

Monitoring and Alerting

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Some questions for you

- Can you monitor things automatically without a way to define and capture it in a software?
- How to define what to measure during monitoring?
- How to collect, transfer and consolidate the measurements in a meaningful way?
- How to react to measurements?

Monitoring

To monitor generally means to be aware of the state of a system. In management, teams and organisation are systems too, but even here it's necessary to confine most of the information about the state of a system in numbers, so you can understand the context more objectively and can measure these numbers against each other. How much workload is pressing, which resources are available / blocked, which deadlines and releases have to be kept, etc.

In software systems, which the ZDMP Platform and the ZDMP Monitoring and Alerting component are mostly dealing with, the state has to be a well-defined set of data that can be continuously monitored, so states can be defined and where operators (or automation) need to change things.

In all these cases, data is needed that is a good indicator for the health, productivity, and performance of real-world processes. As a lot of data could be captured and evaluated, and parts of this data might only have a vague or inconclusive implication to the real-world processes. So first the key values need to be examined, which indicate process status in a conclusive and sharp way. These values are called Key Performance Indicators (KPIs).

Key Performance Indicators (KPIs)

“A Key Performance Indicator (KPI) is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organisations use KPIs at multiple levels to evaluate their success at reaching targets. High-level KPIs may focus on the overall performance of the business, while low-level KPIs may focus on processes in departments such as sales, marketing, HR, support and others.” [1]

The KPIs can vary by industry, company, department, and role. These metrics can vary from total revenue, number of sales to number of items produced with defect or even machine efficiency based on energy consumed by item produced. The KPIs monitored by a company can also vary in time, depending on the business model, crisis periods and many other variables that affects the company or target department. Normally, KPIs are metrics which the value has a great importance to the business objectives, and that can be improved considering the company resources.

Collecting and consolidating Information into KPIs

KPI data can either be collected automatically using software and a machine interface if the data is available in a software compatible way, or it has to be collected manually when there's no automation in place.

- Manual collection can involve the assignment and training of data custodians, creation of a data collection process map, documentation of the entire process to ensure consistency in measuring each KPI, as well as performing internal audits to identify critical issues that may alter the quality of the data produced.
- Automatic collection is all about choosing the best technical solution that can collect raw data from the systems used by the company to calculate the KPIs.

Smart Factories and KPIs

“Smart manufacturing requires the collection of information from multiple intelligent devices, consolidating the information into KPIs, and making these KPIs available, in real-time to human and automated decision makers. Order

Cycle Time, Gross Contribution Margin Analysis by Product and Segment, and Fill Rate Effectiveness as a Percent of All Orders are examples of KPIs that provide end-to-end manufacturing process visibility.” [3]

Smart factories are being designed to support lifecycle-based production methods that provide more accurate data to enable monitoring for production costs, waste, defects & risk management, process statuses and also to enable new possibilities in terms of product customisation or lean processes.

Monitoring KPIs within the ZDMP platform

ZDMP is designed with Smart Factories in mind, but also with traditional manufacturing that is retrofitting their software infrastructure and their machines to take advantage on technologies such as Monitoring and Alerting. When adding ZDMP to a factory network, the assets deployed within the ZDMP platform send raw data to the ZDMP Message Bus. The Monitoring and Alerting component collects the data from the Message Bus and enables the user to define which parts of the data should be treated as KPIs, so the Monitoring can continuously extract these KPI values.

This is accomplished either by using the APIs or the user interface provided by the component. The user can be informed about the origin of the raw data (from which asset does the data come ie the Data Acquisition component, which itself might be bolted on an ERP or a machine PLC), and using a JSONPath[2] expression, extract significant values from the complex JSON data objects. Using this mechanism, the Monitoring and Alerting component will keep track of the updates of the KPI values and is not confused by irrelevant parts in the raw data like a changing time stamp.

Alerting

With the KPIs defined in the Monitoring and Alerting component, alerts can be defined to inform the user of changes in the KPI values that should be carefully monitored, for example, when a KPI value is out of the acceptable boundaries. When creating an Alert, the user can define one or more e-mails used for notifications, so that everyone who needs to be notified will receive a message in real-time, as well as the structure of the message to be sent (For example, to include the KPI and the boundaries).

What will ZDMP achieve

ZDMP aims at impact reduction of manufacturing issues by improving communication, monitoring, as well as improving business strategy planning by allowing easy access to KPIs from different control levels. With the monitoring and alerting component, issues can be identified and notified in real-time and KPIs data collection automated for any data sent to the Message Bus.

ZDMP Links

• Architecture Component(s)	Monitoring and Alerting
• Work Package	WP5: ZDMP Platform Building
• Tasks	T5.4 - Monitoring and Alerting

References/Acknowledgements

- [1] What is a KPI, <https://www.klipfolio.com/resources/articles/what-is-a-key-performance-indicator>
- [2] JSONPath - XPath for JSON, <https://goessner.net/articles/JsonPath/>
- [3] KPI Exchanges in Smart Manufacturing using KPI-ML, <https://www.sciencedirect.com/science/article/pii/S2405896318313545>