Scaling Enterprise AI at Georgia-Pacific

Georgia-Pacific (GP), one of the world's leading makers of tissue, pulp, packaging, and building products, has over 100 manufacturing facilities across North America, including paper mills. Paper mills are large-scale, complex operations that require efficient and reliable operations to avoid costly unplanned downtime.

In 2018, to dramatically improve operational reliability, GP established the Collaboration and Support Center (CSC). Home to over 150 engineers, IT personnel, and data scientists, the CSC brings subject matter expertise, data, AI, process control, and cloud technology together to help facilities improve efficiency and reliability.

Since its inception, the CSC delivered remarkable results using rule-based and machine learning (ML)-based models to monitor thousands of individual sensor readings, or tags, and generating alerts when a specific tag became anomalous. However, as the CSC looked to scale up its program to monitor more complex assets (e.g., pumps, boilers, turbines) and processes, they found that existing software platforms were not optimized to meet their data and ML needs.

The CSC needed a new solution that could uplevel their program in two ways: (1) monitor at an asset (equipment or system) versus tag level to better contextualize issues and eliminate redundant alerts, and (2) utilize massive data sets from disparate sources and more advanced ML techniques to improve monitoring performance, producing more precise alerts with longer lead time.

To meet these needs, in 2020, GP chose to embark on a multi-year partnership with C3 AI to leverage the C3 AI Platform and applications, as well as C3 AI's expertise in developing and scaling enterprise AI applications. A Center of Excellence (CoE) consisting of engineers, data scientists, and subject matter experts from both companies was formed, and the team quickly got to work on the first use case: leveraging the C3 AI Reliability application to reduce unplanned downtime.

By integrating AI into its manufacturing operations, GP is seeing significant improvement in overall monitoring performance, reduced unplanned downtime and maintenance costs, improving overall equipment effectiveness (OEE) by up to 5%. Building on this success, GP plans to expand the application to eight additional critical asset classes.

This deployment is just the start for GP. The CoE continues to identify and scope new AI use cases, while delivering scalable, high value enterprise AI applications across GP.

Company Objectives

- Improve process monitoring performance by leveraging more data and advanced ML techniques
- Rapidly scale across any asset class or process unit
- Effectively deploy and manage ML models at scale

Initial Results

Up to 5%

OEE improvement

100s of hours

of avoided downtime

Challenges

Since 2018, the CSC has led an increasingly successful reliability program to reduce unplanned downtime and maintenance costs across its facilities. The CSC began its journey by deploying rules-based and machine learning models to monitor individual asset sensor readings, or tags. For simpler assets, this tag-level monitoring approach proved to be effective. However, as the CSC looked to scale its program to complex assets – assets with multiple processes, components, and sensors — the CSC found that more sophisticated data integration and modeling capabilities were needed and that existing software platforms could not sufficiently meet these needs.

The CSC has access to data from more than half a million sensors spread across GP facilities. However, existing software platforms could not easily support ML model pipelines that integrated multiple tags and other data sources such as vibration, work orders and equipment information to create asset-level models that provided a holistic view of assets. Consequently, the models were limited to “out-of-bounds” alerting for equipment vibration, and individual process tag variables, creating barriers for GP to scale up its program for complex assets.

Moreover, existing platforms provided limited investigative and case management workflows that accelerate risk identification and resolution. As a result, the CSC sought a scalable solution to enhance their alerting approach that could do the following:

1. Utilize a virtual asset hierarchy to monitor at an asset-level (equipment or system) versus at the sensor-level, while contextualizing sensors on various components of an asset
2. Leverage large amount of data from disparate sources across sensors and enterprise systems in a single model, including timeseries and non-timeseries data
3. Easily deploy, manage, and maintain models using advanced ML techniques to improve monitoring performance
4. Configure streamlined investigative and case management workflows for complex assets

About Georgia-Pacific

- Leading manufacturer of tissue, pulp, packaging, and building products
- HQ in Atlanta, GA
- Over 100 facilities

Project Highlights

- 200+ assets monitored across 13 paper mills
- 1 live ML model per asset, plus continuously deployed challenger models
- 2,816 ML model features
- 6 disparate data sources integrated

Center of Excellence

With these challenges in mind, GP chose to embark on a comprehensive, multi-year partnership with C3 AI to augment large-scale data integration and advanced AI capabilities within the CSC. As part of this vision, GP and C3 AI established a CoE consisting of developers, data scientists, engineers, business unit leaders, and executives from GP and C3 AI to support the identification, prioritization, development, and deployment of AI-based solutions.

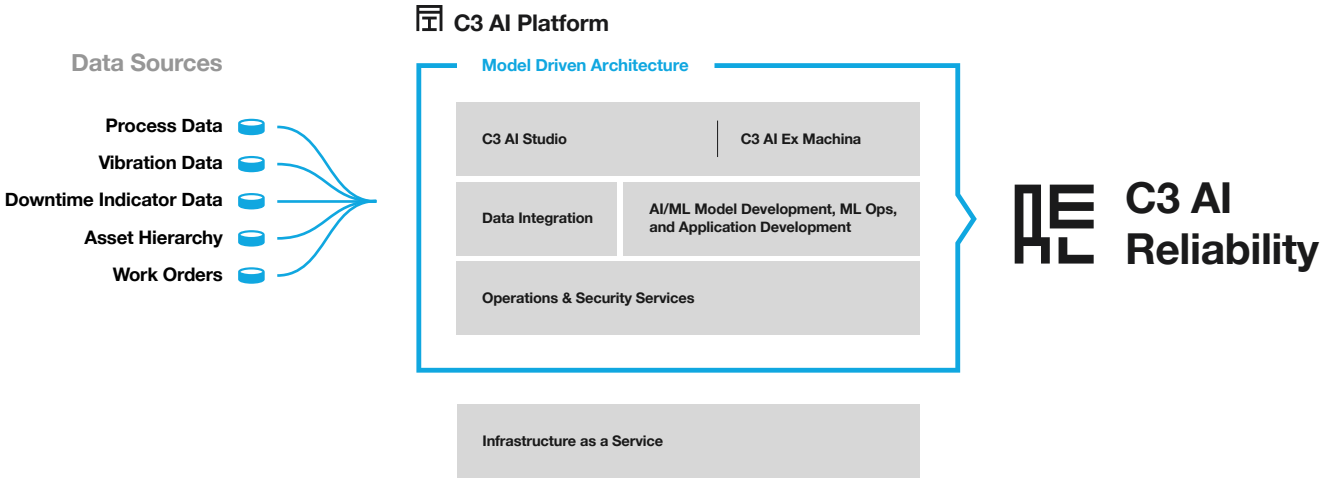
GP decided to kick off the project by onboarding an asset class that is critical to the manufacturing process and downtime avoidance. To create asset models that provided a holistic view of assets, the CoE data engineers started by unifying data from six disparate data sources including process data, vibration data, downtime indicator data, work orders, and asset hierarchies, creating a foundational data layer for AI use cases.

Then the CoE worked to rapidly configure virtual hierarchies that organized these data in the context of the asset. The virtual asset hierarchies capture the interdependencies between components and processes and create the consistency required to model these assets at scale. On top of the asset hierarchies, the CoE data scientists employed advanced feature engineering and ML techniques to train ML models that could monitor assets holistically and utilize all the available data.

Additionally, through the rich and integrated workflows of the C3 AI Reliability application, CSC engineers can investigate alerts and collaborate with facilities more effectively. Engineers can review detailed alert evidence packages that indicated which sensor readings triggered the alert, review time series and non-time series data related to the asset, track issues and cases, and communicate with the impacted facility to resolve risks.

The CSC initially deployed C3 AI Reliability to monitor 60 assets and has since scaled the deployment to more than 200, where one ML model is deployed per asset to monitor its health (as opposed to the previous one-model-per-tag approach). By taking a more holistic approach to monitoring complex assets, the CSC has been able to improve monitoring performance and significantly reduce the number of alerts generated.

Solution Architecture



Looking Ahead

With this initial deployment, GP has already seen hundreds of hours of avoided downtime and significant improvement in overall monitoring performance and efficiency, realizing up to 5% of OEE improvement. Given the continued success for the initial scope of assets, GP is expanding the scope of C3 AI Reliability to eight additional asset classes in the next year.

Benefits

Through the partnership with C3 AI and implementation of C3 AI Reliability, GP can:

- Scale asset management program for complex assets across facilities, starting with various types of assets
- Integrate large amount of data from disparate data sources into a single virtualized data layer that can be leveraged for various AI use cases
- Utilize advanced ML techniques to enable holistic monitoring of high-value assets and prioritized AI-driven insights
- Enable comprehensive alert evidence packages that visualize feature contributions and streamlined case management workflows for asset engineers, driving productivity and efficiency
- Drive manufacturing productivity across critical asset classes