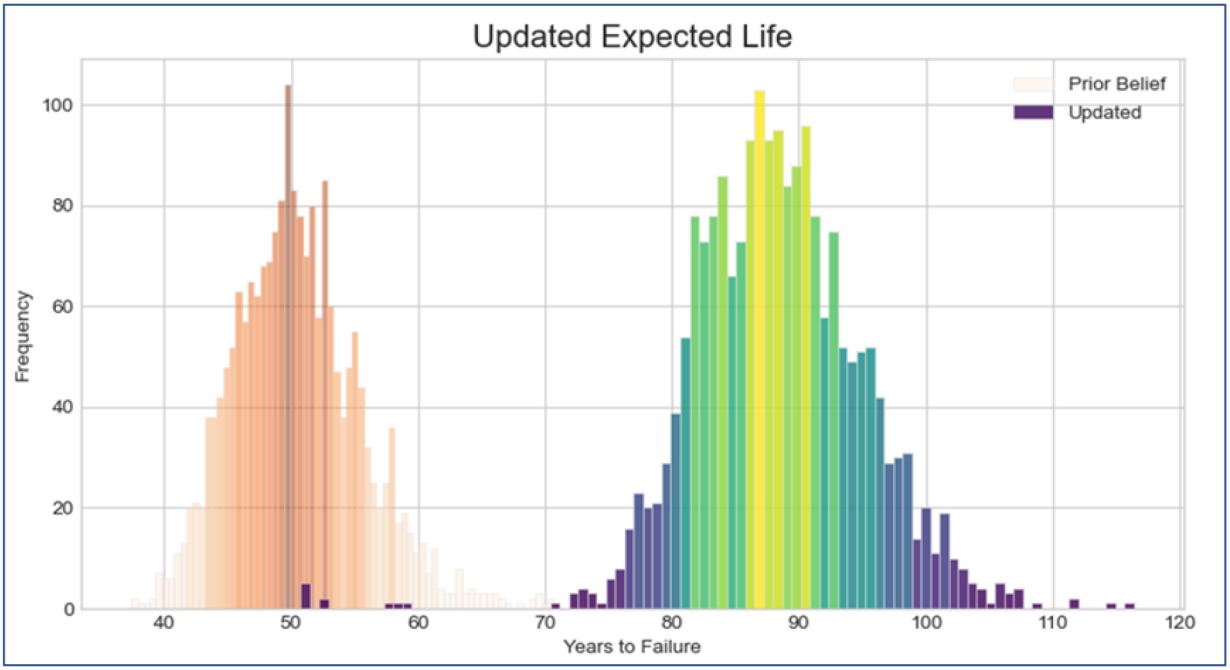


Bayesian Statistic

Probabilistic Remaining Useful Life (RUL)

All results can be presented with a probability calculation, taking the level of model uncertainty into account.

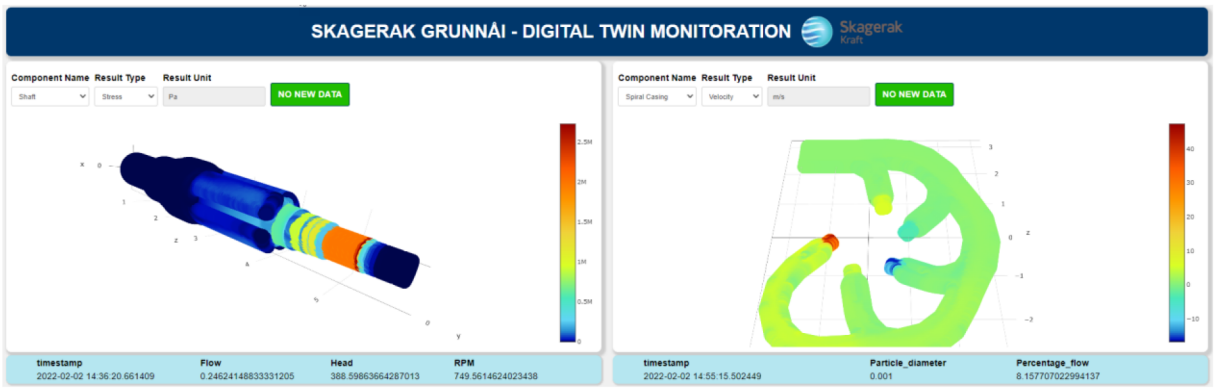
Results are thus presented as lifetime distributions, allowing the user to make data- and risk based operational decisions



3D Digital Twins

The output from the analytics solutions can be consumed and visualized in several ways. A traditional way would be to collect the scalar data and present them in various 2D plots. With the Engineering Technology you have more options. As the mathematical models can calculate the needed data for any location in the equipment, full 3D representations of the results are also available.

In the plots below this are illustrated with two models from Skagerak Kraft. Skagerak Kraft is one of the most innovative and advanced hydropower producers in Norway. Here, they are utilizing Engineering Technology to calculate and visualize the stresses in the turbine shaft and the velocity flow field for the spiral casing.



To enable a close the real-time execution of the sophisticated simulation models, they have been compiled as mathematically Reduced Order Models (ROMs). A further advantage of this approach is that the ROMs, as they are compiled, can be created and shared without revealing important company IP using standards such as FMI. Hence, an industry eco-system can be built using this technology, where producers, suppliers, research partners and academic institutions can share models, insight and knowledge to create the best possible analytics for Hydropower.

Analytics for IoT

With the Engineering Technology analytics solutions described here, it is possible to benefit from the great value that is attributed to the maintenance and operational expenditures on the asset throughout its lifecycle.

You will be able to develop, deploy and deliver valuable applications for predictive insights into your high value assets - and do it faster.

You get access to an application requiring low effort, up and running with minimal input. In other words, immediate traction and results from your IOT investment.

Who is this for?

If you answer YES to the questions below, we can help you get up and running within a matter of days

- Are you struggling with getting value out of your IOT investment?
- Are you spending too much time training your machine learning algorithms or collecting data?
- Would you like to get started with predictive insights today?

… then this is for you!

Interested?

We encourage you to reach out if you have any questions about our unique IoT Analytics solutions.

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Also: Check out our **Analytics for IoT - Resource Center**: LINK, where you will find; **Usecases, Feature Description,** and **Live Demo Recordings**