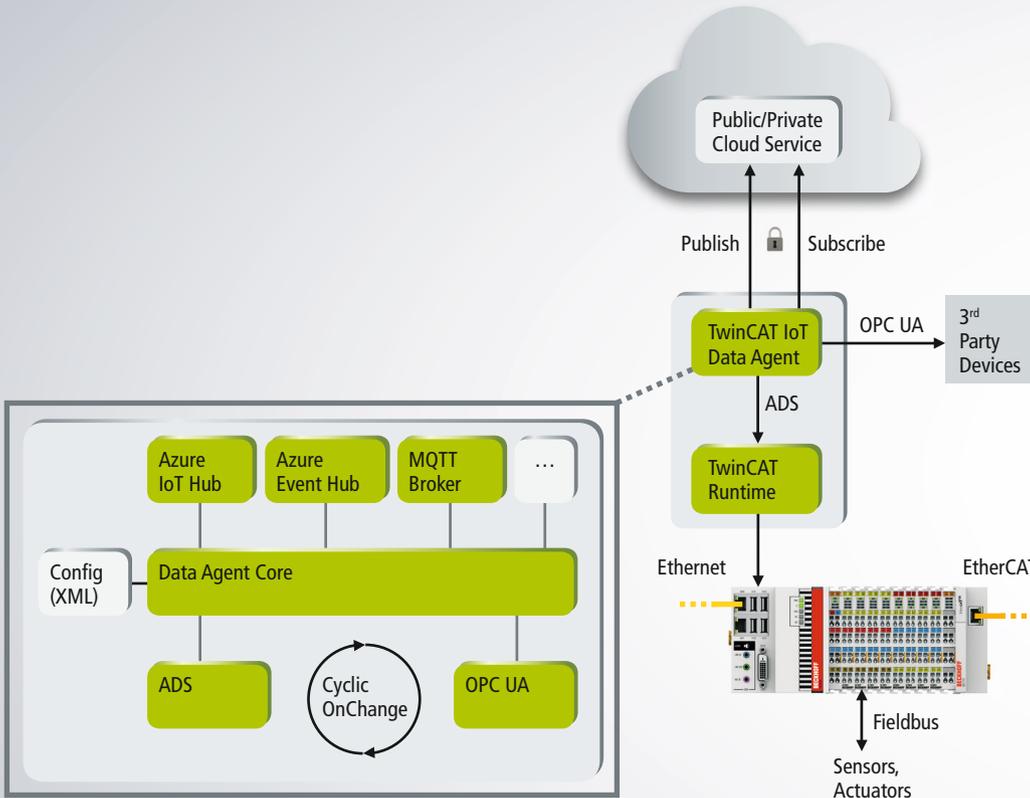




Commercial Building insights through
Azure IoT Suite and Beckhoff standard devices

Grundfos living lab

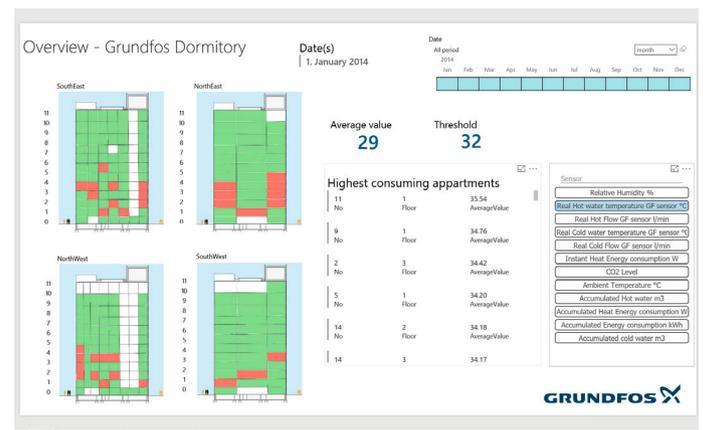
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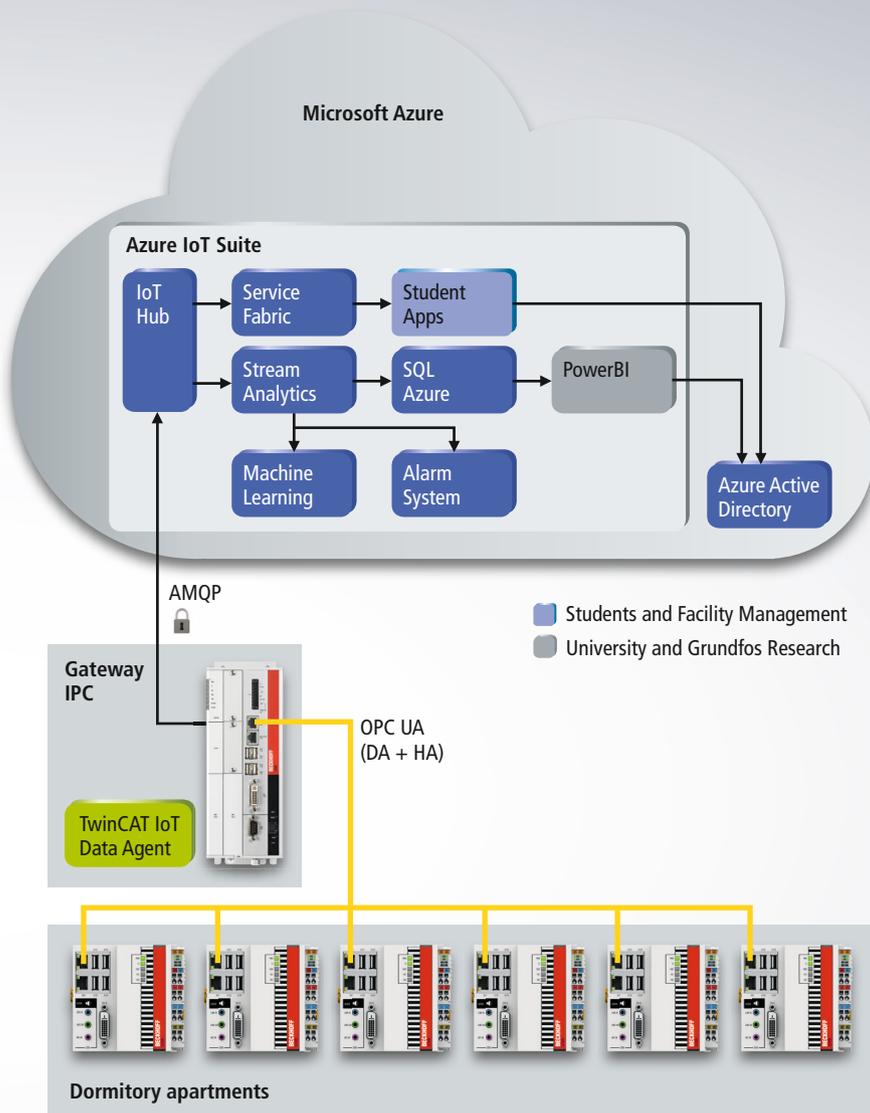


In an energy measurement and smart metering scenario, Grundfos, Beckhoff and Microsoft equipped a dormitory building in Århus with intelligent PLC devices that connect to the Microsoft Azure cloud in order to use a scalable and powerful platform for data storage, analysis and alarm handling. The building consists of 11 floors with a total of 156 apartments and 3000 sensors that collect energy data every 5 seconds. The energy data constitutes the living lab, that benefits the students in the building, the facility management and Grundfos Research and Technology. Through different research studies that involve the buildings residents and facility management, Grundfos tries to gain new insight in the different application scenarios for existing Grundfos products, but is also looking for new business models and product offerings depending on the usage of their products. The University of Århus is involved in the studies and conducting research in the area of behavior related energy consumption.

that acts as a gateway to the Microsoft Azure Cloud. The communication to each PLC Controller is performed via OPC UA. Communication from the Gateway PC to the Microsoft IoT Hub is handled by the Beckhoff standard product TwinCAT IoT Data Agent, which provides a very good de-coupling of the PLC device and the Cloud environment and is set-up via an easy-to-use configurator.

Grundfos has been working together with Beckhoff and Microsoft on establishing a solid platform that is able to handle the amount of data and provide deeper insight on the sampled data for the stakeholders and end users of this project. Sensors are wired up to Beckhoff BC9191 Bus Coupler and CX9000 Embedded PLC Controllers and locally brokered via an Beckhoff Industrial PC





Morten Lykkegaard, Lead Enterprise Architect: "Grundfos has benefited from the use of standards like OPC UA, Beckhoff ADS and AMQP for an easy, fast and reliable deployment of all devices and services involved in this project."

The local buffering of data that has been gathered from the sensor in the event of connectivity failures is secured via standardized OPC UA mechanisms like Historical Access and managed by the TwinCAT IoT Data Agent. If the connections drops, the TwinCAT IoT Data Agent will store a timestamp and, as soon as the connection is up again, the Data Agent will query the underlying OPC UA Server via Historical Access for the remaining data and send it to the Azure IoT Hub. Further insight to the measured energy data is provided via the Microsoft IoT Suite which manages the devices and collects the raw data that can be refined via SQL Azure Data Warehouse and PowerBI. Anomaly detections are performed via Azure Stream Analytics and Azure Machine Learning. Special algorithms in these services detect if incoming values from the sensors are outside of their regular value range or not received at all for more than a specified amount of time. In case such an anomaly has been detected, alarms are sent out via E-Mail. Student are provided an API to allow access to the sampled data in the Cloud in order to give them the ability for own App developments. The API and historian concept have been built on top of Azure Service Fabric. Data security and privacy are maintained via Azure Active Directory and Azure Application Insights.

The above solutions are a replacement of an existing simple data management system that was based on an on-premise, non-standard local device infrastructure. The system was struggling with handling the amount of data, maintenance costs were high and visualization of the sampled energy data was almost impossible.



Further information:

www.grundfos.com

www.grundfoskollegiet.dk/en/about-the-dormitory/about-the-dormitory

www.microsoft.com/azure

www.beckhoff.com/twincat-iot/