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Sharing plant documentation over the box platform using QR codes for fast
navigation

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Declaration

I hereby declare that this thesis is my own work and effort and that it has not been submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged

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1 Introduction

The modern world is shaped by data flows of all kinds. We shop on the internet, storing our data in clouds, moving around in social networks and streaming series and movies. The applications of the internet are inexhaustible. Due to this and the constant presence of the internet we are in many cases also dependent on it. We access the internet around the clock.



Figure 1: Servers in a cold aisle¹

All the data we download from the internet is stored on servers in data centers all around the world. These in turn have to be operated 24 hours a day, 365 days a year. The operator has to deal with a variety of different systems in order to create the best possible conditions in the data center. Therefore in a Data Center surrounding the saying „A jack of all trades is a master of none, but oftentimes better than a master of one” is very true. As it is still not possible to memorize all Data Sheet of any plant, supposed to be switch position data center operators fall back on different standard documentation created for any data center individually. To support operation teams

¹ Vogel Communications Group GmbH & Co. KG

we came up with the idea to store these sheets and other helpful documentation in a cloud. Additionally marking the systems with qr-codes for fast and precise navigation through it.

2 Data Centers

Most people imagine only the white space or customer space when thinking of a data center what makes sense, as it is the purpose of it. That is as thinking of a car when a car factory is mentioned. A data center is much more than just the space with servers, but also the more or less compact building with technical infrastructure for connectivity and availability.²

2.1 TYPES OF DATA CENTERS

Not all data centers are the same. Until a few years ago, there were mostly corporate data centers, also called in-house data centers. However, in-house data centers are expensive and time-consuming, yet often not up-to-date. Other service providers specialize in providing IT equipment-designed and equipped spaces, known as colocation data centers, where customers set up and operate their own IT equipment these are again distinguished colocation service where small cages of different customers in one space, and wholesale, where one customer rents one whole space.³

2.2 COMPOSITION OF DATA CENTERS

A data center, understood as a building, includes the surrounding data center infrastructure, consisting of refrigeration and air conditioning, energy, fire protection and security technology, the IT cabinets and other internal demarcations and possibly office and storage rooms. The functional core of the data center building is formed by the rooms with the IT equipment.⁴

² Vogel Communications Group GmbH & Co. KG

³ Vogel Communications Group GmbH & Co. KG

⁴ Vogel Communications Group GmbH & Co. KG

2.2.1 Electrical infrastructure of Data Center

The data center is fed by two separate network sectors operated by the local utility. If one sector fails, the second ensures that the power supply is maintained. Parallel generators are used to provide power in case of an outage. After transforming medium voltage to low voltage of 400 Volts. From here a UPS (uninterruptible power supply) provides power to the servers. This back-up system makes it possible to deliver power from the time a utility company goes into total failure until the time the diesel generators start up.

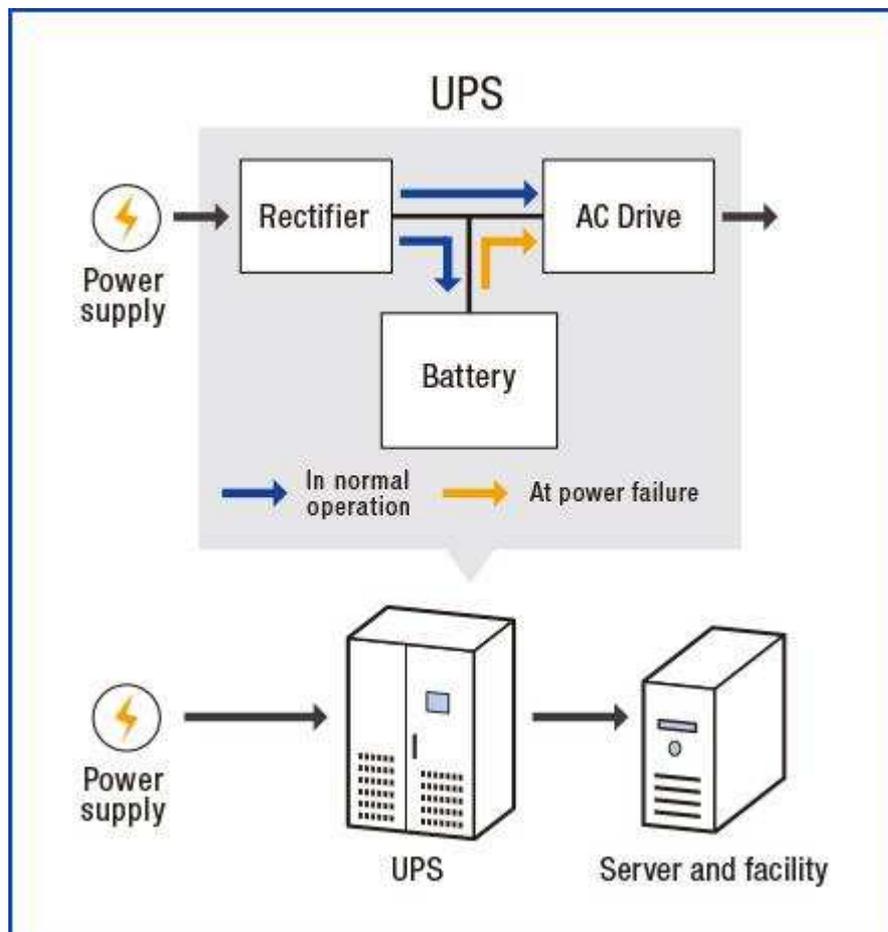


Figure 2: UPS function⁵

⁵ UPS | Promotion | Fuji Electric Global

Multiple servers or storage devices have multiple duplicate power supplies that convert the supply voltage from the two network sectors to the operating voltage. This ensures that failure of one or two power supplies will not cause any problems.⁶



Figure 3: Battery room⁷

2.2.2 Cooling installation of Data Centers

All electronic components and in particular the processors generate heat during operation. If it is not dismantled, the processor's efficiency drops in extreme cases to the point that the component could fail. That's why cooling a data center is essential, and the cost of doing so is considerable because of its concentrated computing power.

A common server cabinet today in a standard data center generates about 1 to 7, 8 kilowatts of heat. In a tiled stove stuck perhaps 5 to 7 kilowatts. In a co-location data center such as Interxion, there are individual computer rooms in which higher-density computers are available. Here has a rack up to 40 kilowatts. But researchers

⁶ Vogel Communications Group GmbH & Co. KG

⁷ Vogel Communications Group GmbH & Co. KG

are already thinking about such densely packed racks that one could take up to 140 kilowatts of power.

If air conditioning in the data center failed, but electricity continued, it would not take 5 minutes for either the hardware's own overheat protection to shut down the hardware, melt the delicate parts, or catch fire. A data center may never fail.⁸



Figure 4: Fan cooled cooling registers⁹

To cool the servers efficiently the white space is parted into cool and hot spaces. the most common design are cold aisle containments. This means that on the white space rows are enclosed these small spaces are then cooled through a raised floor. The servers can then suck that cold air and blow heated air out. The cold is produced by CRAC-Units (Computer Room Air Conditioning). These move the air in the room and move the warmth into a refrigeration cycle. In most cases the warmth is then transported to cooling registers on the roof.

⁸ Vogel Communications Group GmbH & Co. KG

⁹ Vogel Communications Group GmbH & Co. KG



Figure 5: Cold Aisle Containment¹⁰

2.3 DATA CENTERS IN GERMANY

According to estimates, 220,000 to 250,000 people work for data centers in Germany. Responsible for the data center are primarily the data center manager, the CEO and, in the last instance, the company management as well as the commercial management, which approves investments in tangible goods and personnel. When selecting data center staff, the HR department is also involved.

In hybrid cloud environments, the CEO or equivalent function is also responsible for optimizing the technical and economic procurement and coordination of IT services and services from different cloud data centers. In addition, there should be an IT Security and Privacy Officer; in some companies, they are required by the IT Security Act or, in the future, by the EU Data Protection Regulation.

¹⁰ Vogel Communications Group GmbH & Co. KG

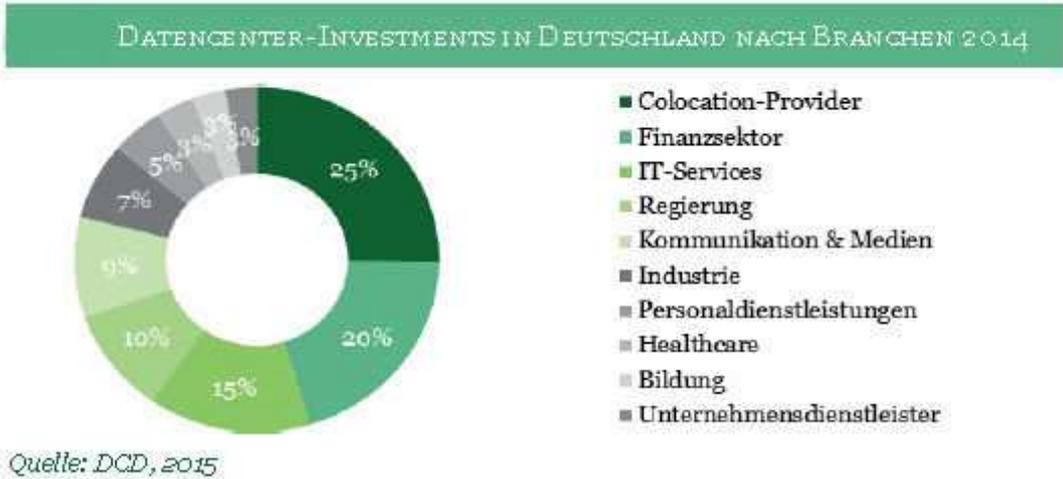


Figure 6: Data Center investments by business¹¹

Typically, higher-level data center staff will take care of one or more areas, such as servers, storage systems, networks, cable systems, monitoring systems and backup power, or software. There are whole teams in larger data centers.¹²

Germany is the third largest data center market and the largest in Europe. For a while, it looked as if the location would lose its appeal, mainly because of the high price of electricity. An approximately 4,000 square meter data center with a capacity of nine to twelve megawatts needs as much electricity as a small town with 44,000 inhabitants, play younger political Developments now in the hands of investors, explained Ralph Hintemann of Borderstep Institute in his keynote address at the recent DataCenter Day.

First there is the NSA wiretapping scandal and the publications by Edward Snowden. A Datacenter Dynamics study this spring suggests US cloud providers could escape as much as \$ 35 billion on their own. In addition, the Brexit seems to develop as a gift for German data center operators.

For example, in Frankfurt, roughly 200 kilowatt of power in an Tier 3 data center can now be earmarked for monthly rentals of € 180 to € 225 per kilowatt per month.

¹¹ Vogel Communications Group GmbH & Co. KG

¹² Vogel Communications Group GmbH & Co. KG

But that's not the only piece of information from the Art Invest report that may be of interest to potential users of foreign data centers.¹³

3 QR Codes

The QR code (quick response, as a brand term "QR Code") is a two-dimensional code developed by the Japanese company Denso Wave in 1994. Due to automatic error correction, this method is very robust and therefore widely used. Further developments include the Micro QR Code, the Secure QR Code (SQRC), the iQR Code and the Frame QR Code¹⁴

The QR code was developed to mark components and components for logistics in the automotive production of the Toyota Group. Since its spin-off from the group in 1949, the Denso company, which develops the QR code, has been cooperating as a supplier for, among other things, all electric and electronic assemblies with Toyota. The 2D code was developed by the subsidiary Denso Wave, which also develops identification systems and devices for mobile data acquisition. The QR Code was invented in 1994 by Masahiro Hara and his teammates Takayuki Nagaya, Motoaki Watabe, Tadao Nojiri and Yuji Uchiyama.

Masahiro Hara and his team won the Audience Award of the European Inventor Award of the European Patent Office in 2014 in the category "Non-European States".

The QR code consists of a square matrix of black and white squares that represent the encoded data in binary form. A special marker in three of the four corners of the square indicates the orientation. The data in the QR code is protected by an error-correcting code. This tolerates the loss of up to 30% of the code, i. h., it can still be decoded then.¹⁵

¹³ Vogel Communications Group GmbH & Co. KG

¹⁴ Wikipedia 2018c

¹⁵ Wikipedia 2018b

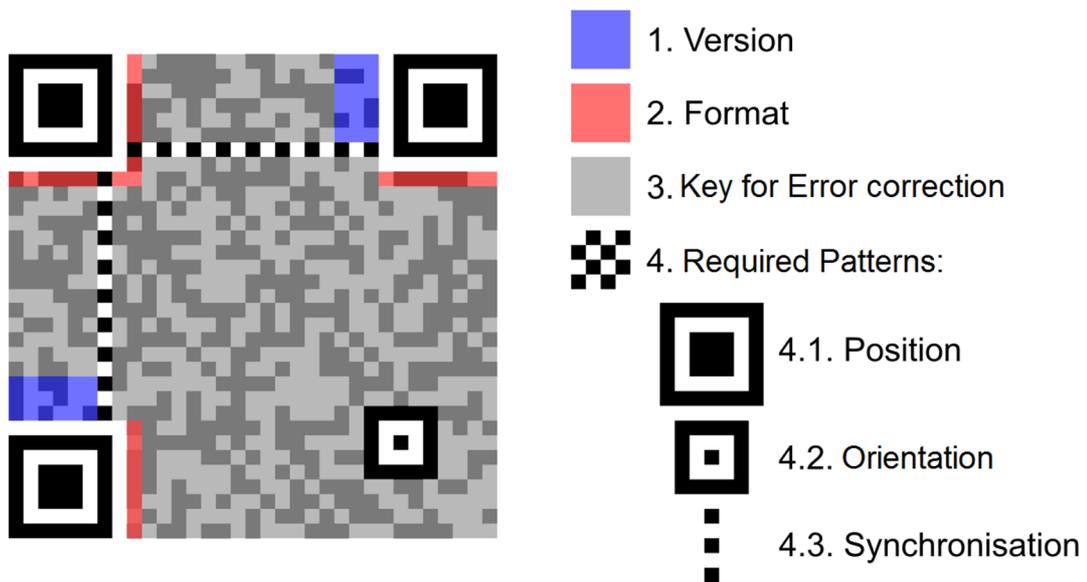


Figure 7: Structure of a QR-Code¹⁶

The use of the QR code is royalty-free and free of charge. The specifications were disclosed by Denso Wave and are available through the International Organization for Standardization in Switzerland. The name "QR Code" is specifically protected in Japan, the United States of America, Australia and Europe as a registered trademark of Denso Wave Incorporated. A note should be attached when in use.

The QR code is established as a public standard. In Japan, it is very widespread, you can find it there on almost any billboard. The Japanese government also uses the QR code. For example, the Japanese Immigration Service uses the QR code with coded data for the visa, which is glued into the passport upon entry¹⁷

To generate a QR code, you need the text to be encoded, and the desired degree of error correction. The rough process is then Based on the length of the text and the degree of error correction, you determine how big the QR code must be.

The recognition patterns that do not depend on the text are first drawn on the surface. These are the position patterns, the alignment patterns and the synchronization lines. From the text a bit sequence is generated. An additional bit sequence for the error

¹⁶ Wikipedia 2018c

¹⁷ Wikipedia 2018c

correction is generated for the text bit sequence. The text bit string is drawn there together with the error correction bit string into the symbol where there is still room. This happens from right to left in serpentine lines. In order to achieve that the symbol contains approximately the same number of black and white pixels, and in order to avoid patterns that make it difficult to read in, eight different masks are placed one after the other over the symbol. The mask that gives the best result is retained.¹⁸

A quick and easy way to create a QR code is an online QR code generator. A script converts texts into a code and creates the graphic. Thus, it is possible for virtually anyone to easily create a code.

"Scanner" is similar to bar code readers the common term for the readers. Also common in the industry is the term "imager" when it comes to a 2D device. They have a camera and a decoder. In addition, many devices provide a targeting aid, often in the form of a laser-generated pattern indicating the reading field.¹⁹

Not only can QR codes be generated as pixel graphics, but they can also be composed of matching Unicode subelements.²⁰

4 Cloud Storages

We use clouds because they are very neat as we want to access files from any device: Use our smartphone, tablet or computer to continue what we've started, wherever whenever. All changes made will be updated on all your devices.²¹

4.1 BOX CLOUD STORAGE

Box offers you automated workflow, collaboration, and the integration of machine learning to link your business processes and content to our secure cloud content management platform. And because Box works enterprise-wide, simplifying

¹⁸ Wikipedia 2018c

¹⁹ Wikipedia 2018c

²⁰ Wikipedia 2018c

²¹ Microsoft OneDrive

processes that involve many different teams - including digital asset management, contract management, virtual data rooms, HR hiring, sales promotion, custom app development, and more.²²



Figure 8: Box Logo

Box protects your entire content with enhanced security controls, encryption code management, and complete information governance. Whether you need to comply with the DSGVO, HIPAA, PCI, GxP, FedRAMP or other key requirements - Box offers you smooth tools designed specifically for the most regulated industries, as well as data residence in nine countries. In this way, you can meet the most demanding global compliance and privacy requirements while protecting the flow of information across the enterprise.²³

The company I work for just recently started using box for the previously mentioned reasons and it was therefore the tool I decided for in the beginning.

4.2 ONEDRIVE CLOUD STORAGE

OneDrive (formerly known as SkyDrive, Windows Live SkyDrive, and Windows Live Folders) is a file hosting service and synchronization service operated by Microsoft as part of its suite of Office Online services. Launched in 2007, it allows users to store files and personal data like Windows settings or BitLocker recovery

²² Sichere Dateifreigabe, Speicherung und Zusammenarbeit | Box 2016

²³ Sichere Dateifreigabe, Speicherung und Zusammenarbeit | Box 2016

keys in the cloud, share files, and sync files across Android, Windows Phone, and iOS mobile devices, Windows and macOS computers, and the Xbox 360 and Xbox One consoles.²⁴



Figure 9: OneDrive logo

Although the OneDrive online service is very well integrated with Windows and Office, it follows a simple philosophy: Every user should be able to flexibly access the content that is needed at any given time, whether with a PC, Mac or on the go is the tablet or smartphone. OneDrive can therefore be used via an app or simply via a browser. Access works through a Microsoft account, such as an e-mail address from Outlook.com, Hotmail, or Windows Live, or any other address you use to sign up for free.²⁵

And OneDrive is encrypted with SSL.²⁶ But how safe OneDrive actually is is difficult to judge. Although the service uses common, high-quality encryption techniques to block access to your data, the data itself is unencrypted on Microsoft's servers.

When uploaded to the server data is protected by the SSL protocol. That's why possible data thieves can do little with these encrypted data. Once stored on the server, Microsoft uses 256bit AES encryption protects the data. That makes it impossible to asses file unauthorized. However, Microsoft can also access the

²⁴ Wikipedia 2018a

²⁵ Microsoft OneDrive: Das kann der Online-Speicher

²⁶ Microsoft OneDrive

unencrypted files stored in OneDrive. In the past, cases were known in which Microsoft has searched programs of its users' files at OneDrive, for example, to detect child pornography content and bring to display.²⁷ For maximum security, the user must encrypt his most important information in addition.²⁸

5 Implementation

At the beginning of the project, we wanted to use our company Cloud Storage Box. This was unnecessary because our client uses Microsoft's OneDrive. In this cloud, we created a folder structure. Here are all plants.

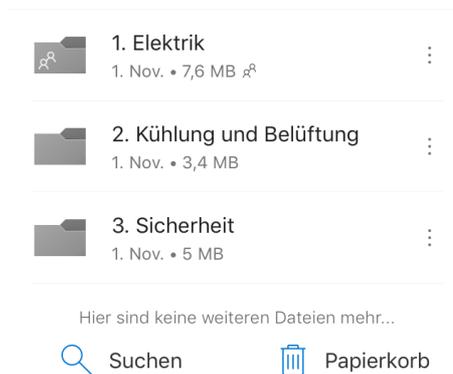


Figure 10: Folder Structure

To fill the folders we worked on creating the standard documents. The SOPs and EOPs are created at this point and are ready in the cloud. Furthermore, there are also different plans and diagrams. In the first step, we encoded only the URL links of the folders belonging to the attachments in QR codes.

²⁷ Wie sicher ist OneDrive? Alle Infos

²⁸ Microsoft OneDrive 2018



Figure 11 Example QR-Sign

When entering a technical room the technician can now simply scan the QR code on the door. He will then be forwarded to the Systems folder where he can find safety information. In the future he will also find supposed to be switch positions or values to be expected on measuring devices. He will also be able to store annotations or pictures directly in the right place. Up to now the project received a lot positive feedback for the ideas. But there are many steps that will need to follow to finalize it.

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