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Cloud vs. Edge Computing – Why a hybrid version will do its best for your Predictive Maintenance Solution

To build a global industrial IoT solution, the considerations of system architecture must choose between a centralized and a distributed data processing allocation. That is to choose between cloud and edge computing. On an earlier article, we have presented the main challenges when building a global industrial IoT solution and highlighted the benefits of cloud and edge resources. In this article we focus on the considerations of how to balance the combination of two key components: cloud and edge computing.

The cloud – always available but only with available connectivity

The cloud is always available so why not have everything on the cloud? The nature of a global IoT solution involves by nature multiple locations. And in the case of industrial sites, many of those locations are remote with limited network connectivity. In such a scenario the advantages of edge devices are intrinsic: close distance to machine and to sensor or signal source. Furthermore, thanks to an edge device it will be possible to process data for initial decision making with low latency, also reducing the required bandwidth for data transfer to other locations (i.e., cloud). Finally, network availability may change over time, sometimes during the day, therefore, for any time-critical processing (decisions) the faster response offered by edge solutions will be preferred.

The difference between cloud and edge computing

Characteristic	Edge Computing	Cloud Computing
Data processing	Fast / Real-time	Non-time-sensitive
Internet connectivity	limited or unavailable (remote locations)	Reliable and available
Workload & datasets	Large datasets (too costly to send to the cloud)	Dynamic workloads
Data sensitivity	Highly sensitive data and strict data laws	Data in cloud storage possible

Edge devices – growing computing capacity but with limited resources

Edge devices are growing in capacity so why use cloud at all? Edge devices are growing in computing power and can address a good deal of signal processing, basic analytics and nowadays also machine learning. However, the resources available on the edge will always be limited and comparably difficult to change or extend. Especially remote hardware changes may result cumbersome, even more when compared to the resources available on a cloud platform.

Cloud? Edge? Go for hybrid!

Beyond more resources and capabilities, the cloud will be able to provide powerful functionalities such as advanced analytics, training of learning models, long-time data storage, easy access to users in many locations, collection of very large data sets. Particularly, if the cloud resources are used wisely, it will be possible to generate machine learnings applicable across the “community of connected machines”. And this is yet another level of IoT development not possible with isolated edge devices across the globe.

However, this is not all. To reduce and optimize the cost (to implement, to operate and to expand), a good balance between the use of cloud and edge computing resources is required. For this reason, a hybrid solution must provide flexibility to scale, facilitate upgrades, and support functionality extensions. Other decisions also require attention, e.g. what data is important on which location? Or what data is required to generate insights vs what data will be needed to train new ML models?

Why is this relevant to Predictive Maintenance?

A global industrial IoT solution to address predictive maintenance will be best served if a hybrid architecture is used, that is combining the strengths of cloud and edge computing. This will provide several benefits, enabling fast development, reducing the cost, facilitating support. However, to **highlight is the flexibility** that can be obtained. Flexibility to improve over time and adjust the software solution will be key to cope with prediction improvements required in the algorithms following new insights. This is an essential feature to learn from multiple applications as machines and components are exposed to multiple different conditions. This flexibility needs to be provided on both levels, cloud, and edge computing.

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