CONTEG CASE STUDY

TRENDS IN BUILDING DATA CENTERS - 2014

CONTEG, spol. s r.o.

Czech Republic Headquarters:

Na Vítězné pláni 1719/4
140 00 Prague 4

Tel.: +420 261 219 182
Fax: +420 261 219 192

Production plant in the Czech Republic:

K Silu 2179
393 01 Pelhřimov

Tel.: +420 565 300 300
Fax: +420 565 533 955

Local Branches/Offices

Austria:	+43 170 659 0115
Benelux:	+32 477 957 126
Eastern Europe / Nordics:	+49 172 8484 346
France, Maghreb:	+33 686 074 386
Germany / Switzerland:	+420 724 723 184
India:	+91 99 1695 0773
Middle East:	+971 4445 2838
Russia, CIS:	+7 495 967 3840
Saudi Arabia:	+966 594 301 308
Ukraine:	+380 674 478 240

conteg@conteg.com
www.conteg.com

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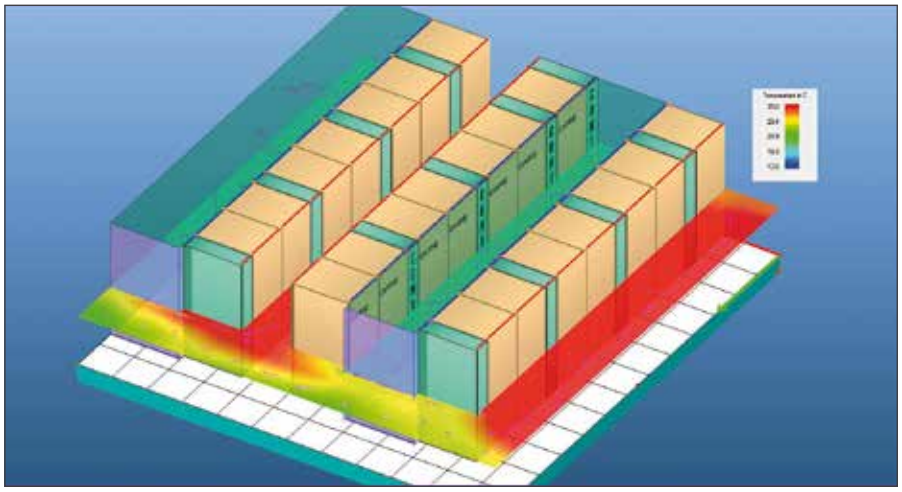
When hearing the term "data center", many people probably imagine huge halls filled with long rows of racks full of servers. In reality, data centers come in several basic sizes that can fit any performance specification: small (several racks), mid-sized (rows of racks in one or more rooms) and really large (football field-sized rooms). However, a data center's environment is very different from a standard office or industrial building, and therefore its construction is unique and purpose-driven. Based on the purpose of the data center, we can identify several types of data centers:

- **Corporate data centers built by clients to serve their own needs;**
- **Housing data centers built to rent free space in either the room or in IT racks or free slots in the racks;**
- **Hosting data centers which rent out computing power of servers, disc space, etc.**

The typical users of **corporate data centers** are banks, insurance companies, leasing companies, telecommunication operators, power and distribution companies, government institutions, the military, health care institutions, logistics and transportation companies and companies involved in multimedia productions and archiving.

Housing and hosting data centers are intended for clients – for example, service providers who rent a part of the area or computing power to third parties. These data centers have higher requirements when it comes to their physical infrastructure and operation. An independent data center is usually understood to be a facility with defined and rated physical infrastructure. **Other key features include a power supply system, cooling system, transmission network infrastructure, environment parameter measuring and control and access monitoring.** The goal is to create an environment that will house ICT equipment, such as servers, disc arrays, back-up equipment as well as active and passive network elements that will function throughout data center's entire lifespan. Under this scenario, the infrastructure would respond to changes and modifications in ICT technologies during operation and would adjust its own capacity to growing performance requirements, while staying energy efficient and green. Since the lifespan of modern data centers is about 15 to 20 years, the requirements and prerequisites mentioned above may only be met by adopting a modular design for data centers. A modular design may be described as a gradual, pre-defined and verified filling of a designated space by technologies in performance units (modules) using CFD modeling. A modular design's infrastructure, secured during the first stage of a data center build-up, will help prevent down-time issues later on. The benefits of a modular design include lower investment costs (lower CAPEX), lower operating costs (lower OPEX) and significant savings throughout the life cycle of the data center (lower TCO). Choosing a place to design and build a data center is very important, as this venue will require around-the-clock care given a data center's non-stop operation. Selecting a suitable location is often the first step in ensuring the safety of a future data center. When designing any data center, many issues have to be considered. It is necessary to get information about the available power supply and data connectivity at a potential location. It is also important to consider the suitability of the location in regard to various safety risks and possible limitations, including floor load capacity, noise and exhaust emissions, layout, fire resistance and gradual construction requirements. There are professional companies and renowned manufacturers that assess the suitability of a location for building a data center. These companies give recommendations for building your facility according to industry standards, while keeping your goals in mind (i.e. future expansion, etc.). When picking a location for a „brick" data center, for example, several basic principles must be followed. The location has to be geologically stable (no earthquakes, volcano eruptions, etc.). The climate must also be stable, and there should be no risk of flooding. When looking for a suitable location, one must take into account factors like whether the site is near aircraft landing corridors or if there is a high fire risk. If the potential location does not meet some of the requirements mentioned above, it is possible to opt for a „mobile concept" instead of a "stone" data center. Mobile data centers are placed into specially manufactured modules (containers), which protect data against earthquakes, fire, vandalism and theft and are easily transferable in the event of an emergency (i.e. flood).



Although newly built data centers house more modern energy-saving IT equipment, which decrease the power consumption of each unit, the overall IT power consumption is growing globally. The logical consequence is that the heat-load density of each data center is also on the rise. With a growing need for more power and the availability of ICT equipment for data centers, ICT elements must be consolidated. This means replacing equipment with a low rate of utilization and high power consumption

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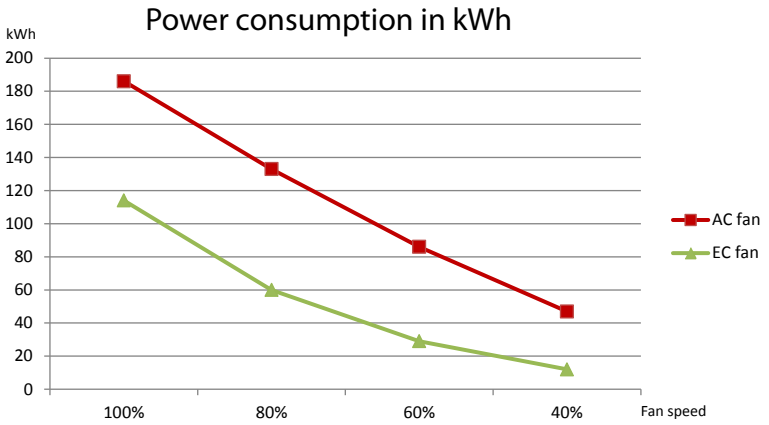
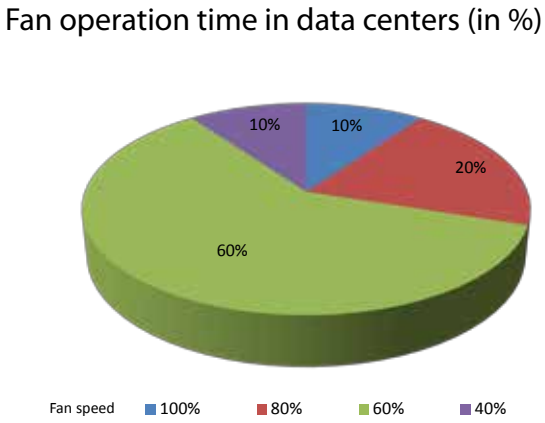
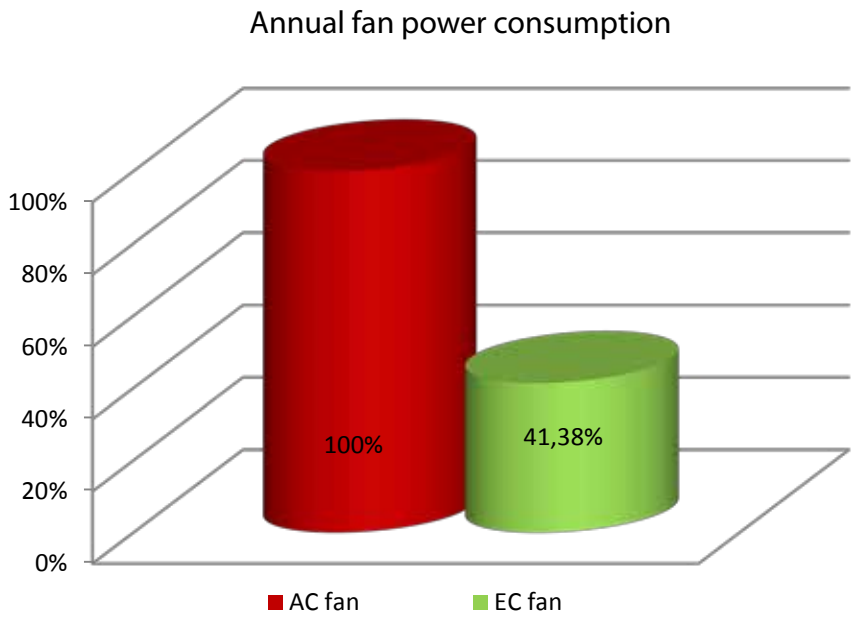
with more powerful equipment with lower power consumption and a higher rate of utilization. This is where the development of virtualization and cloud solutions comes in. While the weight and input power of new ICT equipment is rising, the virtualization and utilization of servers significantly reduce the amount of equipment installed in a data center, making the data center more efficient. ICT equipment's power supply is more efficient with higher loads and can react to varying output power capacities.

All electric power consumed in a data center by IT equipment, management systems, lighting or cooling, will ultimately be transformed into heat. This means that as much as 15 kW of heat may be generated per 1 square meter of floor area. This is several times more than it was a couple of years ago. For that reason, cooling and heat transfer technology must be adapted.

The cooling units in particular must quickly and very precisely respond to fluctuations in the output power of modern ICT infrastructure and deliver the required amount of conditioned air exactly where it is needed. At the same time, the units must quickly remove exhausted hot air to prevent hot spots. From this perspective, the most suitable solution is to use modern in-between-rack cooling units located in the rows with the data racks, called in-row or in-line cooling units. The close proximity will shorten the air path between the cooler and the server. That is why these in-row air-conditioning units are quickly replacing large perimeter cooling units (blowing air into the raised floor), which once dominated the market. Of course, the trend is to save energy, particularly when it comes to cooling. This results in using new technologies, such as EC motors, and modern arrangements, such as direct or indirect free cooling. Introducing modern technologies often involves the need to change the approach of a data center's operation. What we recommend is to raise the pre-set air temperature, a strict separation of cold and hot zones, and change the indoor temperature and humidity limits. Even small adjustments in this respect may lead to major energy savings.







In addition to new ICT equipment and cooling units, it is also necessary to adapt other non-IT infrastructure in a data center, including data racks, power supplies and standby power sources, and management and monitoring systems.

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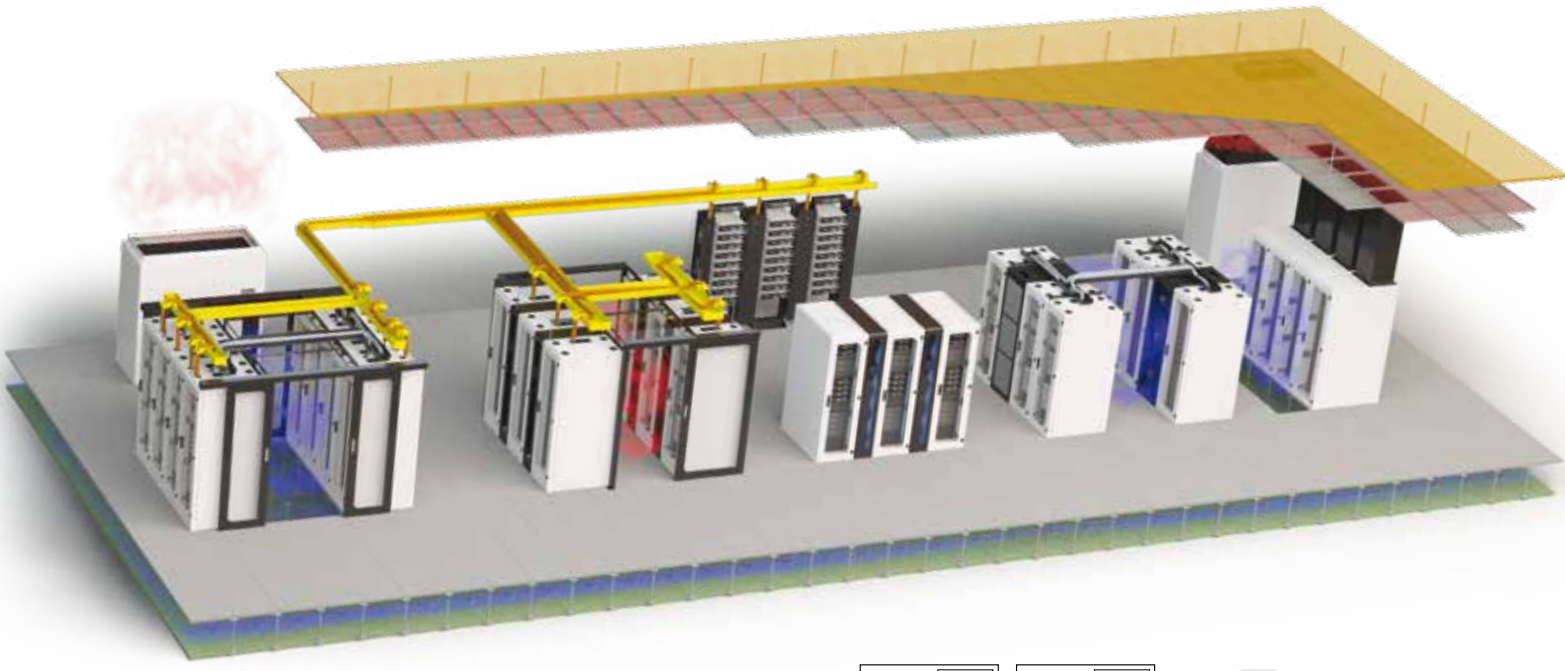
Data and telecommunications racks must be designed for the easy installation of all passive and active equipment and must be equipped with elements that support high-density cable management, power supply, and cooling systems. The important features of data racks are their load-carrying capacity (1500 kg), adaptability (easily replaceable components, including bottom and top plates and door and side panels) and modularity (the internal space that allows for maximum use of ICT equipment). Identical dimensions with in-row cooling units is a major advantage, as cooling units and the row of racks create a natural barrier to separate the air-conditioned air in the front section and the hot exhaust in the rear section. For maximum efficiency and power savings, zone separation elements are frequently added to the racks and a data center's cooling system. Having a cold or hot aisle containment has become the norm in today's data centers.

Last but not least, one must point out investors' growing efforts to reuse waste heat from data centers. Energy recuperation does not seem very efficient at the moment, but may later prove to be beneficial from an economic point of view in large-scale data centers. The use of heat waste to heat premises and utility water may in many cases bring about good results within a short period of time. To start this process, there must be prospective clients for this heat, and a data center owner needs to become a licensed energy distributor.

To conclude, society's growing dependence on information and IT technologies is leading to the design and implementation of a new generation of data centers with a keen focus on modularity, scalability, physical security and back-up technology systems. Modern data centers rely on efficient and professional solutions for all their systems. The functionality of a data center with a totally defunct cooling system would collapse within a matter of seconds. A data center with no backup power will also face serious risks of down time. In an event where temperature would increase above acceptable limits or the main power system fails, a data center will need sophisticated, well-designed and dimensioned solutions to get it through these types of crises. This is why design and implementation are key elements in modern data centers. A data center is housing your irreplaceable data and so it needs to be safe.



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