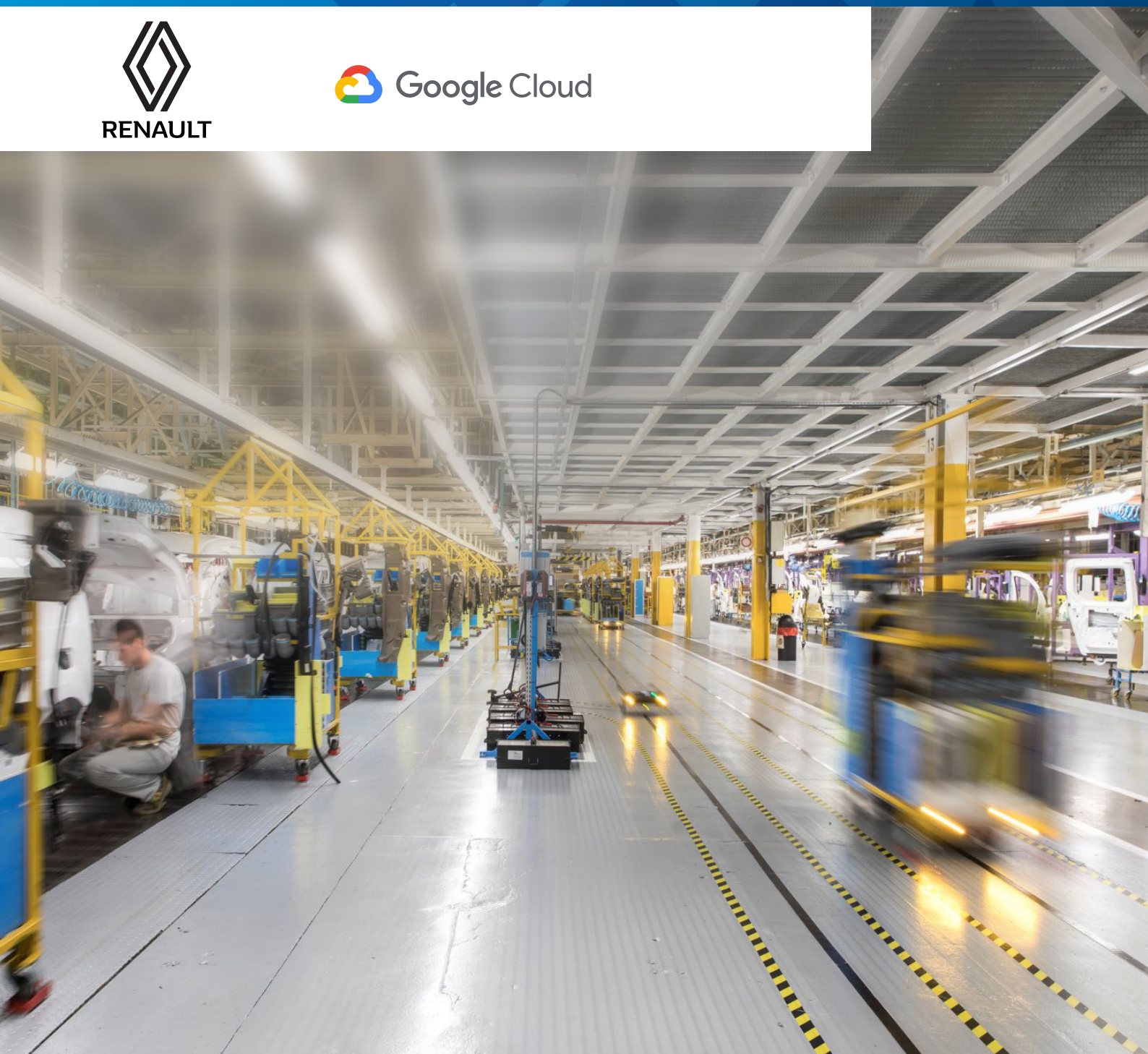
SUCCESS STORY

DIGITAL TRANSFORMATION AT GROUPE RENAULT



DIGITAL TRANSFORMATION AT GROUPE RENAULT

Groupe Renault's plan is to implement the use of OPC UA-enabled devices and equipment at all production sites worldwide, and to implement end-to-end data communication from the sensor to the machines to the cloud and back again using the OPC UA communication standard. Today, OPC UA is already being used in 17 of the 38 production sites with a total of 3,300 OPC UA-enabled devices.

The start of digital transformation at Groupe Renault began as early as 2016 at the Valladolid plant in Spain. Numerous digital pilot projects of an initiatory nature were launched there for the automobile production of the French automotive group. Other production sites in Turkey and Romania also began focusing on digital projects at almost the same time. In 2017, Renault had already recognized that the OPC UA communication standard offered the necessary prerequisite for the efficient networking of data from a wide range of different machines and operating systems. The integration of OPC UA-capable components and systems has been actively pushed forward ever since.

GROUPE RENAULT
ON THE PATH TOWARDS A SMART FACTORY

OBJECTIVES ON THE PATH TO DIGITALIZATION

A group of OT, IT, equipment and software experts defined five concrete objectives for the digital transformation of automotive production for the entire Groupe Renault in 2017. These objectives included a connected workforce, real-time data-driven operations, Process 4.0, flexible supply chains and systems, and the complete traceability of components. Turning the vision of intelligent automotive production into reality was the ambitious future scenario. M2M communication, cloud applications, Big Data, and machine learning were as much a part of the vision as AI and digital twins.

HURDLES ON THE PATH TO DIGITALIZATION

Highly specialized production systems are used in the automotive industry. Groupe Renault uses different assembly systems, maintenance systems, test systems, automatic welding machines, and industrial robots, each of which has specific operating systems. Some sys - tems have been in use as leg - acy systems since the 1980s. A major challenge at the start of the digitalization initiative in 2016 and 2017 was, therefore, the lack of interoperability between systems. Networking the established plants with different operating systems could not be implemented easily. Furthermore, interoperable interfaces had to be integrated and a uniform data structure and communication protocols had to be developed so that production could access standardized data. At the beginning, the vision of the smart factory and profitability was primarily characterized by the search for the appropriate IT architecture. Groupe Renault decided to build the digitalization of production on the foundation of OPC UA technology and the OPC UA-based Companion Specifications. In addition to this, Groupe Renault has also developed its own data model for various different processes.

The control, optimization and profitability of multi-site manufacturing, based on secure real-time data, represents the future of automotive production.

GLOBAL COMMUNICATION STANDARD **FOR THE AUTOMOTIVE INDUSTRY**

WHAT ARE THE CAPABILITIES OF OPC UA?
The letters OPC UA stand for Open Platform Communications Unified Architecture (IEC62541). It refers to an IT architecture that can be integrated on different operating systems. Data is provided by OPC UA servers. The OPC UA client or subscriber can access this data. A system can be both the server and the client at the same time.

WHAT MAKES OPC UA SO EFFICIENT?
The architecture is platform and manufacturer independent. OPC UA is the uniform, global standard for bidirectional information exchange. This standard enables the transmission of machine data and the semantic description of the data.

WHAT IS INCLUDED IN THE OPC UA TOOLBOX?
Simple interfaces, uniform message formats, flexible expansion options, and the implementation of high security standards. OPC UA, thereby, offers an adaptable architecture that can be flexibly and quickly adjusted to innovations in industrial automation. From the sensor to the cloud and back, in real time, is OPC UA's recipe for success.

The advantages of a uniform data model are of significant benefit across manufacturers in the entire automotive and supplier industry.

GOOGLE CLOUD **PLATFORM**

ADAPTORS PAVE THE WAY
To ensure a uniform data structure, gateways or adaptors for the machine data are used for the existing machines. The OPC UA sensor data (Publication Topics) and sensor configuration (Command Topics) are distributed via MQTT. This enables both the transmission of monitoring sensor data to the cloud, but also the controlling of machines with sensor data from the cloud. Groupe Renault uses Google Cloud Platform for data collection.

RENAULT MAKES ITS DECISION
These advantages were the deciding factor for Groupe Renault's group of experts to integrate OPC UA as a communication standard across plants. For Groupe Renault, the OPC UA interface provides uniform access to data from divergent control types. OPC UA generates data security in communication, fast data processing, reliable and contextually accurate delivery of data, a uniform data structure specification, and high scalability. At the beginning, the decision to integrate OPC UA as a communication standard was primarily motivated by the manufacturer-independent data exchange. Today, OPC UA is one of the most important building blocks for the vision of the smart factory.

OPC UA IN PRACTICE **AT GROUPE RENAULT**

The advantages of a uniform data model are of significant benefit across manufacturers in the entire automotive and supplier industry.

INDUSTRIAL DATA MANAGEMENT 4.0

Groupe Renault uses the data structure descriptions (OPC UA Companion Specifications) developed by the OPC Foundation with its partners, in addition to its own data models. Own extensions for the machine level (Unified Data Collector) and the aggregator level (Data Flow Aggregator) are defined by Renault itself. As an example, the extensions affect the device identification and the location of the devices. The 'Industrial Data Management 4.0' (IDM 4.0) platform, which has been in place since 2019, enables data to be collected from a wide variety of sources. The data is contextualized, structured and aggregated, and made available as Big Data for control and analysis purposes. In mid-2020, the Renault-Google Cloud Partnership started with the transfer of Groupe Renault OPC UA data models to Google Cloud's BigQuery. Based on the OPC UA infrastructure, Groupe Renault is able to effectively monitor and control all 17 sites, factory processes, and machines worldwide – all in real-time.

HOW ARE LEGACY SYSTEMS CONNECTED?

The integration of data and protocols from different production components and legacy systems is a necessary step towards automation and digitalization. Without this step, it is virtually impossible to increase productivity. Groupe Renault solved this problem by equipping legacy components and systems with adapters, thus enabling controls, data formats and protocols from different manufacturers to achieve OPC UA capability. With partners, Renault developed an IoT Box in which the specific data protocols of each component are transformed to the OPC UA standard. Regardless of the platforms, production can now access standardized device information.

CONNECTION OF NEW COMPONENTS, TOOLS, OR SYSTEMS

New components or systems that are integrated into production are already equipped with an OPC UA interface as standard. The connection of the new devices to the existing OPC UA infrastructure is, therefore, possible, without any hurdles. Groupe Renault also encourages suppliers to deliver equipment and components with OPC UA interfaces in order to continuously increase the number of components with OPC UA interfaces.

Conclusion: The data of all OPC UA-capable devices are sent to OPC UA servers in a uniform data format. Vision: In the future, digital twins are to be created from Big Data in order to optimally control all factory processes.

DOMINIK WEE,
Managing Director Manufacturing,
Industrial and Transportation, Google Cloud

"We're honored to support the OPC Foundation and our membership underscores Google Cloud's commitment to openness and industry collaboration. OPC UA will be our way of incorporating machine data into our data analytics and AI capabilities, to ultimately drive new capability and performance within the factory. By driving AI across the value chain, our goal is to provide flexibility and choice at industrial scale."

INTELLIGENT TOOLS

Groupe Renault has set itself the goal of reducing the failure-rate of all components to 0.5 percent of operating time. According to Renault, significant savings were achieved in six out of ten workshops where devices with OPC UA interfaces were deployed.

ELECTRIC SCREWDRIVERS

Groupe Renault uses servo-controlled electric screwdrivers in automated or manual production, which use different protocols and generate data (such as process code, job number, and energy consumption) depending on the manufacturer. Renault has defined the first data model for tightening controllers. Groupe Renault's IOT Box is used to transform the specific protocol to OPC UA. Three different tightening controller brands are currently connected and Renault is preparing to add another two to the list. Over 500 tightening controllers are connected at present. The new data protocols include information such as motor number, screwdriver type, torque, and values used when tightening screws. Since 2019, Renault suppliers have also committed to producing OPC UA-enabled electric screwdrivers.

BATTERIES

In 2018, 80,000 measuring points for determining bat - tery power were equipped with adapters and, thus, became OPC UA-capable. Result: Battery charge states of all vehicles are transmitted in real time with OPC UA.

WELDING ROBOTS

Components such as CNCs, PLCs, welding processes, robots and other industrial components become OPC UAenabled through adapters. This applies to data types such as Boolean values, time stamps, analog values, and image and table data. OPC UA is particularly advantageous for the automated welding of components, since an exact current and voltage supply must be guaranteed. If the voltage and temperature are too low, a so-called "sticky point" occurs, which has a negative impact on the quality of the welded components. With the help of the data collected from the 2,200 connected robots in the body shop, Renault is able to efficiently monitor welding processes, detect irregularities in real time, and intervene or perform predictive maintenance on the components. Failure rates in welding processes have decreased by 20 percent.

OPC UA on its path to becoming international industry network standard for automotive manufacturers and their suppliers.

EXPANSION **OF OPC UA DEPLOYMENT**

Groupe Renault is steadily expanding its use of OPC UA. In machine-to-machine (M2M) communication and human-machine interfaces (HMIs), OPC UA has achieved “highly promising results with low implementation effort,” according to Groupe Renault. New process, manufacturing, and quality data will be made accessible using OPC UA-enabled devices. Groupe Renault is gaining access to an increasing amount of data as its OPC UA deployment expands. As of Q1 2021, more than 1 billion messages per day are being transferred to the Google Cloud, according to Groupe Renault. The amount of industry data available is expected to increase tenfold by the end of 2023.

OPC UA **FOR CAR MANUFACTURERS**

OPC UA AS AN INTERNATIONAL STANDARD FOR THE AUTOMOTIVE INDUSTRY

Groupe Renault is continuing to drive the integration of OPC UA interfaces in automotive manufacturing. In 2019, the “Connected Plant” project introduced the use of OPC UA in machining equipment, lathes, and milling machines, among others. An increasing number of suppliers are integrating OPC UA interfaces into equipment and on-board software. Groupe Renault’s vision: An international, industrial communication standard based on OPC UA for car manufacturers and their suppliers, with uniform data models.