

Transforming data into action

How ALPLA is using real-time information to increase efficiency on the factory floor

The manufacturing industry faces multiple challenges: increasing quality demands, labor shortages, cost-pressure...

To stay competitive, it is crucial to invest in technological innovation. The traditional operational processes have to be modernized, taking advantage of the technologies that are now available. In the new industry, decisions are data-driven; operations are remotely monitored in real-time, efficiency is improved, and costs are reduced.

In this article, we will show you how ALPLA, a world leader in the development and production of plastic packaging solutions, is using the Crate IoT Data Platform to digitalize their factories.

About ALPLA

ALPLA is a well-established manufacturer of innovative plastic packaging systems, bottles, closures, and injection-molded parts.

Founded in 1955 and based in Austria, the company serves major brands in markets such as beverages, food, beauty care, and home care. In 2017 alone, ALPLA produced over 100 billion consumer goods packages, and with over 100,000 tons of recycled plastic, it is also one of the leading packaging companies when it comes to minimizing plastic waste and plastic reuse, also known as the closed-loop plastic economy.

Investing in innovative manufacturing helps securing ALPLA's leadership in the market, achieving best-in-class quality at high volume and a competitive price. In 2020, ALPLA has plants in 181 locations worldwide, operating in 46 countries with almost 21,000 employees.

The plastic packaging production process

Plastic packaging is a complex manufacturing process, consisting of the following main steps:

1. The raw plastic is first pulled from big silos in the form of pellets.
2. The plastic pellets are transported to the material dosing equipment. There, coloring materials and other additives are added.
3. In the processing machine, pellets are melted and extruded into a metal mold. The mold is cooled so that the plastic freezes on contact, forming a bottle.
4. The bottles are weighed on a scale and inspected for leaks in a testing machine,
5. A visual inspection is done using camera systems to detect defects and check the dimensions of the bottles.
6. Bottles are moved to handling machines and then boxed, packaged, palletized, and delivered.

Temperatures, pressures and blending ratios need to be precisely defined on every machine; if not, quality suffers, and production costs increase.



Problematics

In the past, to look for quality failures required multiple operators continually moving around the factory floor, checking every machine. As production lines are laid out over the whole factory, the distances between machines can be considerable. This was a slow and labor-intensive operation.

The delays introduced by having to walk around the factory meant that many products were often affected before the error was spotted by the operator. This resulted in the loss of valuable machine time, together with raw material.

Additionally, ALPLA's market entry in North America in 2001 was followed by years of tremendous growth. By 2015, ALPLA was already operating 14 manufacturing plants, having more than 1,000 employees in the USA. This growth came with the challenge of hiring and training enough personnel to run the complex manufacturing processes. With the old setup, every plant required specially trained experts, for every machine and on every shift.

The future of manufacturing

At that time, ALPLA was already producing plenty of data (around 3 GB per day) coming from the process control systems and sensors. However, this valuable information was not being used in a productive way.

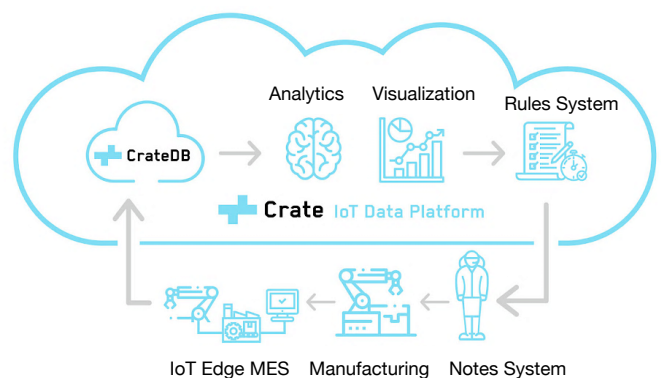
ALPLA already had a proprietary in-house system that was collecting machine data, using a SQL database as a data warehouse. All the plants in the USA were connected to this system—but the data volume kept growing, and the database performance started to suffer. The response time for queries got longer; data analytics were taking more and more time. With the technologies ALPLA was already using, to innovate was not possible.

Jodok Schäffler, the General Manager of ALPLA North America, wanted to operate the production line with more efficiency and less latency. Besides, he wanted to find a way to speed up

the employee training process. It was the time to build a new system.

The result of ALPLA's search for a new technology was a proof of concept built by Crate.io. Crate.io's solution, based on CrateDB, was able to handle huge amounts of real-time data in a multi-plant environment. It also required significantly less resources than all the other solutions ALPLA looked at, and it was 10x cheaper.

The Crate.io solution

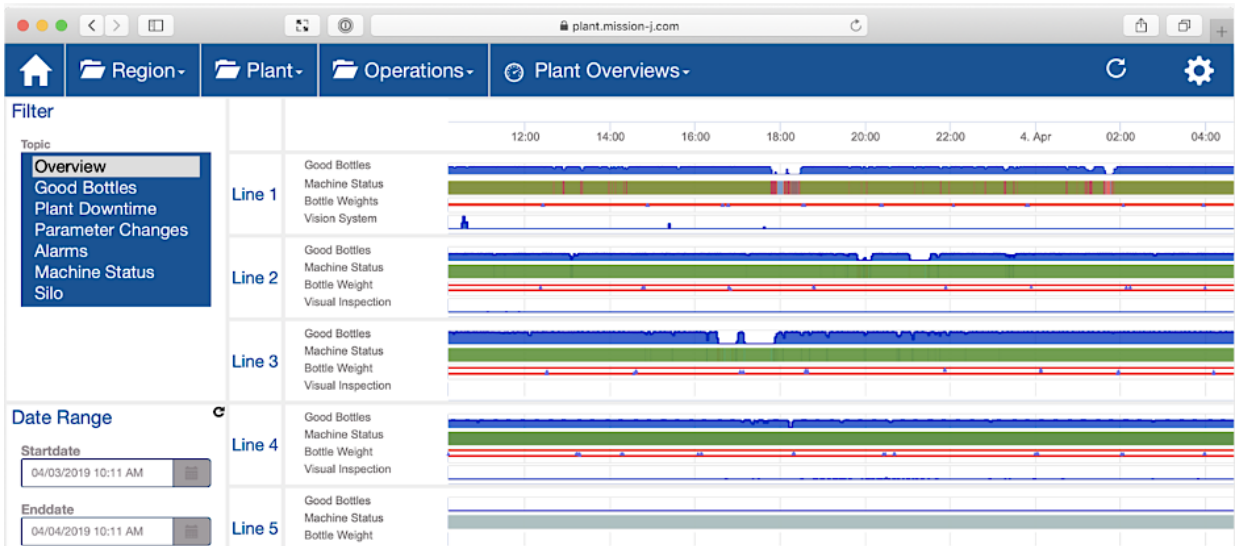


The figure above gives an overview of the elements included in the solution Crate.io built for ALPLA, the Crate IoT Data Platform.

Through the Crate IoT Data Platform, information is collected in real time, and direct feedback is provided to the operators on the production floor. This allows ALPLA to establish a closed loop of continuous monitoring and improvement, based on the data that is read from the different production lines.

First, the desired production state for every machine and line is defined, using product specifications, Bills of Materials from the Enterprise Resource Planning (ERP) system, product specifications, tolerances from Quality Assurance (QA) systems, target times from shop floor... Then, this desired state is compared to the actual state of the production line. Weak points are identified, defining actions to correct them.

Dashboard showing a real-time overview of the production lines



Analytics, monitoring, and visualization dashboards are built on top of the Crate IoT Data Platform, allowing supervisors and management to get immediate insights into any aspect of the production process.

The screenshot above is an example of a dashboard used by ALPLA. It shows the current status of all production lines of a plant, and a summary of the state of main metrics during the last 24 hours.

Closing the loop: the Rules System

Deviations between the desired state and the actual state of the production line indicate a need for action on the shop floor. To that end, a Rules System runs predefined checks on all the data streaming into CrateDB from all the connected plants.

Checks are defined for a specific production process in one plant, and can be reused in other plants with the same production process. This makes the system easily scalable, reducing the cost of duplicate work.

The Rules System is operational 24/7. It continually performs different types of checks, monitoring the following aspects:

- Product quality, e.g., weight data from a scale, or dimensional deviations from a vision system

- Alarm messages from the production machines, such as material running low in a piece of dosing equipment
- The state of a process, e.g., the temperature of molten plastic in an extruder, or the pressure at the extrusion nozzle
- The configured parameters of a machine, such as the speed setting of an extruder

Failing checks are handled in one of two ways:

1. Some are automatically converted into notes and sent to the staff in the production floor right away (more about the Notes App later). The operators can immediately correct the issue.
2. Checks reflecting more complex issues are sent to Mission Control first, so an expert can assess them before creating a note for the production floor.

The Mission Control

With the Crate IoT Data Platform system in place, ALPLA could now take action.

They set up a dedicated Mission Control room in McDonough, GA, with operators monitoring the operation of 11 plants across the USA. Having a single Mission Control room gives ALPLA the possibility to consolidate the expert operators in one location, giving them other advantages as well:

The Mission Control room



- Centralized alerting and monitoring
- Centralized manual checks
- Increased Overall Equipment Effectiveness (OEE)
- Reduced material waste
- Remote support
- Reduced travel costs for support staff

The Mission Control dashboards provide insight into the current state of the machines and processes, as well as information from historical data (with a range from the previous minutes to the last couple of months). From this high-level vantage point, operators can put the more complex alerts into context, notifying the staff on the shop floor by issuing manual notes if necessary.

For example: if temperature check for an electric drive was triggered, the Mission Control operator can assess whether the temperature suddenly spiked or was slowly rising. After checking on the overall throughput and ambient temperature, the Mission Control operator can then send a

note to the machine operator, asking them to check the cooling. This action avoids an unexpected drive shutdown, reducing downtime and increasing OEE.

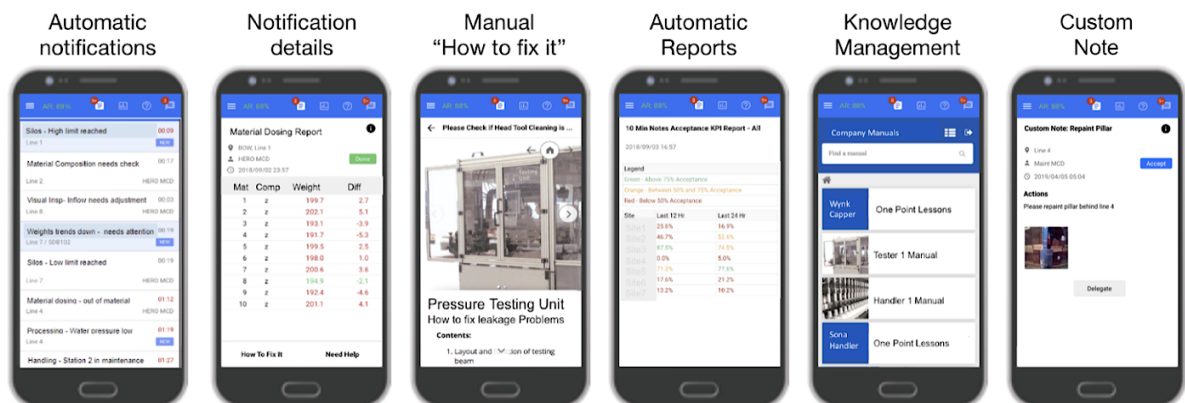
Another example: the Mission Control operator might see an upward trend in the weight of a product. By sending a note to the machine operator, this weight drift can be corrected before it becomes a quality control issue. This, in turn, reduces material waste caused by out-of-spec products.

The Notes App

After either an automatic check or an assessment from the Mission Control, notes are sent to operators in the production floor. These notes are received by assignees responsible for specific tasks, such as machine operation or maintenance. They are equipped with Bluetooth earbuds; each note results in a voice notification using text-to-speech functionality.

The figure below shows the Notes App. From left to right, we're looking at screenshots of:

1. A list of notes displays, resembling an automatically maintained to-do list for this assignee
2. Detailed information and proposed resolution activities the operation sees after selecting a note
3. Notes can also have documents attached with deeper instructions on how to perform the proposed resolution activities, helping with employee onboarding



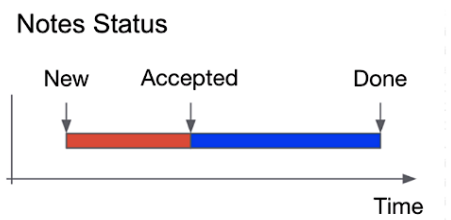
- The app also provides real-time information directly to the operator. Operator can see reports showing the remaining production time for the current production lots on all lines, allowing them to start preparing for a line change ahead of time.
- Machine manuals, operating instructions, and other documentation are available directly within the application, giving an operator immediate access to essential documents on the production floor.
- Custom notes can be created directly on the mobile device, and photos can be attached. This allows supervisors to deeply document tasks, requests and issues, facilitating maintenance.

The notes life cycle

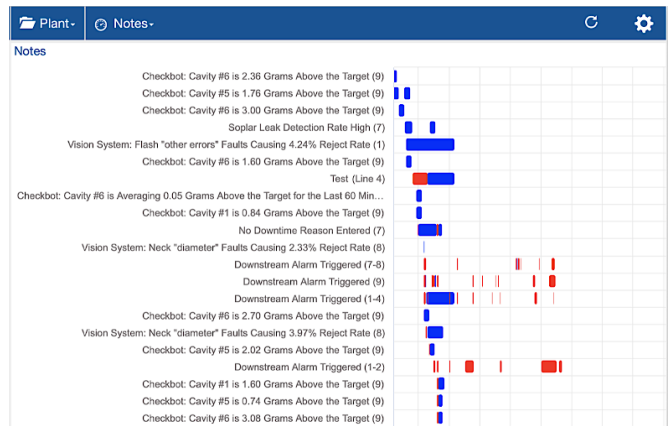
After resolving the issue, the operator registers the activities which led to a resolution. This information is stored together the note, being used for ongoing process analysis and improvement.

Additionally, when a note is marked as resolved, the rules system re-runs the original check that initially triggered the note, verifying that the issue is actually resolved.

The status of a note is shown visually in the app:



Here, the red bar shows how much time it took for the operator to accept the note, and the blue bar shows how much time it took to resolve the issue. This simple visualization is used to create a quick overview of all the issues affecting a particular plant over time, as in the next figure.



The historical information about issues, especially if they are tricky or persistent, is reviewed during regular production meetings, and is ultimately used as input for maintenance planning and Continuous Improvement Programs (CIP).

Summary

After a successful CrateDB proof-of-concept, the system that Crate.io built was put into production for 11 ALPLA plants across North America.

Every plant using the Crate IoT Data Platform saw improvements in Net Equipment Efficiency (NEE), with some showing efficiencies above 90%. Every plant experienced a reduction in manual process adjustments by as much as 50%. The result was a six-figure saving during the year 2018.

“We can now collect continuous production data, turn it into information in a digestible format, and feed it back to the floor for specific action,” says Philipp Lehner, CFO of ALPLA Global. “It’s incredibly powerful. We can guide decision-making on the production floor right in the moment.”

Digitalization will inevitably be a part of the future industry. If you are a manufacturer, we want to help you get ahead of the curve. Reach out to us and start experiencing the competitive benefits of an early implementation of the digital future!

Want to know more? You’ll find us at talktous@crate.io