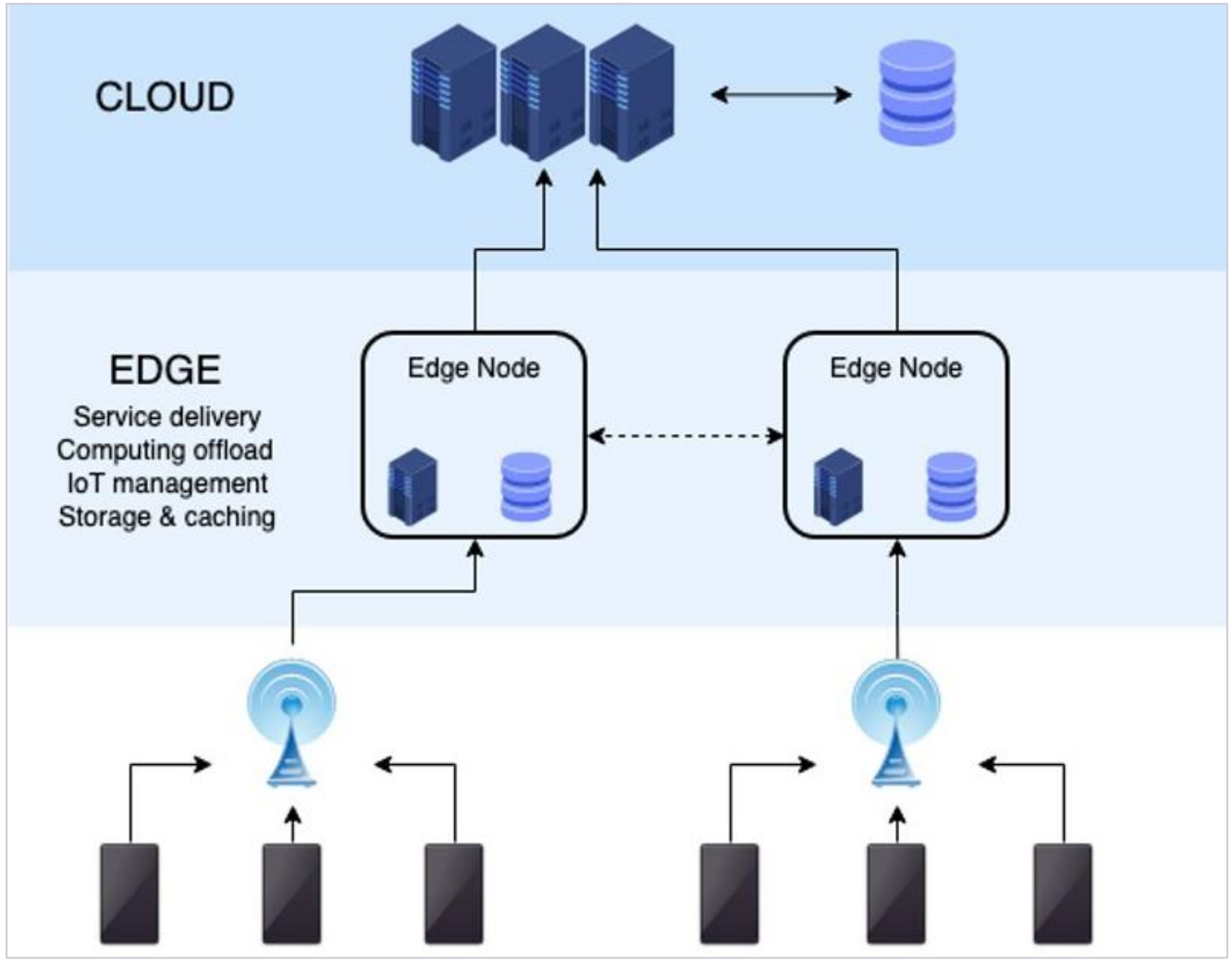
Unlock Full Machine Potential with Siemens Industrial Edge

May.4th, 2023

SIEMENS

Unrestricted

Edge computing is a distributed computing paradigm that brings computation and data closer to the sources of data



What is Edge Computing?

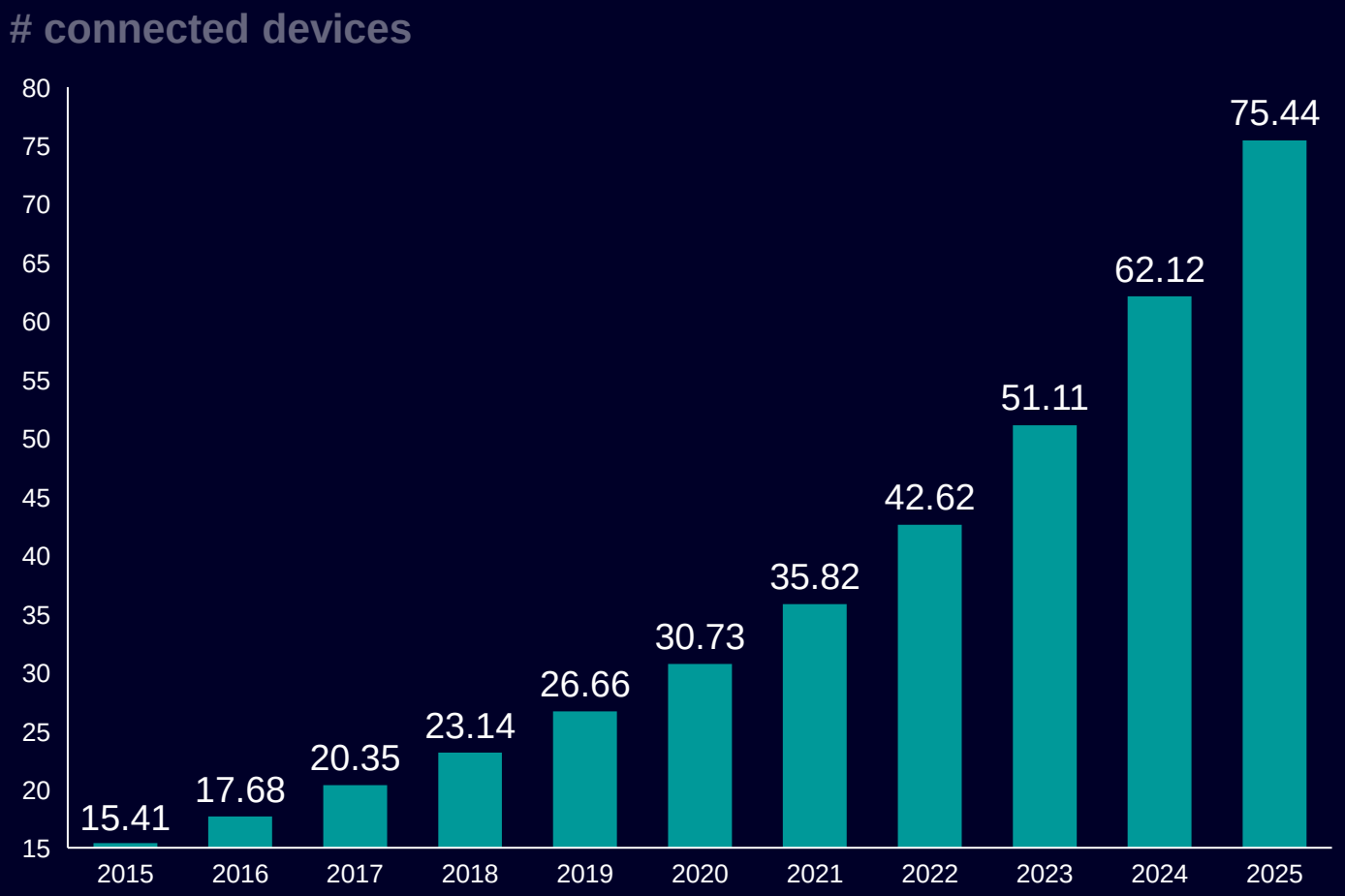
- **Improves response times and saves bandwidth**
- Topology and location-sensitive form of distributed computing
- “Edge” refers to the architecture rather than a specific technology (i.e. the edge of the cloud/network)

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Industrial Challenges Are Increasing

Due to new devices being connected to the systems in the industry



Source: statista, 2019

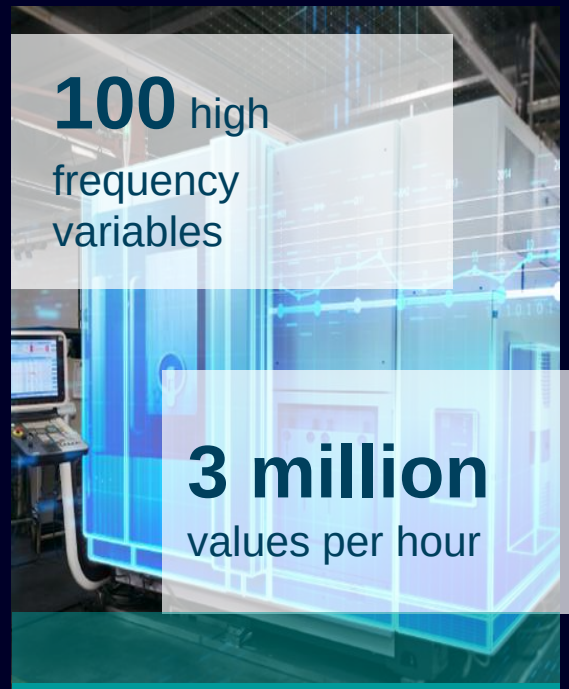
Research institutes estimate more than 40 billion connected devices and 75 billion in 2025.

What about your connectivity?

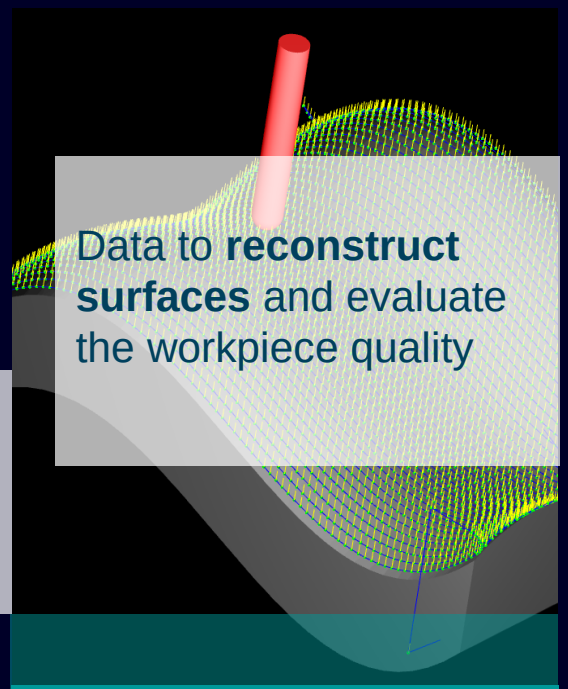
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Why Edge computing is relevant – manufacturing companies face new challenges and opportunities related to Big Data



Process **high amounts of data locally**



Keep very **sensitive data** locally

Make immediate decisions with **no latency**

Bring these capabilities to the shop floor with a system:

- that fulfills IT standards
- and seamlessly integrates into OT (Operational Technology)

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Introducing

Industrial Edge

An open software platform that integrates IT to shop floor and makes data handling simple, scalable and reliable

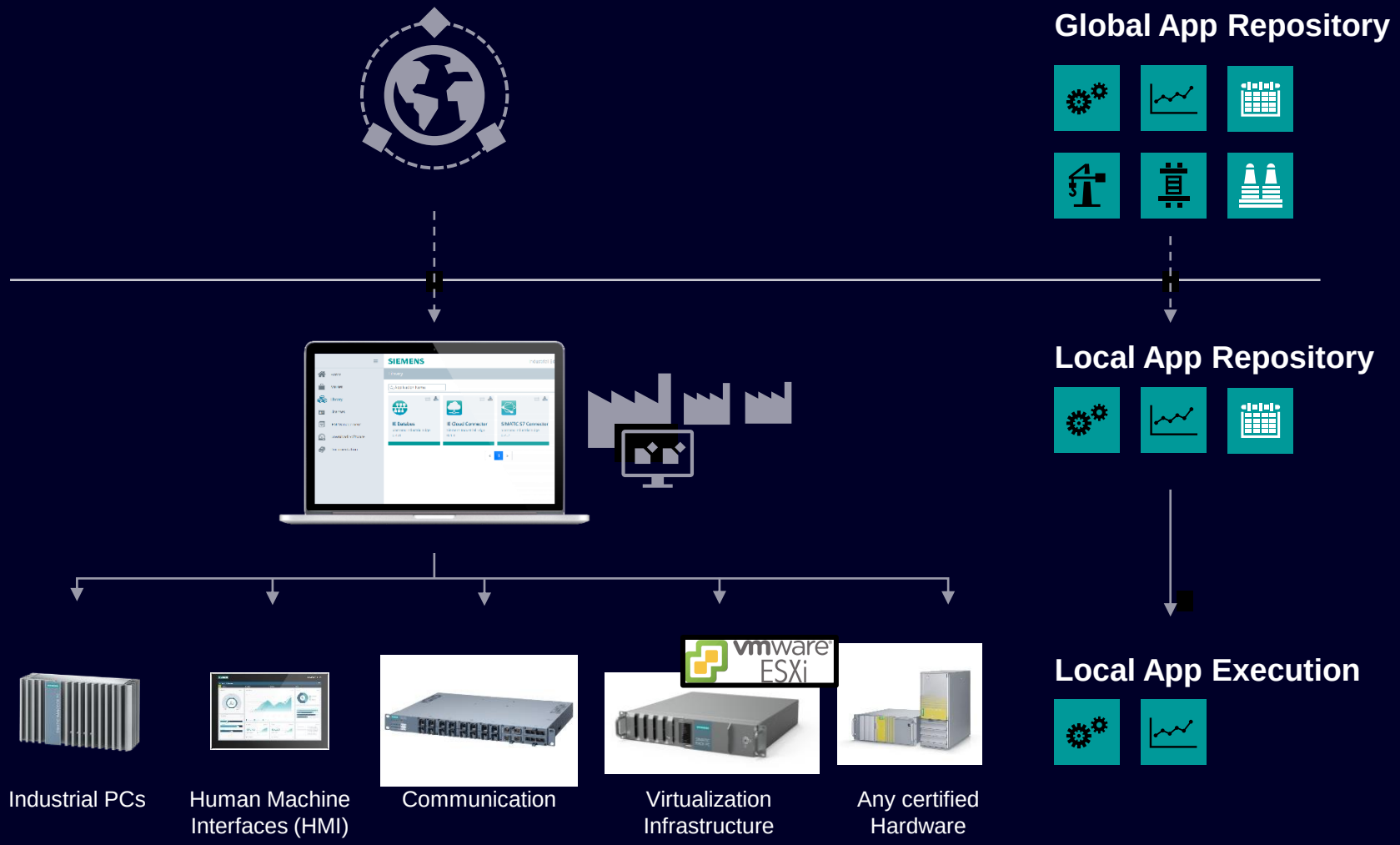
Unrestricted | © Siemens 2023 | Siemens Digital Industries

Industrial Edge offers three components which create a simple workflow to manage distributed IT infrastructure

Industrial Edge Hub
(Siemens operated)

Industrial Edge Management
(Customer-operated)

Industrial Edge Runtime on Industrial Devices
(In-Factory)



Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Portfolio
Industrial Edge Devices

Industrial Edge Devices by Device Builders – Flexible and scalable for customer scenarios

Embedded IPC for small sized applications applications

SIMATIC IPC127E

Embedded IPC for mid-sized applications

SIMATIC IPC227E

IPC for demanding applications

SIMATIC IPC427E

For High Performance Application
SIMATIC IPC847E

Virtual Edge Device for IT infrastructure

Industrial Edge Virtual Device (IEVD)

Human Machine Interface*

SIMATIC HMI Unified Comfort Panel

*Limited Industrial Edge functionality as option available, Part of Performance Analytics Application Scenario only

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

What makes a great platform even greater?

Apps.

SIEMENS

And the 4th component
Industrial Edge Apps

+ Siemens Edge apps

Released /
More in development

+ Partner Edge apps

BRAIN CUBE

DATAHEAD

...

+ Self-developed apps

Can be tailored to any requirement in your production

Publish your own apps via the Industrial Edge App Publisher!

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Transparency on consumption with **Energy Manager**

Easy Dashboarding with **Performance Insight**

Digital maintenance cockpit in **Machine Monitor**

Error and alarm logbook in **Machine Insight**

Connect the shopfloor with Industrial Edge Connectors

Data visualization

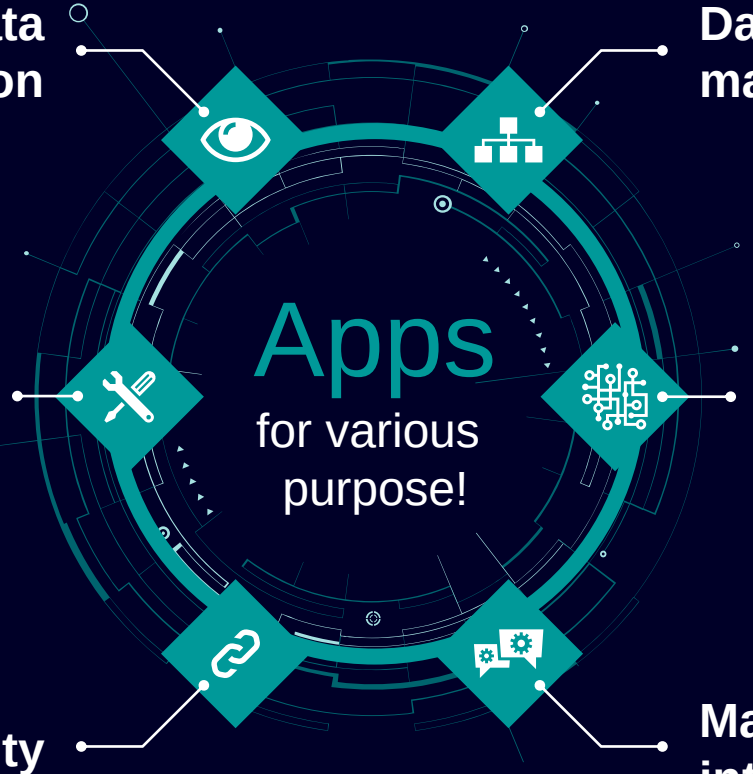
Data & Device management

Machine service

Data processing

Connectivity

Machine interaction



Scan and stock your network with **Inventory**

Update your systems with **SIMATIC Automation Tool**

Structure and store machine data with **Data Service**

Flow based data preprocessing with **Flow Creator**

Run FMU simulations on your machine with **LiveTwin**

Receive Push notifications from machines with **Notifier**

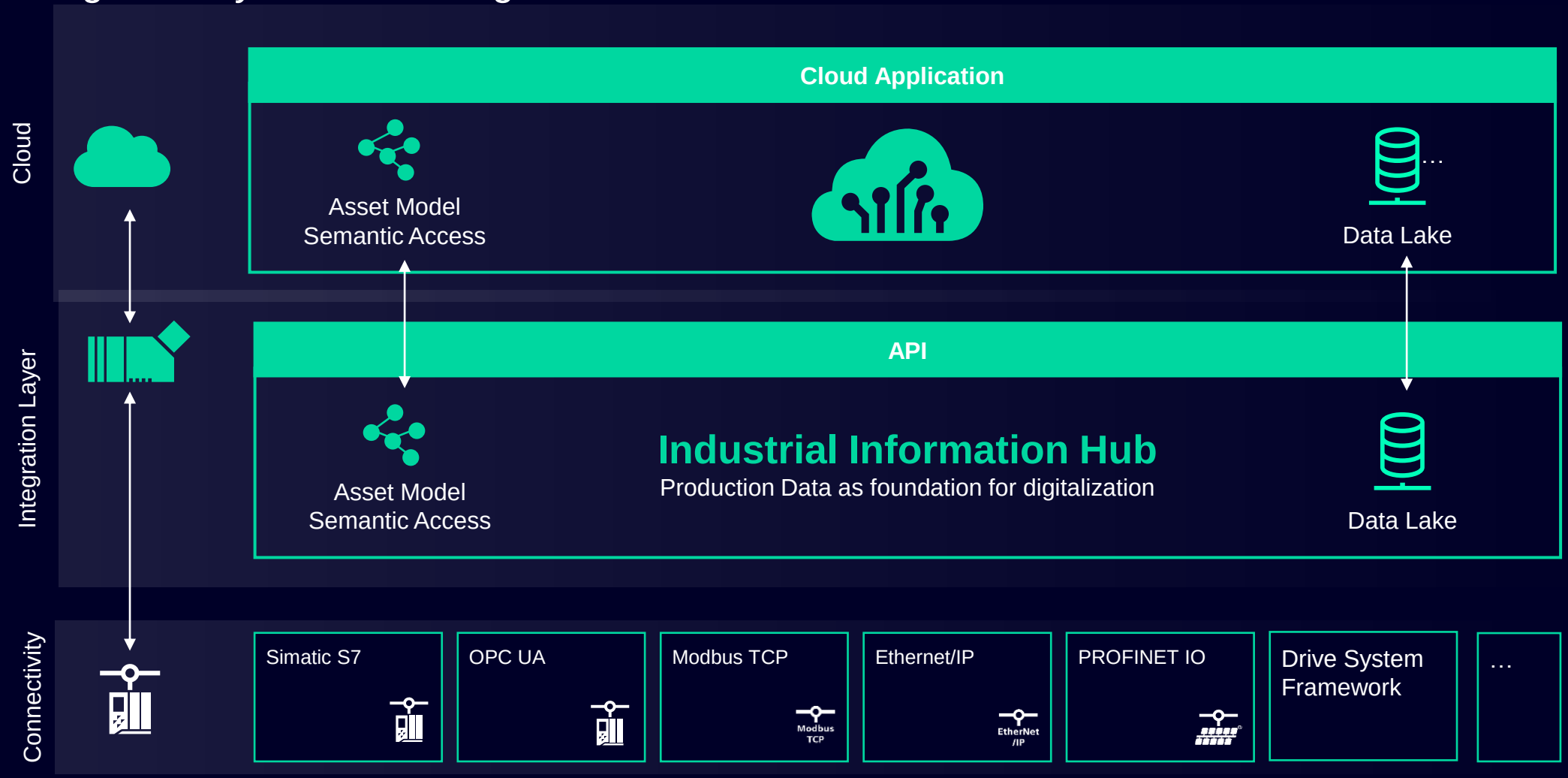
Talk to your machines with **SAM**

..and more!

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

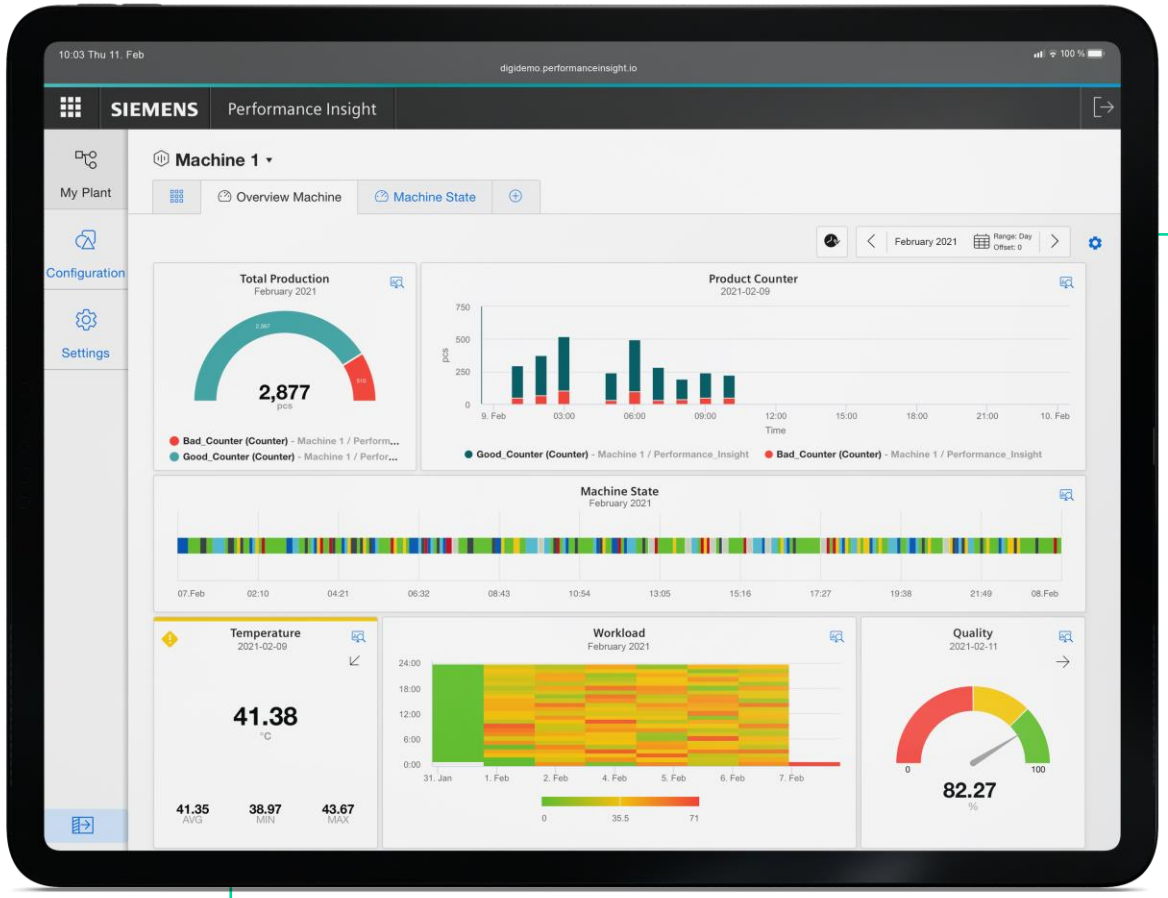
Industrial Information Hub
Data Integration system from Edge to Cloud



Unrestricted | © Siemens 2023 | Siemens Digital Industries
SIEMENS

Apps for Data Visualization

Performance Insight



Increase productivity for any machine, line or plant

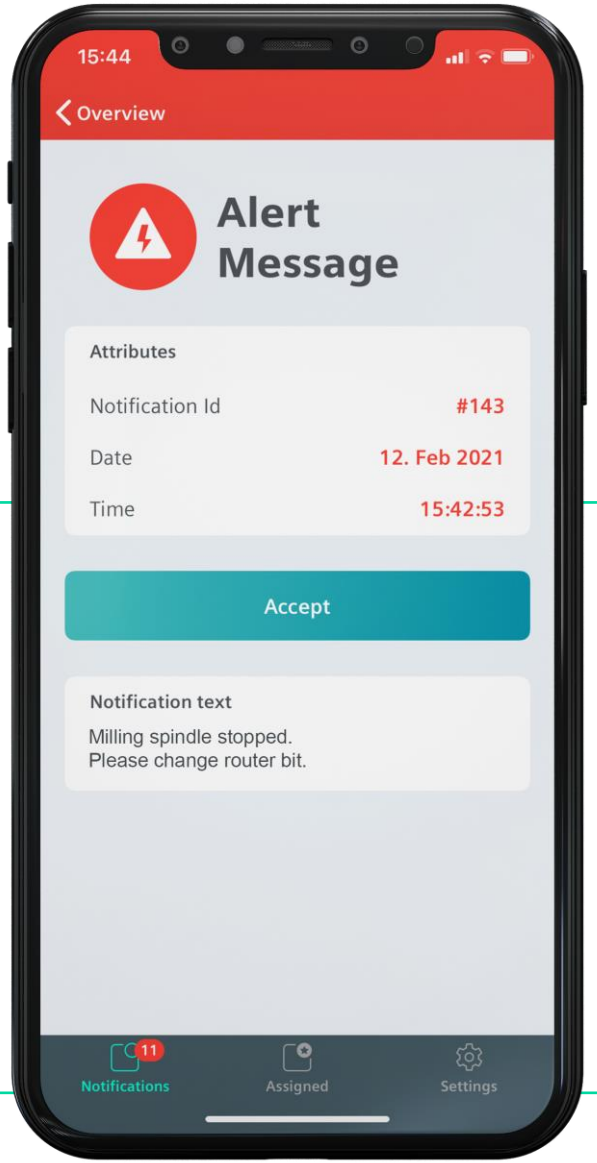
- Flexible tool for calculating and visualizing the machine condition to get additional machine transparency
- Optimize assets by gaining transparency about OEE, quality and further KPIs
- Generic visualization enables an integration of all kind of machines

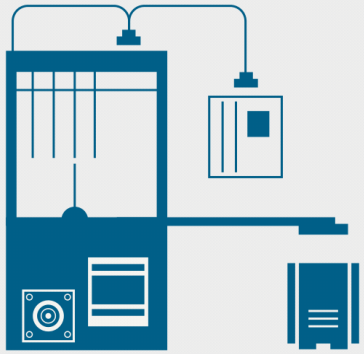
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Apps for machine interaction

Notifier





Stay tuned by push notifications

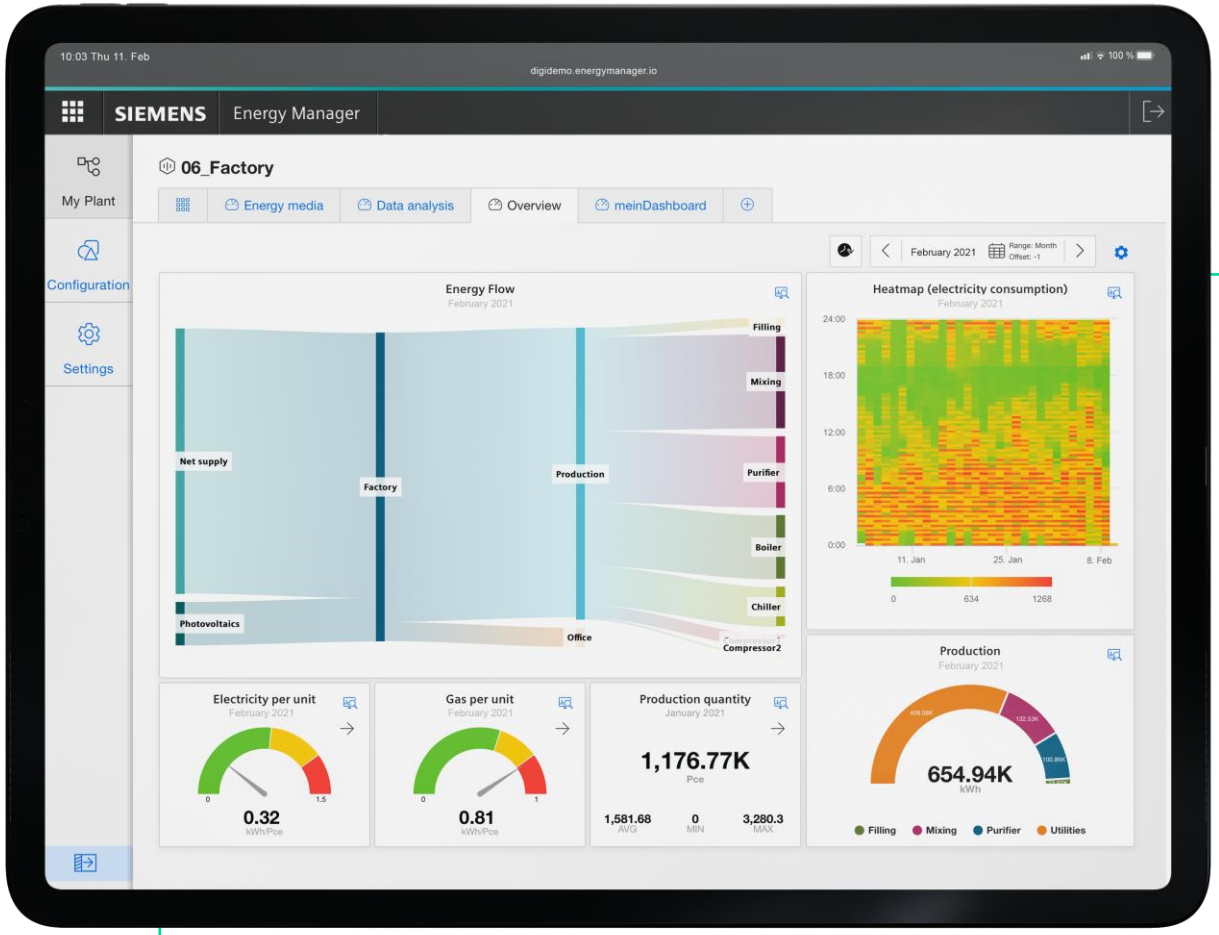
Reduce reaction times and downtimes by sending push notifications to your staff's pocket. See who took over responsibilities.

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Apps for data visualization

Energy Manager



Transparency for energy managers in manufacturing and infrastructure

Increase the energy and resource efficiency for production as well as infrastructure areas.

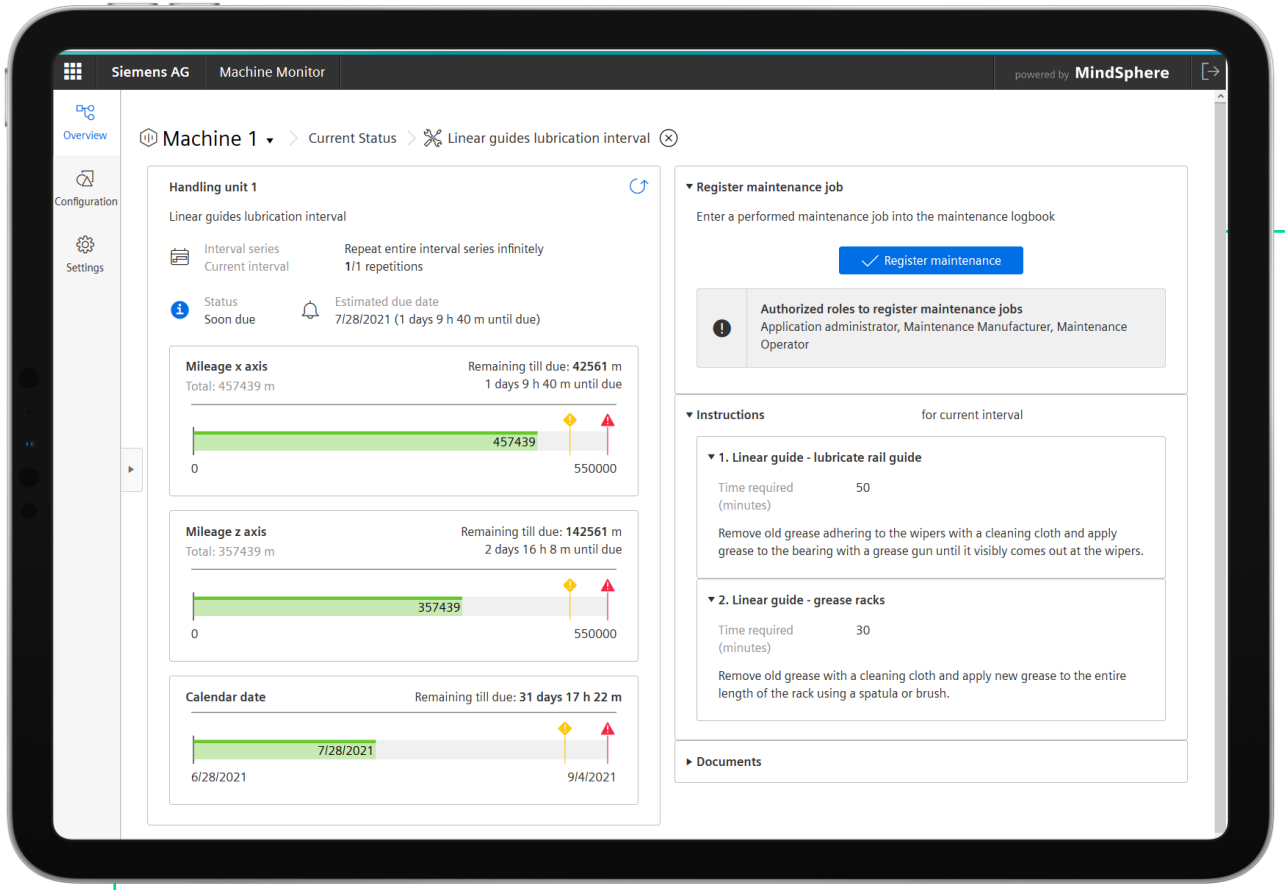
Providing transparency with energy related calculation-
and visualization methods
e.g. Sankey diagram.

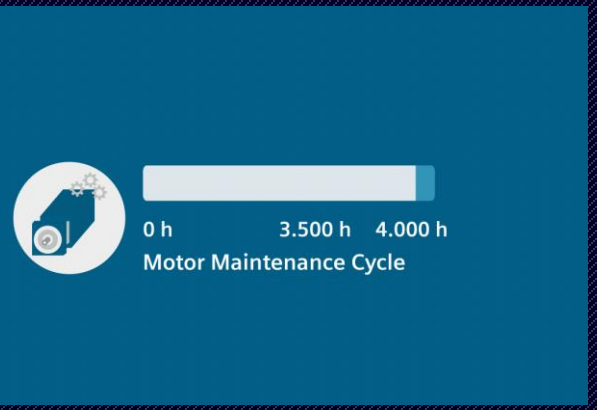
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Apps for machine service

Machine Monitor





Maintenance and service organizer for machine builders

Increased availability of machine for end-users and more efficient planning and scheduling of service routines.

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Live Twin – Big Picture

Edge computing, for simulation in operations

Create Smart Virtual Sensors

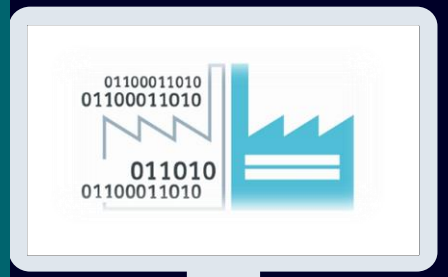
Estimate loads and strains for off-line analysis

Export xDT for data expansion and load estimation

R&D Design Phase

Operations

1D Multiphysics simulation



1

Import the Digital Twin

Data collection

2

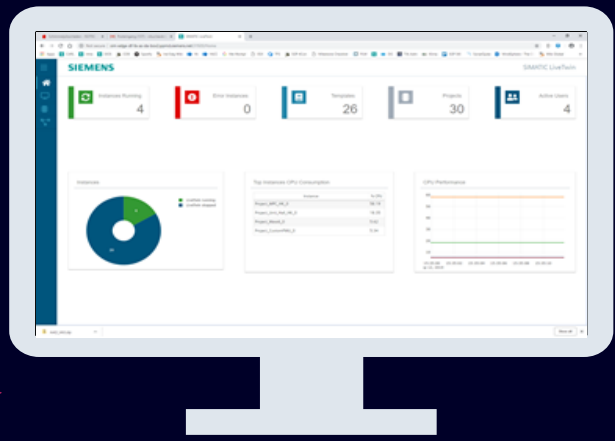
Siemens Industrial Edge

4

LiveTwin data

3

Web access

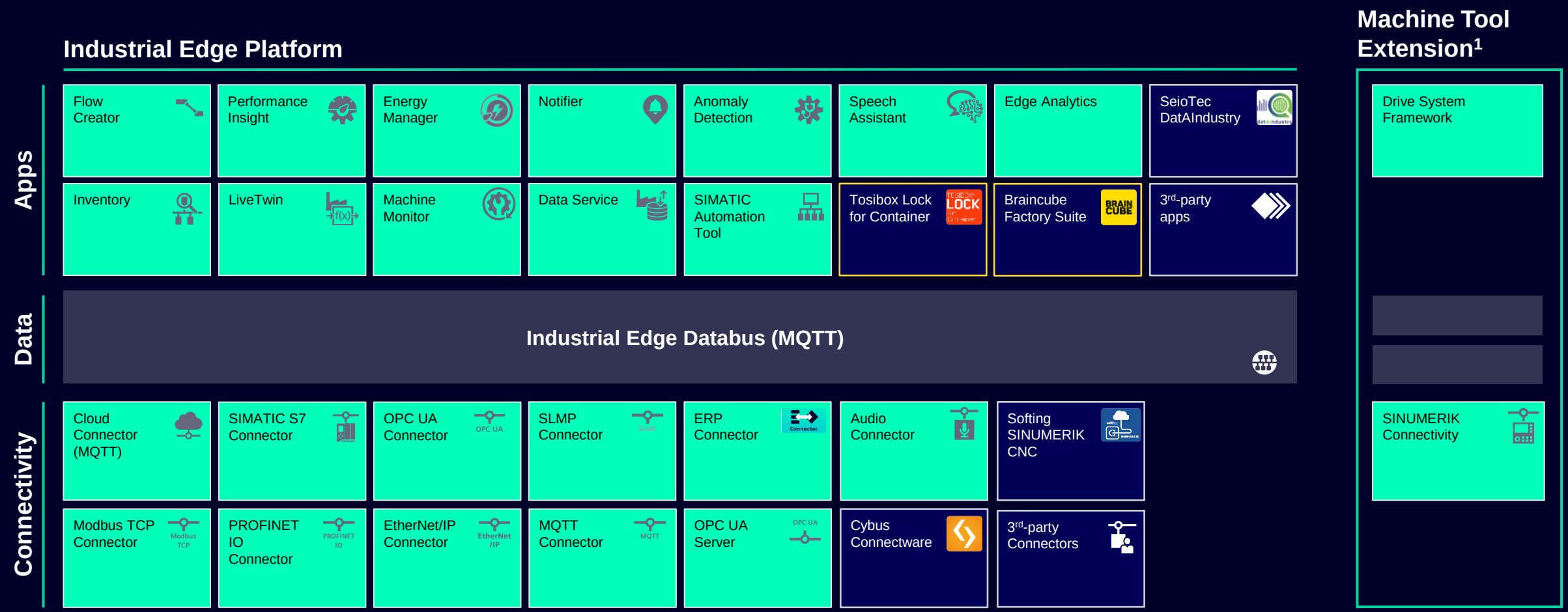


Virtual Sensors, process and control optimization and more

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Explore our extensive app portfolio from Siemens and 3rd parties



Unrestricted | © Siemens 2023 | Siemens Digital Industries

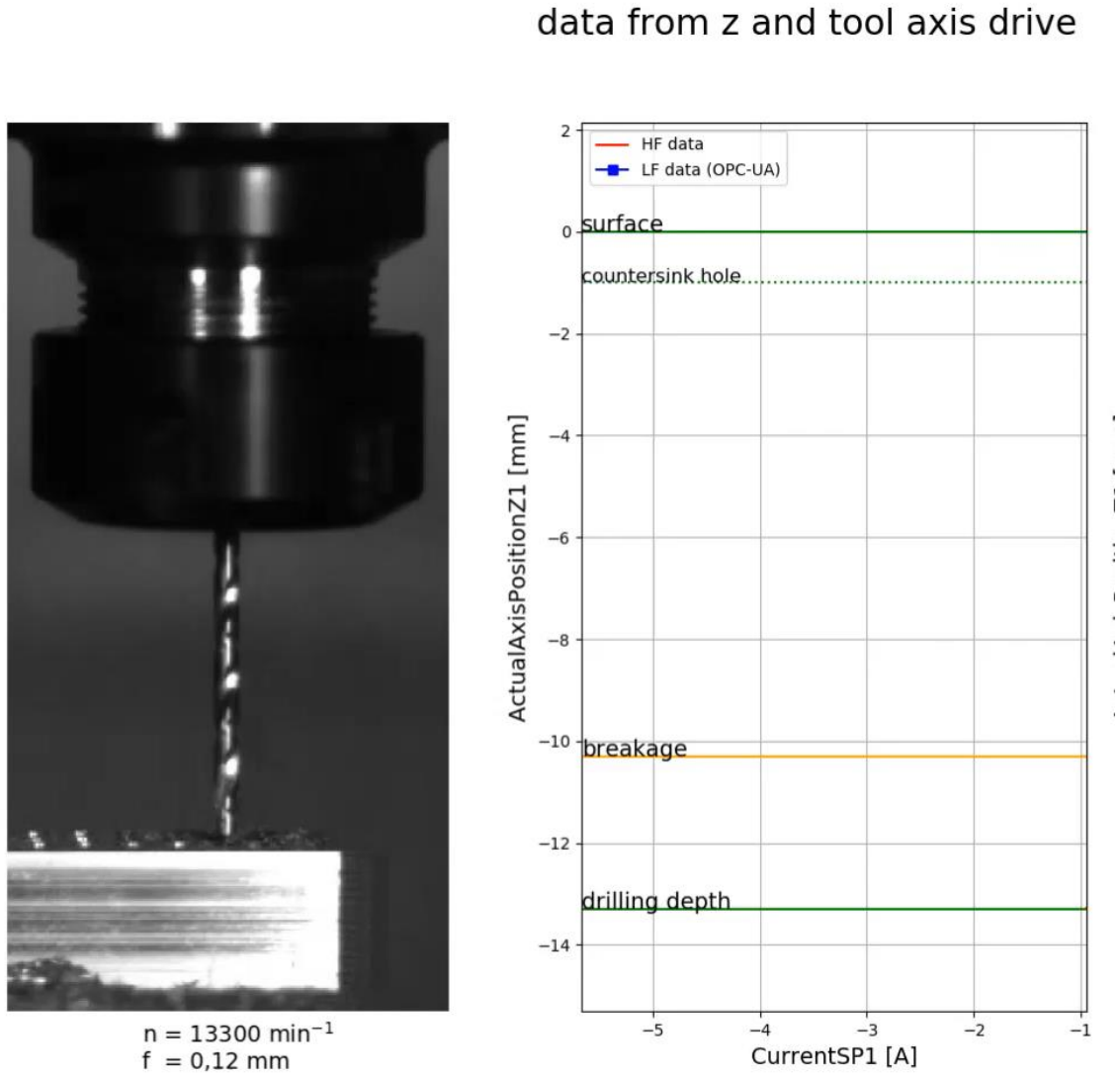
SIEMENS

Industrial Edge for Machine Tools

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Industrial Edge for Machine Tools– what high frequency data can do



Here is an example drilling process. During drilling, the spindle current is measured:

- with the HF data of Industrial Edge for Machine Tools vs.
- with OPC UA

Results

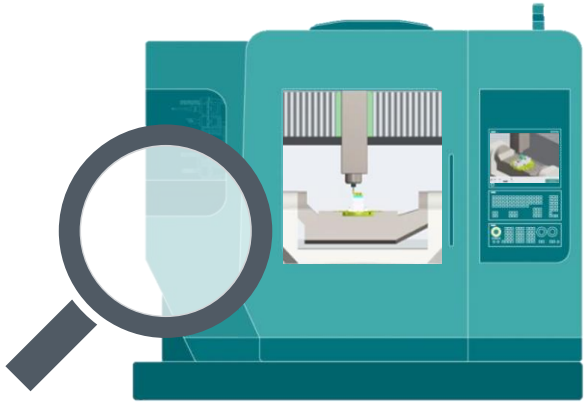
- HF data gives a much tighter view on actual performance, where OPC UA only gives information every 2 mm.
- In case of breakage, the current drop can be identified at or before mm 11 and well than 1mm before OPC can deliver this result

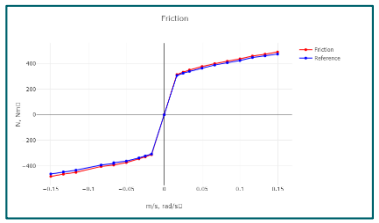
With Industrial Edge for Machine Tools you have a platform that enables you to monitor the workpiece quality very tightly and improve the availability of your machines.

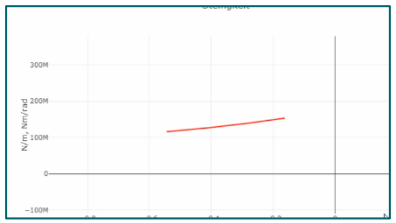
Unrestricted | © Siemens 2023 | Siemens Digital Industries

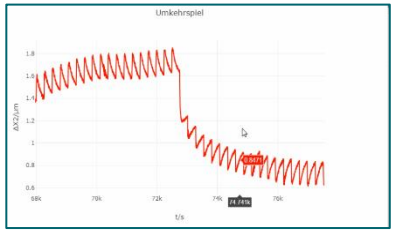
SIEMENS

Transparency of machine condition
with Analyze MyMachine /Condition









Analyze MyMachine /Condition enables users to generate a machine tool's **mechanical fingerprint** so that potential deviations can be identified at an early stage, machine failures prevented and machine operation optimized.

Various parameters can be recorded with the aid of **flexibly configurable measurement series**:

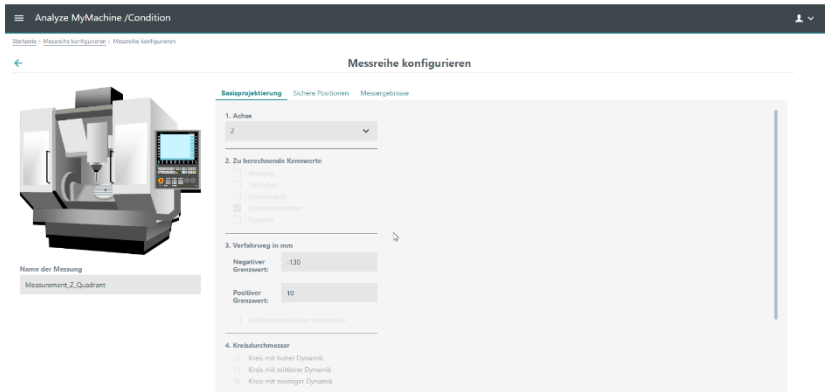
- Stiffness
- Friction / Friction distribution
- Backlash
- Quadrant error
- Signature
- Equability
- Frequency response

The results of measurements can be **visualized** and compared to reference values.

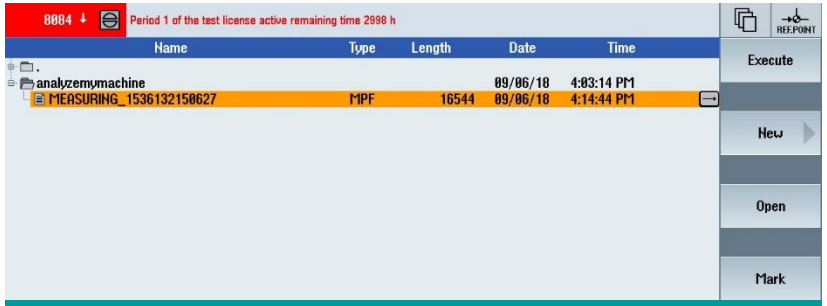
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

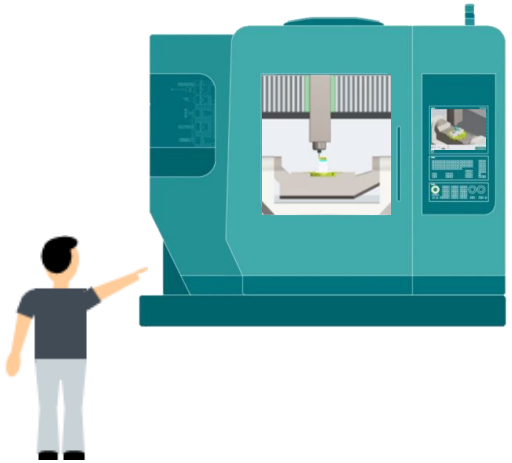
Using Analyze MyMachine /Condition to determine a machine tool's mechanical fingerprint

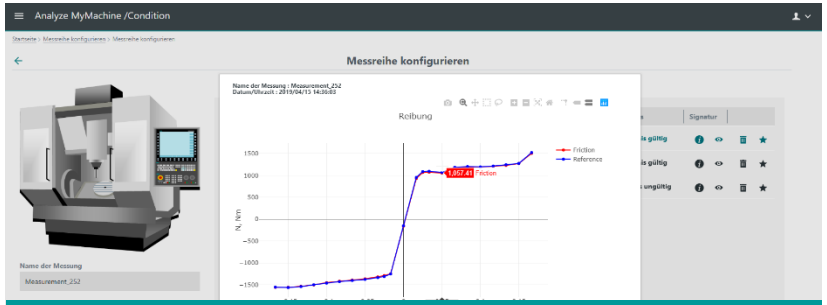


1. Create and configure series of measurements

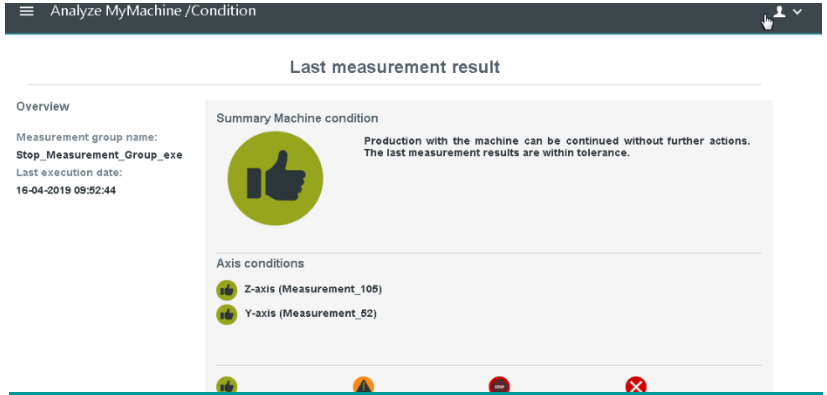


2. Execute the measurement program on the controller





3. Analysis of measurement results

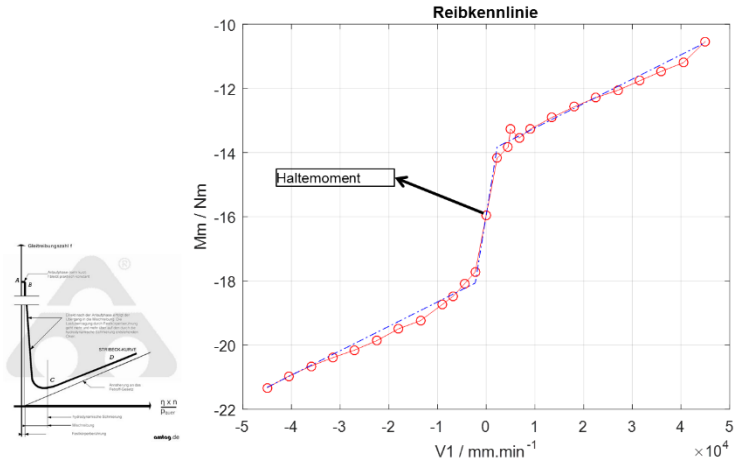


4. Basis for recommended action

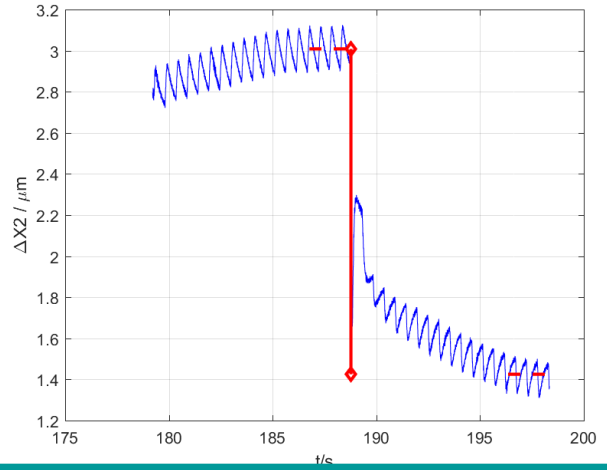
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

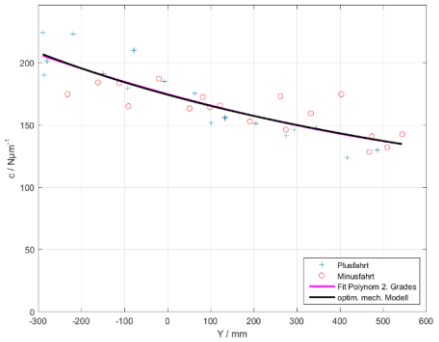
Mechanical fingerprint based on up to 7 measurement characteristics



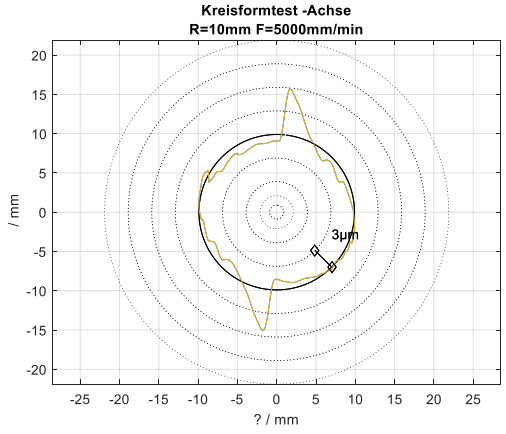
Friction: Determined by traveling with different sets of constant velocity



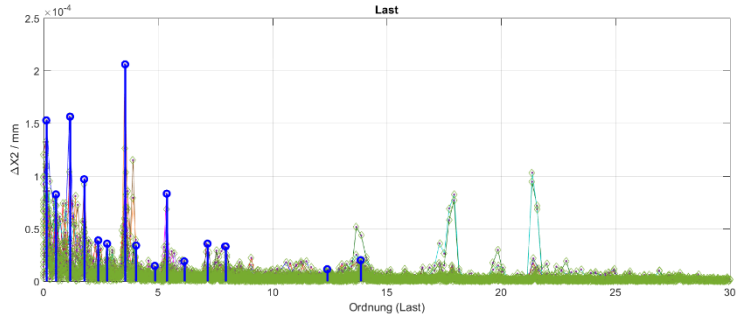
Backlash: Determined by difference at 2nd encoder after traveling with µm-distance



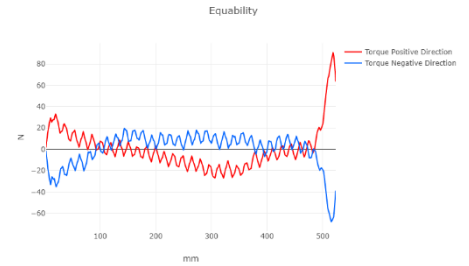
Stiffness: Determined by acceleration of the axis at different positions, then polynomial description of the individual discrete measuring points



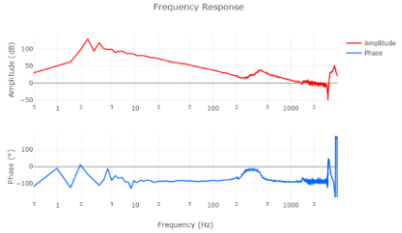
Quadrant error: Axes travels a sine path. Difference to ideal sine gives quadrant error



Signature: Determined by equability test with different sets of constant velocity. If order appeared 3 times it gets shown as order



Equability: Constant travel along the defined measuring range



Frequency response: Automatic determination of the natural frequencies of the drive train

 Unrestricted | © Siemens 2023 | Siemens Digital Industries

Quality Monitoring for every Part
with Analyze MyWorkpiece /Monitor

Continuous quality control

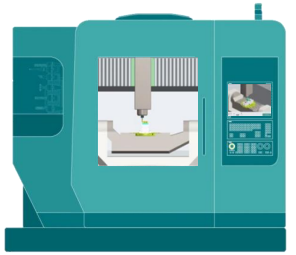
Analysis of machining data in-parallel to production by statistical models

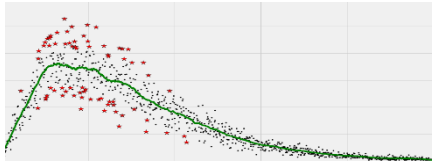
- Early detection of quality issues in the production through continuous production monitoring

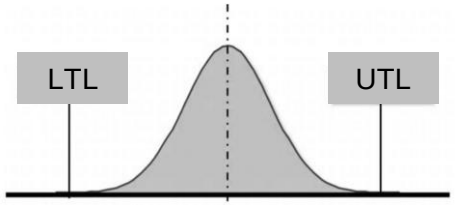
1. Capture high frequency data for valuable operations

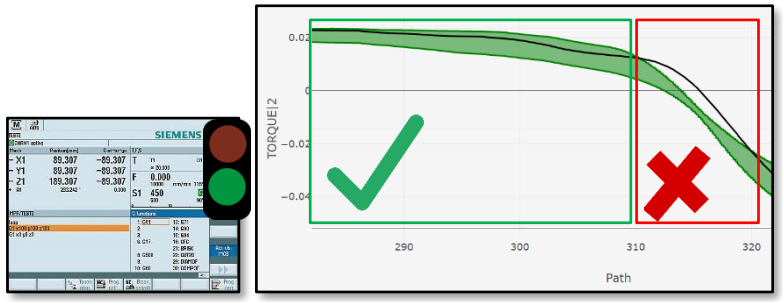
2. Automatically evaluate the data with statistical methods or machine learning models

3. Results are feed back directly to CNC controller and report is created









Unrestricted | © Siemens 2023 | Siemens Digital Industries

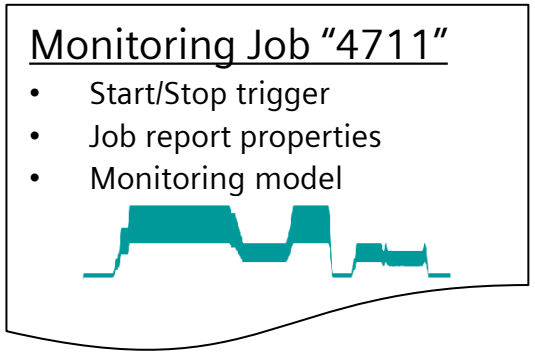
SIEMENS

An active monitoring uses the trained model
Process anomalies are now automatically detected

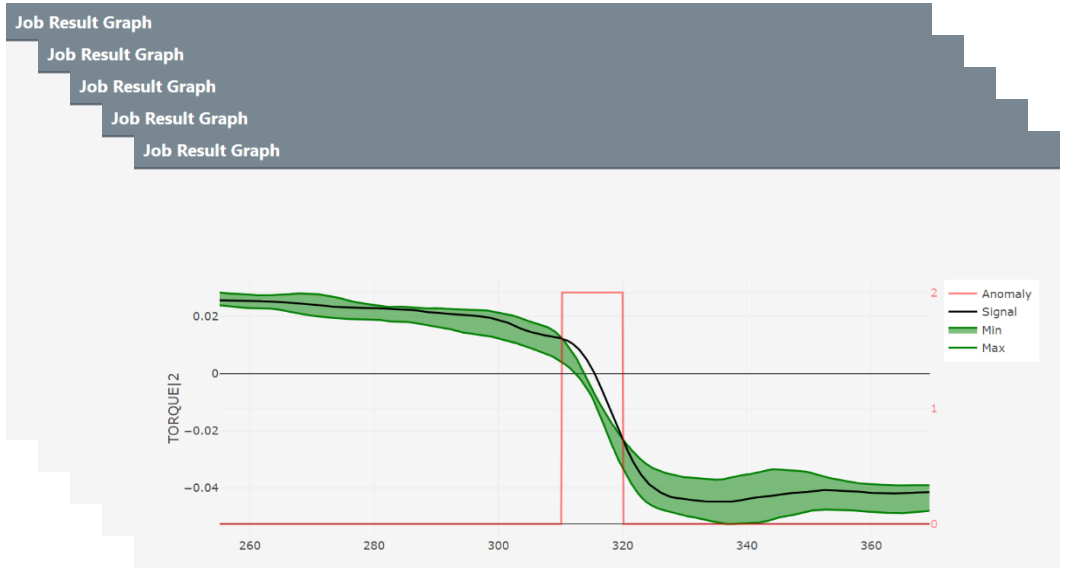
Once the monitoring is active, a job report is being created for each execution of the operation.

Analyze MyWorkpiece /Monitor automatically detects:

- Existence of an anomaly
- Location of the anomaly



Setting up a monitoring job



Job reports

Unrestricted | © Siemens 2023 | Siemens Digital Industries

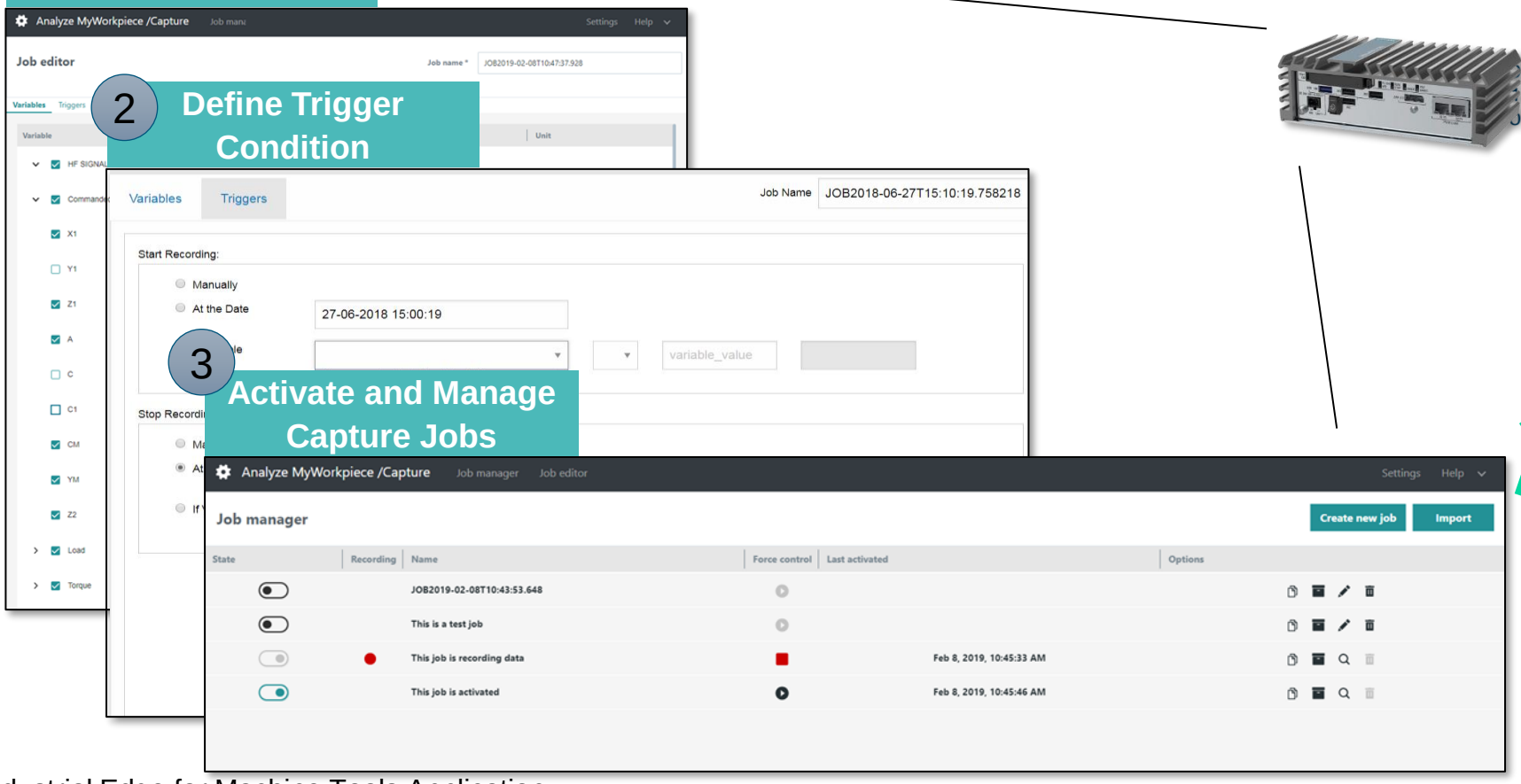
SIEMENS

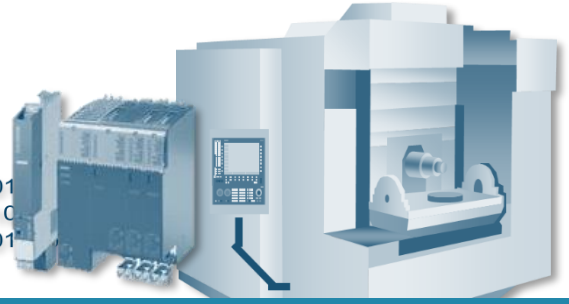
Automated Machining Process Data Collection
with Analyze MyWorkpiece /Capture4Analysis

1 **Select Variables**

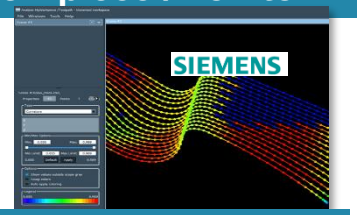
2 **Define Trigger Condition**

3 **Activate and Manage Capture Jobs**

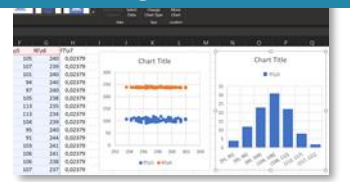




Use with
Analyze MyWorkpiece /Toolpath
and
Analyze MyWorkpiece /Monitor



Use data in
other tools via Web-Interface,
REST API, & MQTT



Industrial Edge for Machine Tools Application

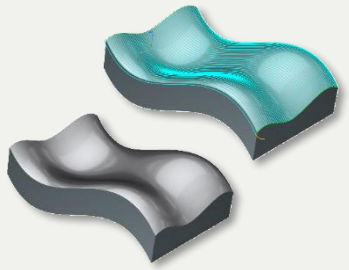
Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Closing the Loop from Production to Design
with Analyze MyWorkpiece /Capture and /Toolpath

Office

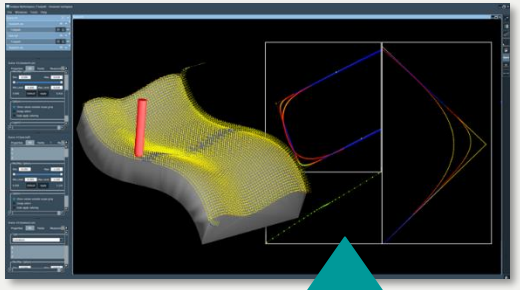
CAD / CAM



```
CYCLE832(0.05,0,1)
TRAORI
G54
ORIWKS
ORIAXES
G0 C4.032 A-47.82027
G1 X51.51842 Y132.47642
Z1.77312 M8 F250
.....
```

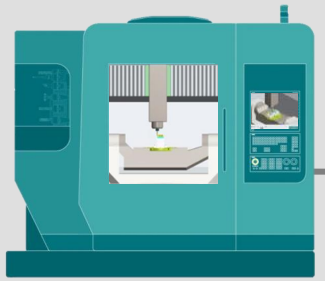
3D CAD file
NC part file

Analyze MyWorkpiece /Toolpath

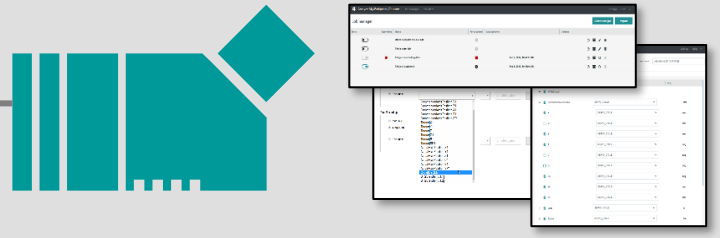


Shop Floor

SINUMERIK



Industrial Edge for Machine Tools
Analyze MyWorkpiece /Capture



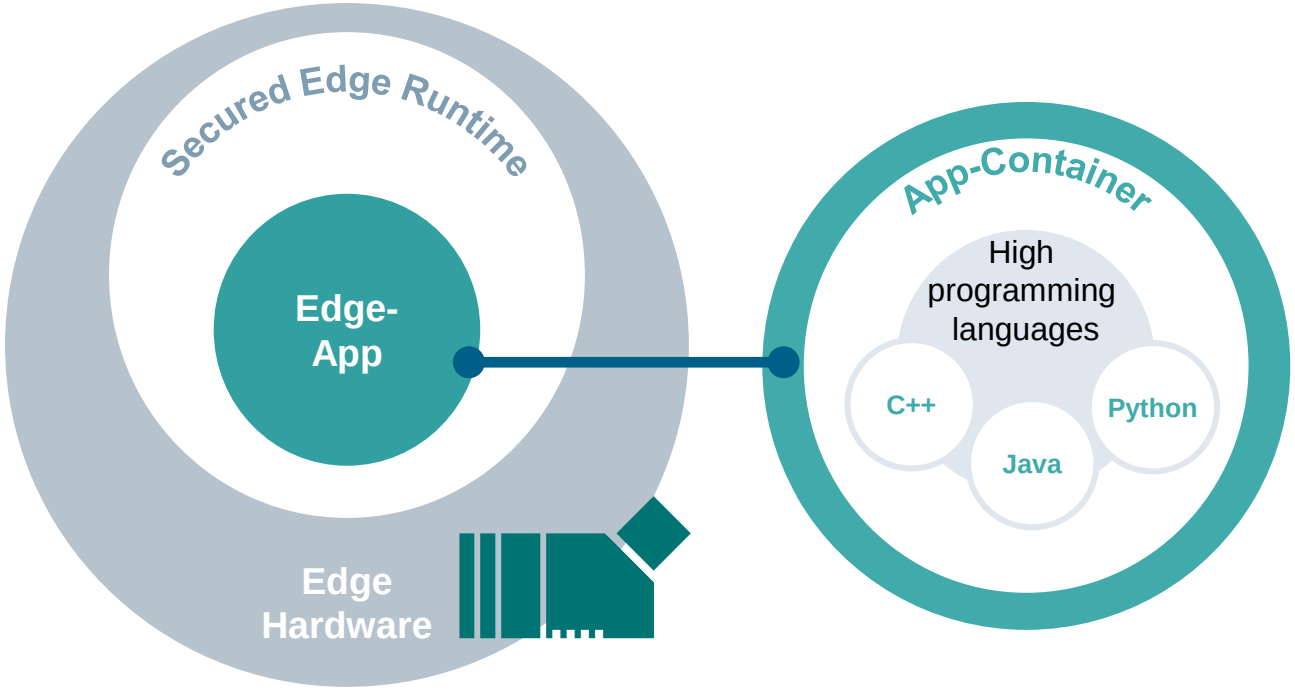
Virtual Twin of Production

Virtual Twin of Performance

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Open ecosystem with a secure infrastructure for Apps that can be developed by different parties



Secured ecosystem with hardware, runtime and separated app containers

Open ecosystem for Edge Apps by Siemens, machine builders, 3rd parties

App SDK for customer individual Apps, supporting high programming languages

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Industrial Edge Reference

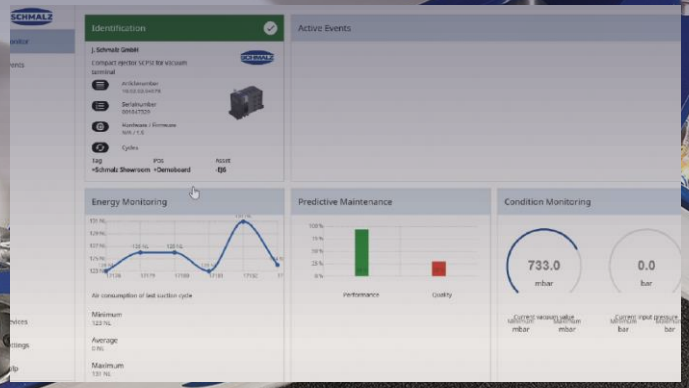
SIEMENS

EMUGE and Analyze MyWorkpiece /Capture4Analysis Germany

Customer profile	EMUGE is a full-range supplier for precision tools and economical machining processes, located in Lauf an der Pegnitz, Bavaria. The company has been one of the world's leading manufacturers of tools for threading, drilling, milling, testing and clamping for over 100 years.
Customer objectives	Aim was to optimize processes and connected costs that arise due to: • Process force- and tool monitoring through expensive measuring system and complex measuring chain • High wear of the sensor technology due to the machining process and resulting follow-up costs
Siemens solution	Analyze MyWorkpiece /Capture4Analysis enables borehole monitoring with high frequency data. Meaning torque data is automatically recorded during drilling processes by the Industrial Edge for Machine Tools.
Customer value	High conformity of measurement results from Industrial Edge to measurement system in recording individual drilling processes and resulting trend analyses
Why Siemens?	Due to the connectivity options with third party applications, Siemens' Industrial Edge for Machine Tools with Analyze MyWorkpiece /Capture4Analysis enables costumer-specific use to get the best out of the valuable data collected.

 Unrestricted | © Siemens 2023 | Siemens Digital Industries

Availability Scalability



https://siemens.mindsphere.io/en/solutions/customer-success-story/schmalz

SCHMALZ

Less maintenance costs ↘

Increased Availability ↗

J. Schmalz GmbH

Predictive Maintenance application for suction gripper (OEM)

Customer challenge

- Suction gripper wearing causes energy wasting and in worst case machine defects and availability losses
- Predict next service interval in order to optimize machine
- Need for a scalable infrastructure to integrate existing software

Solution

- PLC data from machine gets evaluated by Schmalz on an Industrial Edge device with the SICON Edge app
- Due to Edge-infrastructure there is no longer need for time-intensive connectivity programming or security hardening, plus devices and software can be scaled globally.
- Machine users can visualize data both on-prem and over Cloud

Customer benefit

- Avoidance of unplanned downtimes for machine customers
- Reduced energy consumption for machine customers
- Optimized service planning and remote service offerings

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

Industrial Edge Resource

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS

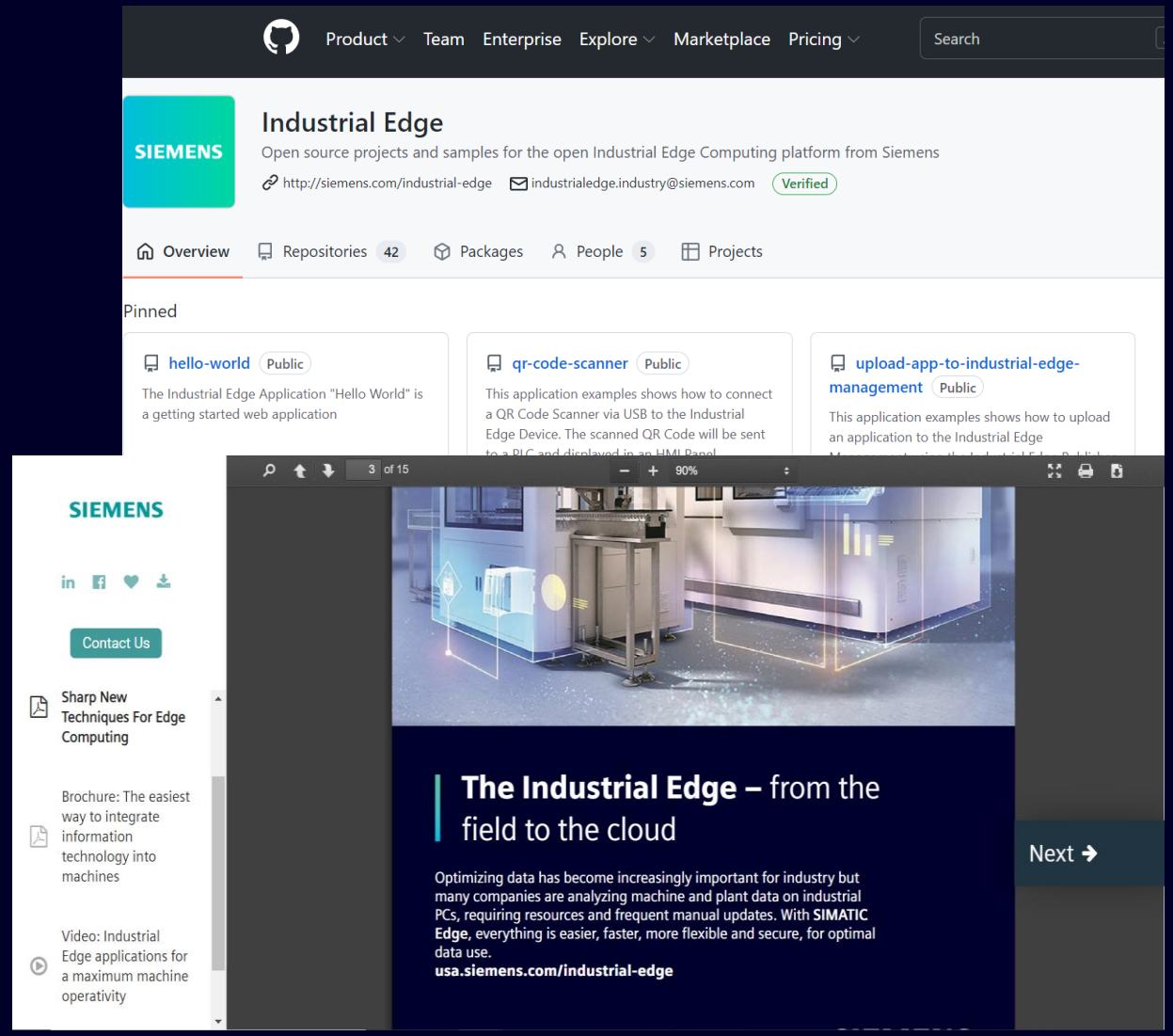
Siemens Industrial Edge
Helpful Links

Industrial Edge Forum:
https://www.siemens.com/industrial-edge-forum

How Tos:
https://github.com/industrial-edge

PathFactory:
https://resources.dc.siemens.com/industrial-edge-2/edge-video

Industrial Edge Marketplace:



Unrestricted | © Siemens 2023 | Siemens Digital Industries
SIEMENS

Contact

Gus Gremillion
Solutions Consultant – Machine Tool Digitalization
Siemens Industry Software Inc.
+1 (470) 216-3572
august.gremillion@siemens.com

Chris Liu
Industrial Edge Product Marketing Manager
Siemens Industry Inc.
chris.liu@siemens.com

Unrestricted | © Siemens 2023 | Siemens Digital Industries

SIEMENS