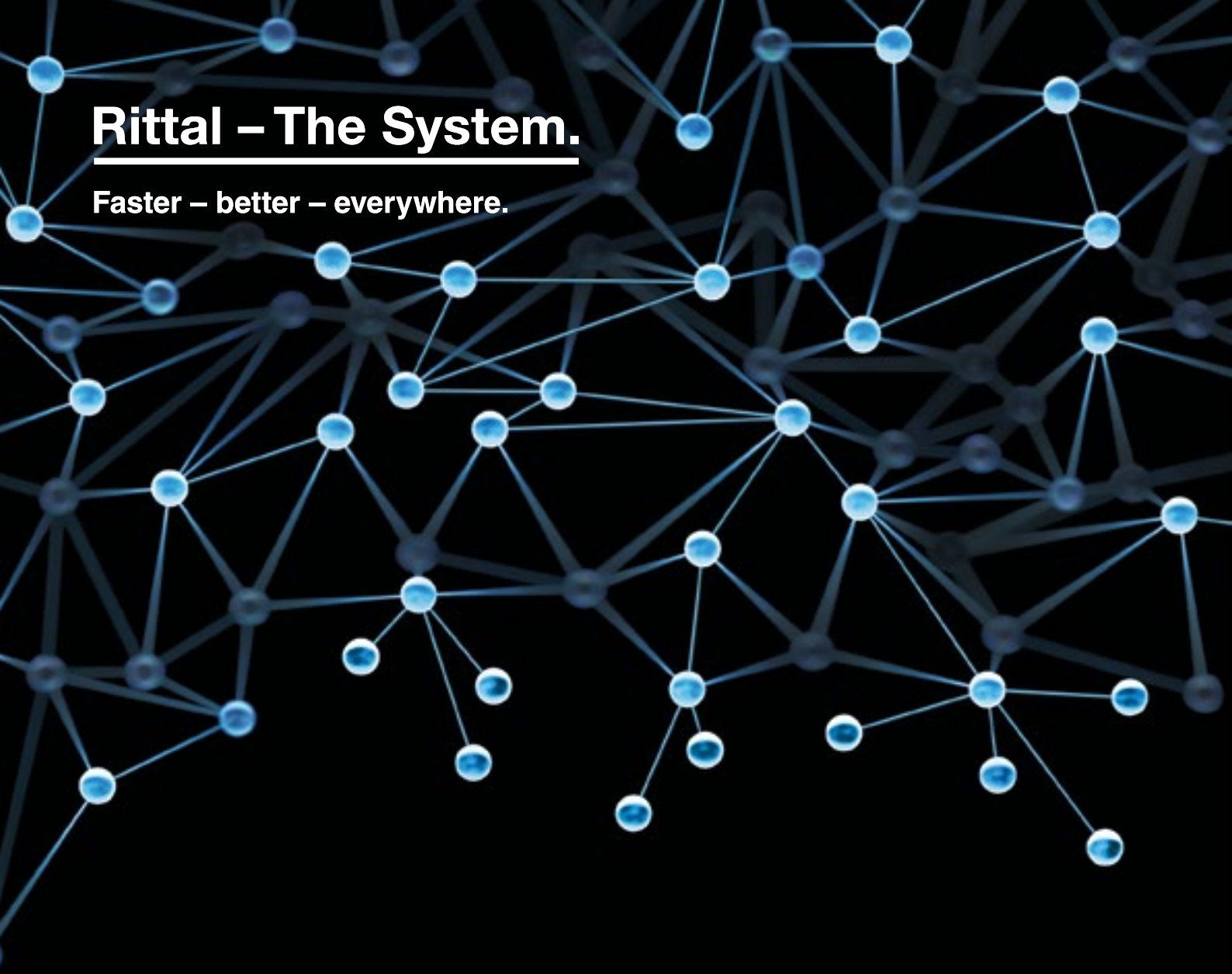


Rittal – The System.

Faster – better – everywhere.

Discover the Edge.

ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL | IT INFRASTRUCTURE | SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

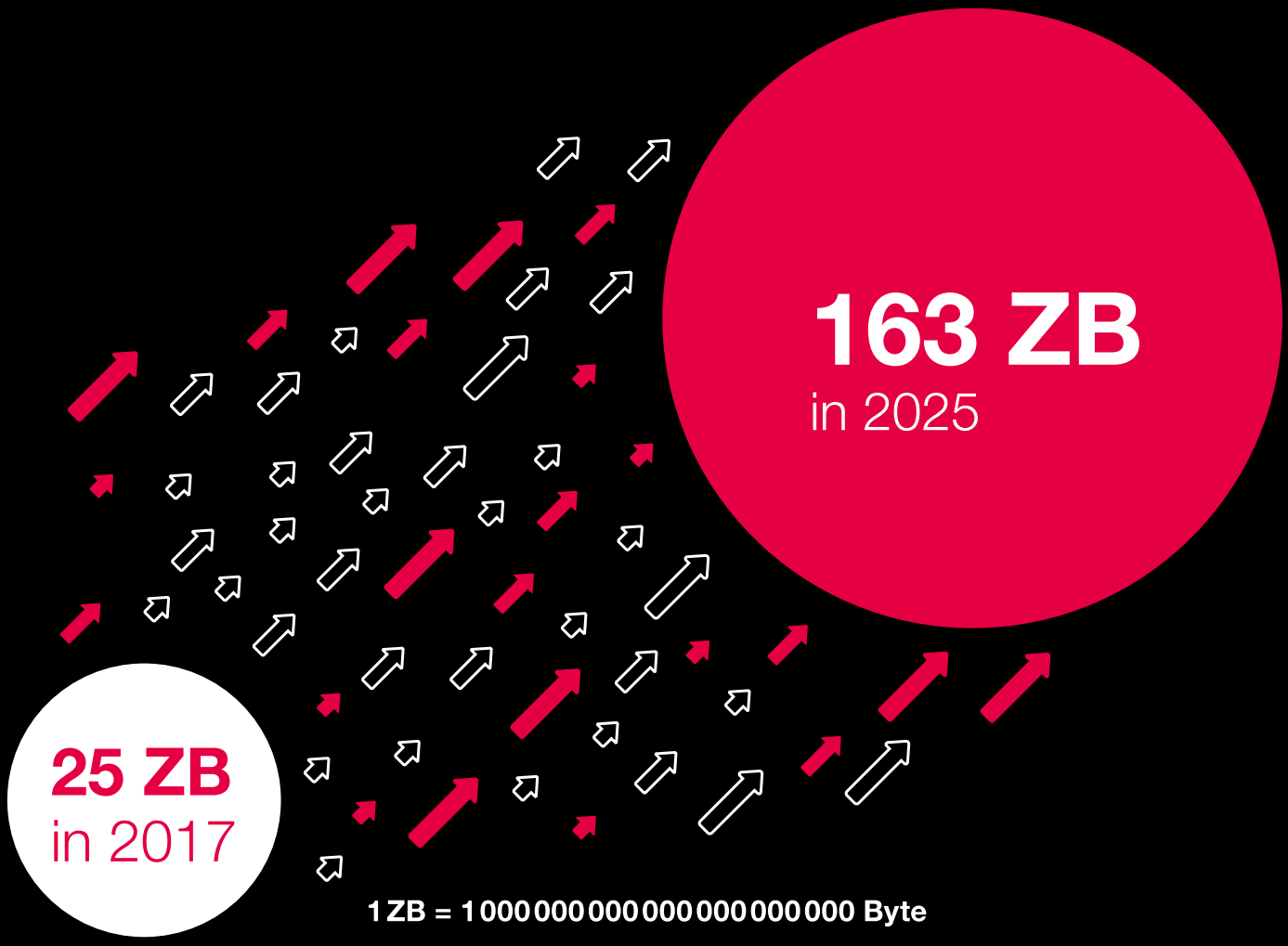
Edge is the Next Big Thing

Digital Transformation

For a while now, digitalization has been enabling people and businesses to engage with technology to get things done. Interactions, communication, business functions, and business models are undergoing transformation as a result of digitalization. All of this generates vast amounts of data that needs to be gathered, evaluated, stored, and made accessible when needed. Therefore, the growing demand for integrated and intelligently connected solutions means that companies are increasingly relying on digitalization.

Everything is Connected

The Internet of Things (IoT) encompasses devices that are connected to the internet. These intelligent devices collect data and exchange it with other devices or machines. In addition to adding tremendous convenience to our lives, this networked exchange requires an increase in monitoring and oversight. These trends reflect an incredibly dynamic IT market that will impact future IT strategies. Industry, economies, and all of us will face new challenges arising from the constant development of technologies designed to make our world smarter and safer.



The Rise of Data

Studies forecast an explosion in real-time data volume in the next decade – some predict that it will double every two years. This real-time data is needed for machine learning, streaming, car-to-car and car-to-infrastructure communication, analytics, and reasoning. Therefore, it is vital to have low latency and immediate data processing. The demand for more servers and storage media means higher demand on network capabilities, IT infrastructures and solutions. Major investments will have to be made to handle this tremendous volume of data.

Market Demands

It is essential to bring data processing closer to the data source to avoid any delays. This proximity is key to low latency. Protecting data and systems is another highly important issue: both digital data security and physical access to data centers must be guaranteed at all times. To keep up with the fast-pace in the market, and to satisfy demands for efficiency, businesses have to install scalable IT systems to meet varying performance demands. An uninterrupted maximum bandwidth connection is one of the most important prerequisites of data availability.

The Edge of the Smart World

Basically, edge computing is pushing the frontier of computing applications, data, and services away from centralized nodes to the edge of a cloud data center. This minimizes latency by eliminating the route to data centers or clouds. It also enables real-time analytics and knowledge generation to occur quickly at the data source, a need that is not only shared by industries such as healthcare, manufacturing, telecommunications, and finance, but also by people interacting with IoT devices.

The extent to which the IoT could disrupt our future will depend on the design of fast, secure, and scalable networks that connect consumers and businesses reliably to a large number of systems that orchestrate our lives and work. To move intelligence to the edge is crucial for making environments smarter.

Smart **Healthcare**

Today's healthcare system is an intelligent network between manufacturers, pharmacies, hospitals, insurers, and healthcare providers. Patient data requires high availability and secure shareability. Diagnostic imaging alone generates massive data that has to be managed precisely – processed, evaluated, stored – and very quickly. The data also helps providers effectively communicate with suppliers to ensure they have a low cost but efficient inventory and drive preventative care.

Digitalization and the permanent availability of data can help improve the healthcare supply chain and, in turn, lower costs, increase revenue, and improve quality of care. An edge data center can offer this highly accurate confidential information with very low latency and very high security.

Patient Data Less Than a Heartbeat Away.

Smart Healthcare – with the Rittal Micro Data Center Level E and iNNOVO Managed Service.

The Rittal Micro Data Center Level E with iNNOVO Managed Services offers a secure environment for IT solutions, and a high level of protection against physical threats like fire or burglary – an absolute necessity when it comes to sensitive patient data. MDCs can be set up individually or in a row.

- Connection of several network branches to a private cloud
- Highest level of certified IT and data security
- Secure ICT operational continuity and ICT availability through service level agreements
- Cost optimization based on pay-as-you-go financial models and individual extension options
- Highest possible and appropriate IT and data security through separate contracts for ensuring GDPR requirements

Smart **Mobility**

Digitalization is effecting radical changes in the automotive, railway and aviation sectors: Traffic systems are being improved, vehicles networked, data from fuel consumption, speed, and traffic conditions are all generated anytime anything is transported.

Aviation and railway industries are increasingly digitalizing products and services, connecting operations and logistics for more efficient performance. Vehicles are becoming more autonomous and can offer driving assistance in real time. Equipped with hundreds of sensors, they will be the equivalent of supercomputers, generating and transmitting a massive volume of data – according to some estimates up to 40 TB per day, per car. Therefore, low-latency connections to networks and edge data centers everywhere and at any time will be of vital importance.

For a Future in the Fast-Lane

Smart Mobility – with the Scalable Modular Data Center (SMDC) by IBM and Rittal.

The Rittal SMDC solution achieves lowest latency through distributed infrastructure systems. It comprises the IT rack, climate control, power distribution and supply, early fire detection and fire extinguishing, as well as monitoring.

- Turnkey data center for edge computing
- Safe protection according to IP20
- Available with two, four, and six racks, with 5 kW each, depending on client applications
- Reliable IT components and services, together with our solution partner IBM
- LCP CW with higher cooling capacity through water/glycol mixture

Manufacturing is being transformed by digitalization and the Industrial Internet of Things (IIoT). Industry 4.0 is paving the way for digital twins, predictive maintenance, and smart factories with fully connected and flexible systems.

Sensors in machines and their components are networked and can process data and communicate with each other in real time. Production processes can be optimized by analyzing all the data coming from the machines. But to meet these demands, edge data centers need to be put to use to manage the information and deliver information in real time to help improve product quality, traceability, and availability.

Smart **Industry**

Maximum Speed on All Production Lines

Smart Industry – with SEDC Secure Edge Data Center from Rittal, HPE and ABB.

Turnkey ready industry 4.0 models can be robustly implemented with Rittal SEDCs. The IT environment for the Internet of Things can be scaled to individual needs. Businesses profit from lowest latency and, at the same time, cloud connection (e.g., Microsoft Azure Stack).

- Complete data center with OT and IT components
- Low installation costs due to HPE pre-integration
- Secure data processing in real time through highly available IT infrastructure
- High degree of prefabrication for quick and secure commissioning on site

Rittal as Partner of the HIENG Facility Integrated Rack Solution

A cooperation that pays off: With Hitachi Information & Telecommunication Engineering (HIENG), Rittal presents the HIENG Facility Integrated Rack Solution. This edge solution is perfect for gathering production data, IoT sensor data, and data management for lots of other types of information.

- Turnkey edge data centers with solution partner Hitachi
- Specific IT components available for specific solutions and applications
- Options like cooling and security can be configured

Smart **Telco**

Everyone is streaming everything. There's more and more content out there, and no one wants to wait for it. The demand for high-quality and high-speed data, anywhere, is a challenge telecommunication providers have to meet.

5G networks are the new driver for the telco market, as they are predicted to deliver speeds in multi-gigabits per second. The rise of 5G coincides with the explosion of connected devices and systems associated with the Internet of Things (IoT). Processing these high volumes of data, at a faster speed, will require new antennas, new devices, and new applications. And the influx of this additional data – which will need to be processed in real-time – will drive the need for mobile edge computing.

The Buzz of the Future

Smart Telco – with the Rittal OCP Edge Data Center

Rittal offers an OCP-based edge data center in container housing. At the OT level, it is made up of racks, climate control, and power supply. Furthermore, the Rittal solution already includes all IT components needed for the implementation of individual customer requirements.

- OCP Modular System (racks, system accessories, power distribution and backup, climate control, and monitoring)
- Scalable solutions based on the OCP Modular System
- Pre-integrated IT components (in cooperation with partners)
- New generation of Liquid Cooling Package Rack/Cold Water (LCP CW) with higher cooling capacity even with water/glycol mixture

Smart **Government**

Technical and economic innovations are creating more advanced, sustainable, and efficient societies. Intelligent, networked IT and communication technologies can help public institutions carry out their tasks more efficiently and effectively.

Air-quality monitoring and CCTV surveillance are only two of various benefits of technology applications in governance.

Edge data centers speed up data processing, providing information much faster. This is critical in providing seamless security from government services like police and fire departments. Town halls and other state-run offices also benefit, streamlining process like zoning and construction regulations, elections, and interactions with governing councils.

Running Public Services Efficiently

Smart Government – with the RiMatrix Edge Data Center in High Availability rooms supported by iNNOVO Managed Services

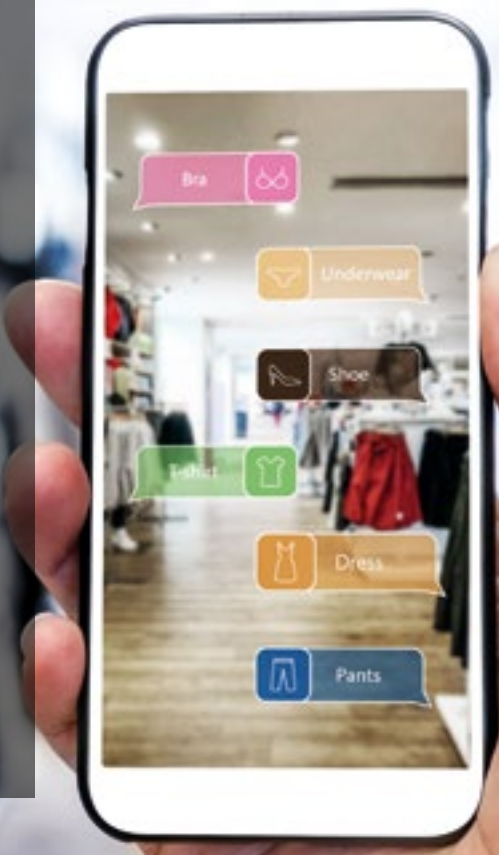
In close cooperation with iNNOVO, Rittal offers an edge solution that can be scaled depending on the application type and provides data almost in real-time: the RiMatrix Edge Data Center in the High Availability Room.

- Innovative, energy-efficient edge data center
- Highly secure room in an existing building, no construction measures needed
- Secured authentication of IoT endpoints and sensors connected to the cloud
- Data security within the cloud and networks for edge applications
- Upscalable IaaS (Infrastructure as a Service) platform via OpenStack that has fully-automated communication with corresponding applications

Smart **Retail**

Digitally-supported shopping is booming: it enhances the customer experience while driving efficiency. Electronic newsletters, sales promotions, and customer preferences all help consumers stay oriented. In stores and markets, retail data is enhanced by using edge data. When retailers are geographically spread across a market, an Intelligent Assistant application benefits from the three-layer model of an edge data center.

Edge computing enhances on-site retailing by optimizing product availability, streamlining logistics, and deciphering customer preferences. Constant availability of this data through edge computing enables the steering of customer behavior. But because these systems interact with all the branches of the retailer, the solutions also need to be highly standardized.



A Customer Journey Safely Reaching the Goal

Smart Retail – with a Rittal Edge Data Center

Rittal supports companies by implementing a hierarchically-networked data center architecture. This ranges from an edge data center at the POS (Point of Sale) to a spine data center in the local warehouse and a core data center in the head office. The iNNOVO Managed Services can be tailored to individual company needs. By using intelligent cloud services, they can be used at a regional level or nationwide, and of course always customized.

- Evaluation of the customer behavior
- Need-based purchasing
- Targeted marketing
- Individualized advertising and promotional offers
- Customized shopping lists and search functions
- Provisioning and control of flow of goods
- Electronic payment – also via smartphone

Smart **Finance**

Today's demand on banking is: anytime, anywhere. This requires innovative, robust, secure, optimized computing that meets the expectations of empowered and tech-savvy customers. And edge computing is highly applicable in the automation of fast and secure transaction and billing processes in the financial world that require low latency.

Omni-channel experiences allow customers to interact with banks effortlessly regardless of transaction type. The data involved in these transactions doesn't need to go to a cloud – edge data centers located nearby guarantee low latency and real-time data analysis. The physical proximity of an edge data center also increases real-time data availability.

Visionary Investment without the Risk

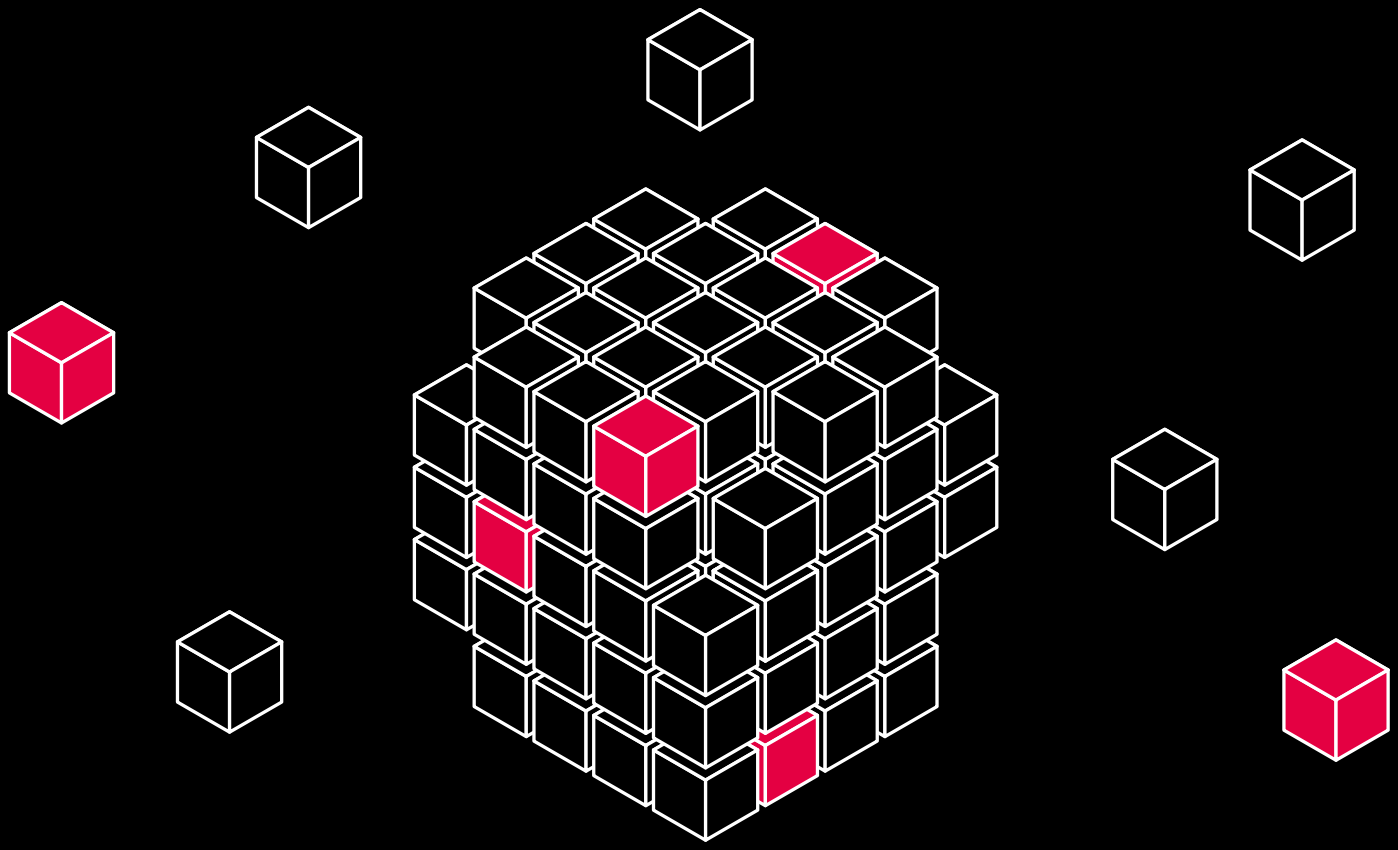
Smart Finance with Ethereum-Blockchain-as-a-Service (EBaaS)

iNNOVO Cloud, Frankfurt School of Finance and Rittal have developed a new Blockchain-as-a-Service platform. The platform is hosted and operated by iNNOVO Cloud together with partners acting as Blockchain software integrators.

The EBaaS offering is a complete and turnkey-ready Managed Service solution with an integrated smart contract functionality. It enables the secure implementation of new business models for financial services with Blockchain and smart contracts.

- Automated transaction and billing processes
- Precise smart contract implementation
- High security standards for confidential data through decentralized and revision-proof edge data center infrastructure
- Highly-scalable, turnkey-ready platform and service from one provider
- High transparency and traceability

Smart Solutions for Smart Businesses



Rittal and Edge

Industry 4.0, automated financial transactions, mobile streaming, and autonomous driving generate data that requires super-fast processing, extreme safeguarding, and uninterrupted availability. Rittal edge solutions deliver just that: A high volume of data can be securely and precisely saved, processed, and shared, wherever necessary and in real time. Our project planning, development, and reliable commissioning allow us to implement edge solutions around the world – quickly and suited to your needs.

Flexible and Scalable

Rittal's modular system enables individually scalable combinations of OT and IT components like IT racks, cooling, power distribution, monitoring and security. Together with our partners we also provide server, switch and storage systems. From a high-performance edge data center with software solutions to an edge data center in a container with managed services from trusted partners: Rittal's concepts are flexible, and highly standardized so we can offer the best individual solution for every customer in every industry.

From Planning to Operations

A data center is an evolving organism that's in a constant state of flux. In order for it to keep pace with the business's changing demands, it needs to be flexible to meet varying performance demands. With Rittal Lifecycle IT, our comprehensive solutions portfolio, we support companies during all four phases of the data center's lifecycle: From planning and implementation all the way through to operation and optimization of a multi-site IT infrastructure.

Strong Partnerships

Strategic alliances with trusted international partners help us pool resources and take advantage of knowledge transfer synergies. For example, the SEDC Secure Edge Data Center has a redundant and secure power supply from ABB, and a cloud connection from HPE. The alliance with IBM generate synergies by building a joint market presence and utilizing the complementary customer bases. Close collaboration also with channel partners like resellers or system integrators simplify the cost-efficient delivery of complete data centers that are ready to use.

Rittal Lifecycle IT

Optimize
Efficiency, costs and sustainability of the solution installed is analyzed to draw conclusions about the data center's potential for optimization.

Design
Once the concept has been developed, the solution modules to be used are selected, and the investment (CAPEX) and operating costs (OPEX) are calculated.

Operate
The data centre can be operated by the customer or through our partners as managed service.

Build
The physical infrastructure (power, cooling, monitoring, security) is put in place. IT components (server, storage, switches) can be optionally integrated via Rittal and our partners. This is followed by commissioning and acceptance.

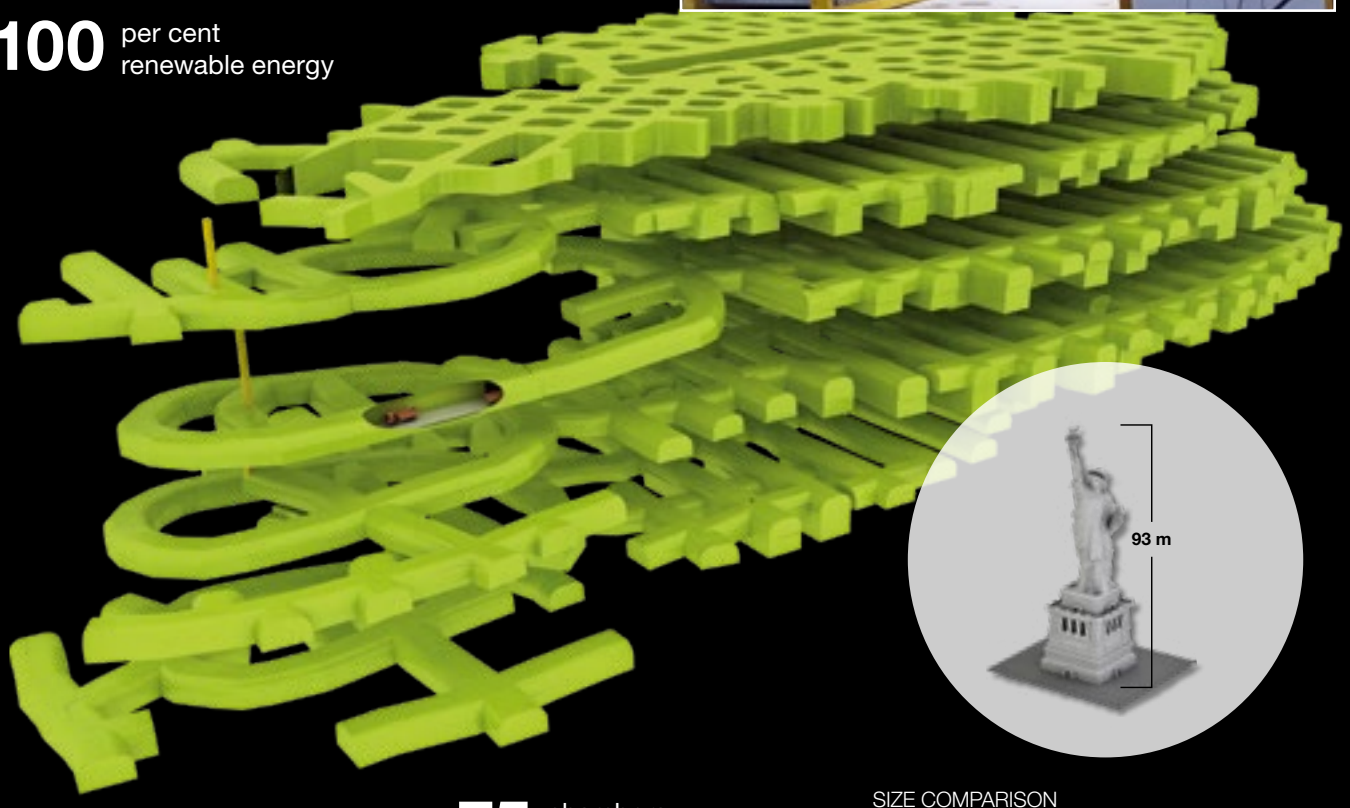
Lefdal Mine Datacenter

The Lefdal Mine Datacenter (LMD) on Norway's west coast sets new standards. The five-story tunnel system with 120,000 m² of space provides a total capacity of 200 MW. It operates exclusively on renewable energy and is cooled by water from a nearby fjord. Significant cost savings of up to 40 % can be achieved compared to placing a cloud data center, for example, in Germany. And it is a highly secure facility: While the rock formation provides natural protection from electromagnetic waves, the facility has access through just two points of entry.

The Lefdal Mine Datacenter is a unique facility that pays off: Companies increasingly need access to highly flexible, secure and efficient IT resources. To this end, Rittal's standardized data center designs and containers enable to meet all demands and to implement flexible, scalable IT infrastructures within just six weeks.

5 levels underground

100 per cent renewable energy



75 chambers with up to three levels

120,000 square metres

SIZE COMPARISON
Building an equivalent to the underground facilities above the surface would require enormous plots of land and involve huge construction costs.

Cloud Technologies for Smart X

Rittal and iNNOVO Cloud offer flexible infrastructure and cloud solutions as “IT as a Service” models. The result is a standardized and “virtual private” cloud data center, which is suitable for highly scalable applications and demanding scenarios such as high-performance computing or Big Data applications.

In collaboration with iNNOVO, IT components (server, storage, network, etc.) are also incorporated and serve as a platform for the services (XaaS). The modular data centers can be accommodated compactly and in any location. Besides that, iNNOVO offers its cloud platforms and managed services from two regional Frankfurt based data centers for customers with high data protection needs and strong compliance regulations. For example, insurance companies, healthcare or financial institutions.

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- Enclosures
- Power Distribution
- Climate Control
- IT Infrastructure
- Software & Services

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