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Taking Advantage of the Digital Data Center Infrastructure

The Internet of Things, Big Data, cloud computing, 5G networks and artificial intelligence are all helping to make data centers one of the fastest growing markets in the world.

The emergence of 5G networks, for example, is setting new requirements for the data center industry: to support the required speed of 5G networks, data centers must be placed at the edge of the network, close to end users. Even so, data centers still need to have enough space to store and process the large amounts of data users consume and create, while being compact enough to fit into smart cities of tomorrow. All these trends are driving demand for modular, edge-connected data centers with the infrastructure to satisfy very strict and challenging requirements.

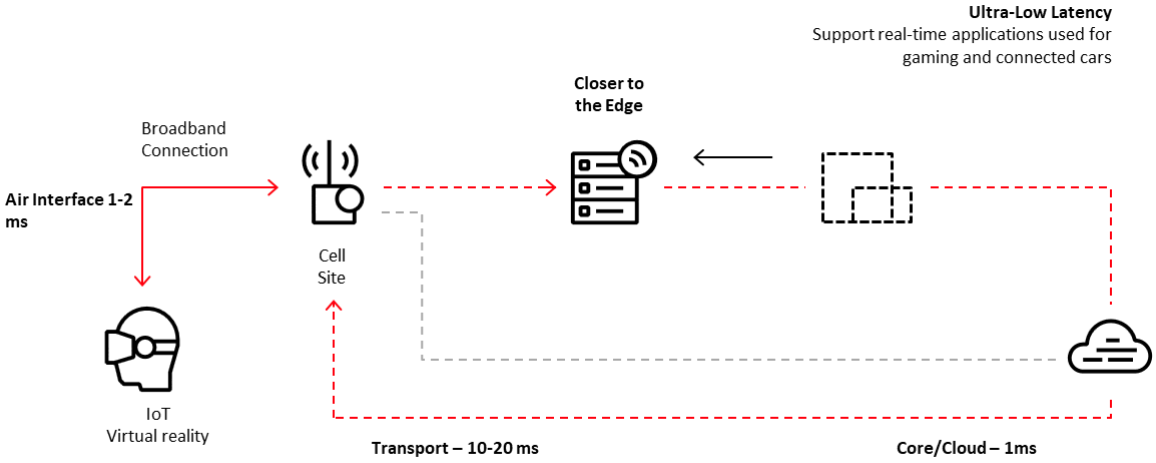

Figure 1: 5G wireless networks can achieve latency of 2-3 milliseconds before transport. Decreasing transport latency requires moving the core compute and cloud interface closer to the customer.[1]

Digitalizing the data center infrastructure represents a key solution to building scalable, compact and energy efficient data centers of tomorrow. But what is a digital data center infrastructure? And, how can you take steps towards a more holistic, highly efficient data center?

A smart, digital infrastructure will include devices such as intelligent circuit-breakers inside the data center powertrain, meaning that the devices can communicate between each other and exchange information. The next step is to collect and visualize the information coming from the devices through a real time monitoring solution. Yet, the real

power of the digital era comes from aggregating the data and turn this data into actionable insights and information to improve business operations and efficiencies. A digital system can holistically review and capture data from IT, power, cooling and building systems, eliminating the need for manual data entry when calculating utilization metrics and other KPIs.

And, in some instance, digitalization is also leading to the creation of new business models, where key decisions are taken thanks to precise and accurate information coming from digital technologies.

Figure 2. What is digitalization?

Digitalization on products

Decentralized Parallel Architecture, DPA™ technology provides redundancy for the critical components avoiding single point of failures and maximizes the system resiliency when the UPS is equipped with N+1 configuration. The control and monitoring of the UPS modules and paralleled UPS frames are implemented by using redundant ring bus communication. In case a UPS frame is physically disconnected from the overall power system, then the redundant communication allows continuous monitoring. Therefore, the **continuity of service** is guaranteed without any interruption. This technology is available in the new MegaFlex UPS range, for large colocation and cloud data centers, or DPA 250 S4 for mid-power applications.

Figure 3. New ABB MegaFlex UPS

Sustainable operation with reduced energy consumptions and costs should be ensured with the varying of the IT load. Digital infrastructure should be agile and adapt the power

consumption to the power demand. ABB modular UPS can provide the demand power without compromising the efficiency. Higher than 97% efficiency for low IT load demand is guaranteed with ABB Xtra VFI mode

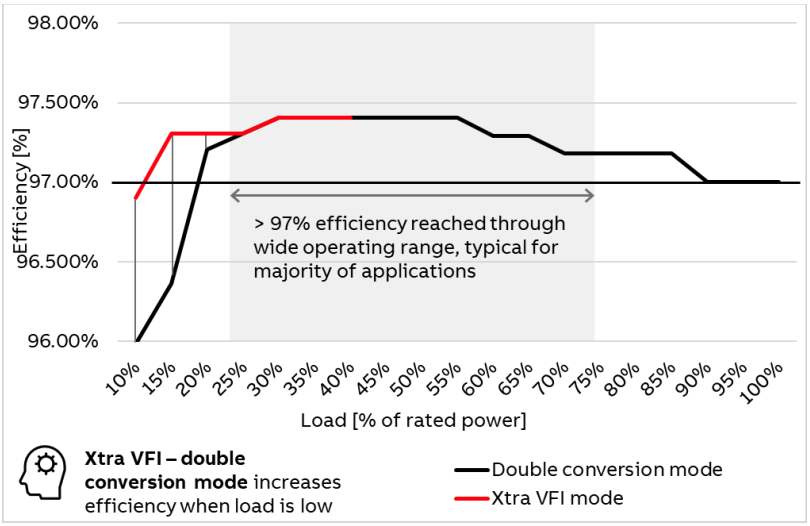

Figure 4. UPS energy efficiency curve in double conversion and Xtra VFI mode

The same feature guarantees **upgradeability and safe maintenance** without any power distribution interruption, since all UPS modules are hot swappable. Finally, the compact module design provides **space savings** and ensures maximized UPS frame power capacity, including the power redundancy N+1.

By using the example of the UPS, as one of the most important and critical component within electrical distribution of a data center, it is clear how digitalization can address the four key major challenges of any next generation data center, including continuity of service, energy efficiency, space saving and scalability.

Figure 5. UPS DPA™ modularity

The same consideration can be applied for other products within the electrical distribution powertrain from circuit-breakers to transformers, where digital features inside the products maximize their value for data center use.

Digitalization on the Powertrain

The real power of digitalization comes when we connect different distribution components into a system to guarantee that every component works in synergy and that the system performance and energy efficiencies can be analyzed.

Data centers usually require very detailed information on energy distribution, with a very high level of accuracy. This is also defined in “The Green Grid Association and ASHRAE, 2014”, where also the well-known metric PUE (Power Usage Effectiveness) is defined.[2]

Three levels of the PUE measurement

Measurement		Total facility energy	IT equipment energy	Measurement interval
Level 1 (L1) Basic	Required	Utility input	UPS output	Monthly
	Recommended	Utility input	UPS output	Weekly
Level 2 (L2) Intermediate	Required	Utility input	PDU outputs	Daily
	Recommended	Utility input UPS input / output Mechanical inputs	PDU outputs	Hourly
Level 3 (L3) Advanced	Required	Utility input	IT equipment input	15 minutes
	Recommended	PDU outputs	input	15 minutes or less

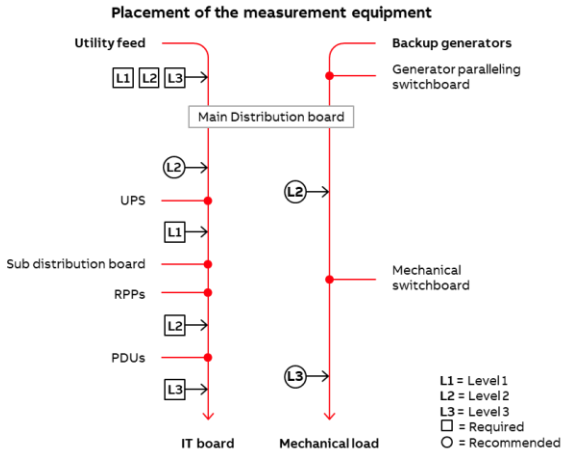

Figure 6. Three levels of PUE measurements and placement of the measurement equipment[2]

Additionally, EN50600-2-2:2014 Standard “Information technology — Data centre facilities and infrastructures — Part 2-2: Power distribution, EN 50600-2-2 Standard, 2014” requires monitoring of energy and power with Class 1 accuracy and monitoring of Total Harmonic Distortion (THD) of voltage and current.

Thanks to ABB’s latest innovations in digitalization, it is very easy to optimize energy distribution. For example, just by using low voltage protection devices it is possible to monitor all mentioned electrical parameters, with required accuracy, in one holistic view, without any additional metering device. The measured information can be easily transferred to any local monitoring system using any of the several most common industrial communication protocols, such as IEC 61850, embedded inside the devices (starting from nominal rating of 160A up to 6300A). Thanks to that, it is possible to monitor and optimize all measured parameters to maximize efficiency and reliability. Furthermore, in the event of an electrical distribution fault, the affected area can be isolated by digitally identifying the faulty area and redirecting power through unaffected MV and LV devices, using only IEC 61850 communications.

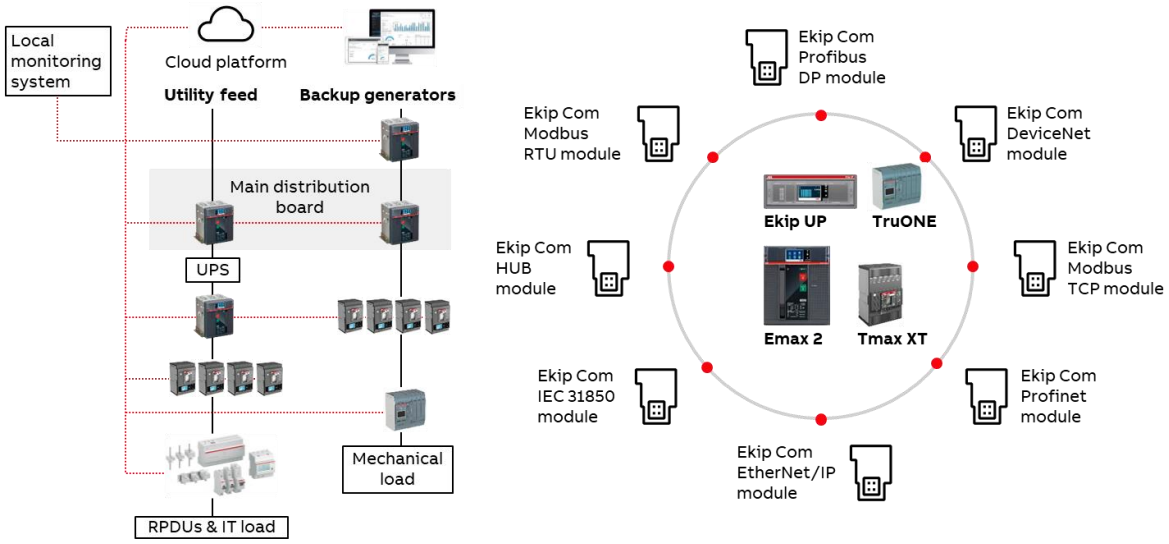

Figure 7. Simple and flexible solution for complete monitoring of a low voltage distribution in a data center

Digital System Monitoring

The next step in your digital transformation journey is to ensure visibility across your data center through a digital data center monitoring system, which is usually customized to the project needs.

To satisfy needs of smaller and more standardized data centers, ABB has developed a solution: ABB Ability™ Electrical Distribution Control System (EDCS) for Data Centers, a cloud-based monitoring solution which is fully tailored to the site.

Such monitoring systems will become a critical point with the advent of 5G, which will see more mid to small size compact data centers closer to the end user for faster downloads and to meet storage requirements. This will likely result in more data centers being placed inside crowded cities and it will be almost impossible to have the same physical infrastructure at each data center. Monitoring solutions, such as ABB Ability™ EDCS, offer remote access through cloud connectivity and provide a single platform with a unified, holistic view regardless of physical location, whether it's from multiple data center sites and from any mobile device.

Having a clear insight into the electrical distribution and energy consumption of each data center enables operators and data center owners to analyze where the energy is going and to act based on facts. This is the simplest way to improve **energy efficiency** of a data center and decrease PUE.

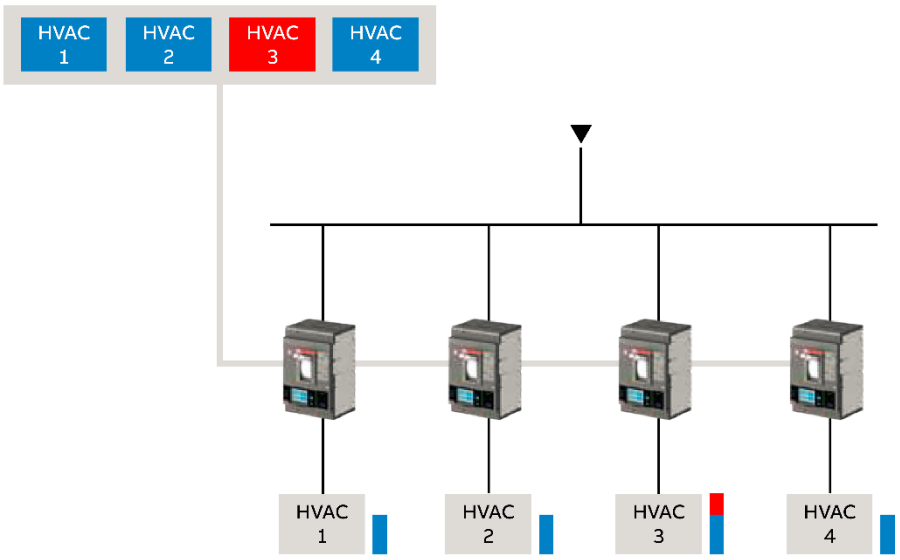

Figure 8. Simple solution for detailed monitoring of a data center cooling system

Digitalization and Continuity

Having the real time monitoring of the installation with the possibility to immediately receive alerts and alarms (via SMS, email or other notifications) in case of a failure across any part of the equipment, maximizes data center reliability and guarantees **continuity of service.**

The real power of digitalization comes when we can collect all the data coming from devices and apply analytic algorithms to transfer the data into useful information.

One example of true powers of digitalization is Predictive Maintenance which is available with ABB low voltage devices and ABB Ability™ EDCS cloud monitoring system. For example, Emax 2 air circuit-breaker is producing a lot of data: the number of operations, trips for overload (L - ANSI 49), short circuits (S - ANSI 51 & 50TD, I – ANSI 50), earth faults (G - ANSI 51N & 50NTD), possible errors or trip unit malfunctions and all the environmental factors (temperature, humidity, corrosion, dust level and vibrations). Now, all this information is sent to the cloud where ABB Ability™ EDCS analyzes all the information coming from low voltage devices and provides a very simple and user-friendly reports, detailing:

1. What is the health condition of the device?
2. What is the health condition of the plant?
3. When is the next maintenance needed?

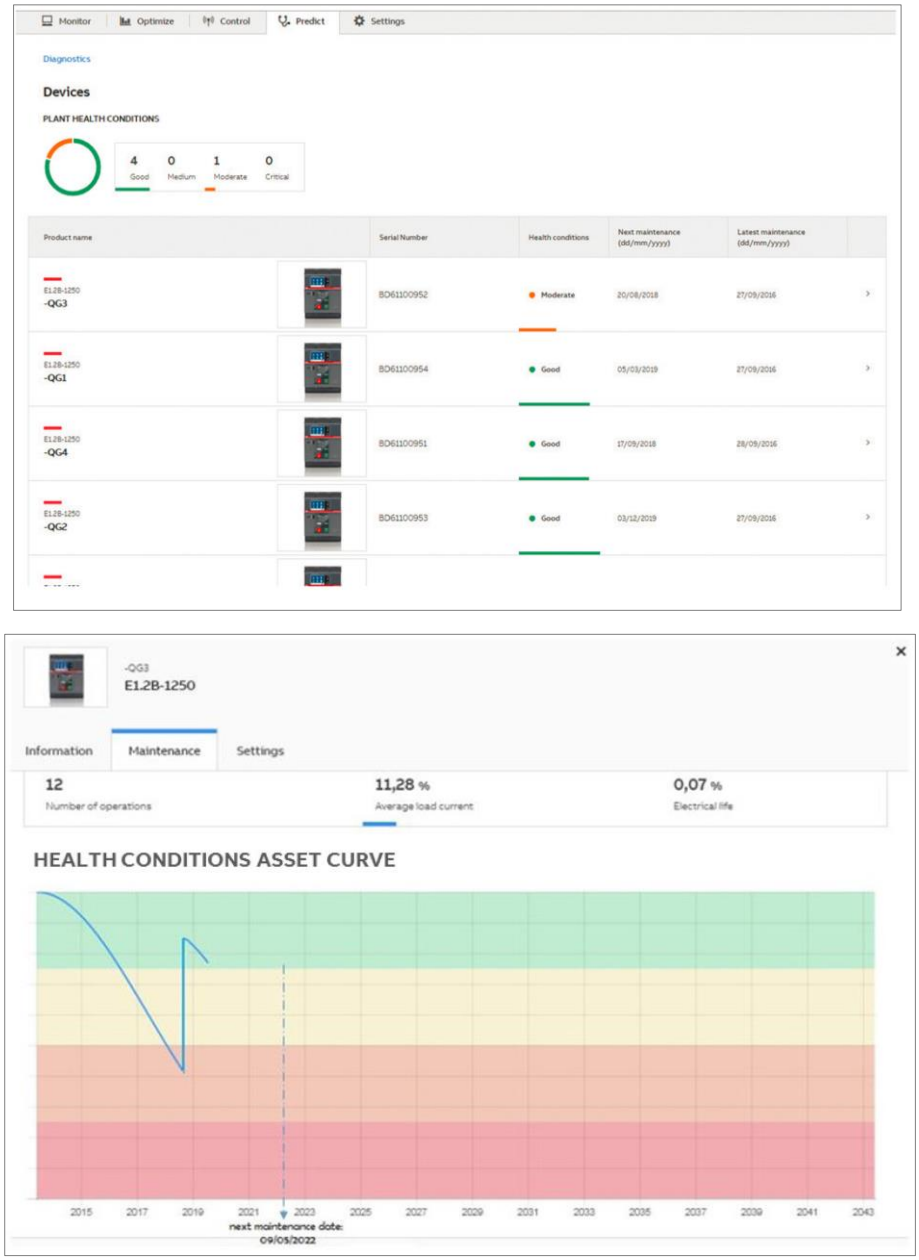

Figure 9. Cloud based predictive maintenance

Shaping the future

Up to now we have analyzed how digitalization can help to improve performance of individual products and infrastructures. However, the future of digitalization comes when we enable communication and information exchange between different data center infrastructures, leveraging the on-cloud connectivity.

It is likely this will happen soon since we are already storing data across different data centers, sharing and exchanging data which has seen new IT technologies and phenomenon such as big data, machine learning and data analytics emerge, creating truly flexible digital ecosystems.

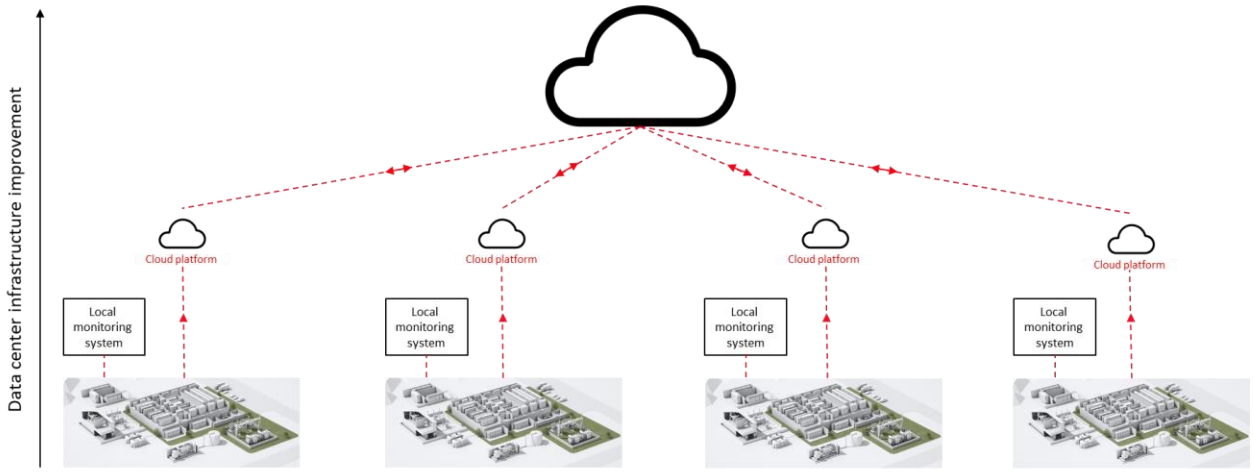

Figure 10. Future of digital data center infrastructure

Emerging technologies like autonomous vehicles, “massive” 5G and smart cities will drive the need for colocation at the “edge” and for near real time performance and further efficiency. Digitalization plays a pivotal role in assuring business continuity, scalability and energy efficiency in data centers and make every watt count.

References:

1. The Edge is already happening inside ‘traditional’ data centres in secondary markets. Data | Economy. (2019, May 6). Retrieved March 10, 2020, from https://data-economy.com/the-edge-is-already-happening-inside-traditional-data-centres-in-secondary-markets/
2. The Green Grid Association and ASHRAE, PUE: A Comprehensive Examination of the Metric, Atlanta, GA: ASHRAE Datacom Series, Book 11, 2014.