EXPERTS IN
SUSTAINABLE
BUILDINGS

WHITE PAPER

DATACENTER TRENDS 2019
The era of the EDGE

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Driverless cars, serverless datacenters and ubiquituous zettastructure were the buzzwords at Datacenter Dynamics London and reflecting the trends of a new era.
New applications in which the user or machine interacts with its surroundings, need fast decision making while coping with big data.

The centralized model of bringing these tremendous amount of data to a huge datacenter and distribute the processed data back to the user by fiber networks, comes to an end because of latency. And that's what new trends are all about now: the push of processing data to Edge datacenters, deployment of next generation networks like 5G, the next level of energy efficiency by using smart grids. These new technologies enable smart cars, smart buildings, smart cities interacting with the user.

1 Zettabyte equals 1021 bytes. If a byte were a sand grain, you would need many earths to house them

However, there are also some challenges to deal with too: distributed computing, cybersecurity , speeding up the Internet and energy storage within smart electrical grids.

Shifting Cloud to the Edge

The Cloud has come and is here to stay. It's a solution for housing user applications and data but only for as long a the round trip delay from the user to the Cloud and back is not critical.
A driverless car speeding at 120 km/hour travels a distance of half it's length in 80 milliseconds. If a Cloud application should run the decision making process of that car, than we would need to transport the (big) data to the Cloud, having them processed and then transported back to the car in a much smaller timeframe of about 8 milliseconds.

Impossible with current networks: the technology, the amount of fiber networks, the speed of the Internet as know it today are not sufficient to deal with this kind of applications. Therefore, data need to be processed as close to the user as possible. That 's where Edge computing and Edge datacenters come in.

5G and IoT networks will transport data from the user or machine to an Edge datacenter. Most of the data will be processed there while only a small portion of other user application data will go further into the Cloud.

IoT data are large in number but age very fast to have a usefull meaning. So why bother to put all these data in the Cloud were they age at the speed of light? That's were Edge datacenters also take an important role : they act as a filter towards the Cloud and they are structured as a maze in a way to support distributed computing. When one edge datacenter falls out, another one takes over just like that without notice by the user.

In defining their Smart Office 2023, the Flemish government already anticipates today on this by integrating Edge datacenters in its new smart building to be built in the Brussels Nord region. Ingenium is helping them to write the specs this futuristic smart office building.

Edge datacenters

In the near future, we will have 3 types of datacenters: the large centralized datacenters – small in number - to support Cloud applications, regional Edge datacenters and local Edge datacenters - huge in number but containing only about 10 racks. In the latter case, the Edge will support users interacting with smart buildings in a smart city using smart networks and smart electric grids. Knowing that some new buildings have 2 sensors per square meter, the Edge will gain importance rather sooner than later.

On the software side, edge native apps are developed besides Cloud apps using Blockchain. This technology perfectly fits in distributed computing and will also play a mayor role in the edge. VMWare is developing its software not only to virtualize servers on a datacenter level but on a Cloud level. One could call this Virtual Edgeware or Virtual Cloudware.

Since Edge datacenters are distributed, the user impact of losing one of these is small. Therefore, from a facilities point of view, Edge datacenters can be built less redundant – somewhere between Tier level 2 and 3 - because of their mazed topology. They will be small in size and containing about 8 to 12 racks. Some manufacturers already launch new products like HyperPODs (Physical Optimized Datacenters). These are a set of racks with a cold corridor provided with power and cooling distribution, ready to extend in a modular way.

A side effect of Edge datacenters is energy efficiency: since data are processed in the edge which is much closer to the user, data don't have to be transported further down the network and this saves power.

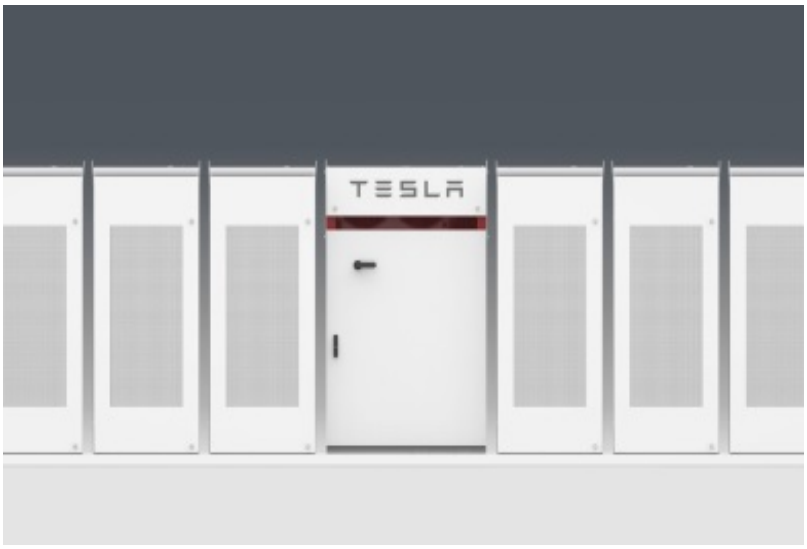
Next generation Internet

By 2020 the volume of IoT traffic is estimated to be 600 ZBytes per year, meaning 275 times larger than traffic done by humans.

Wired and wireless networks tend to converge.
So it becomes clear that for the future that the Internet - as we know it today - is becoming too slow for all this human and machine traffic. A next generation Internet is already being built.
A joint venture of Microsoft, Facebook and Telxius has put a new sea cable (called Marea) between the US and Europe. The initial capacity of this cable with current technologies is 160 Tbits per second. So no problem to stream 71 million high def videos at the same time.
Besides new cables, also a new architecture of the Internet is under construction in which the Edge and distributed computing will play a much larger role.
Data coming from an Oculus or other Virtual or Augmented Reality application is too large to be

transported to and handled by the Cloud. Human vision generates about 5,4 Gbit per second and if VR apps don't want you to make sick, then a 7 ms delay is the maximum to respect. Again, the processing of these data will need to be handled in the Edge instead of the Cloud.

Another innovation comes from Microsoft which is experimenting with fuel cells in its datacenters. These fuel cells are put in the datacenter above the racks to limit the distance between energy generation and consumption.



Energy storage with Tesla batteries in Californian datacenter

Datacenters whether they be Cloud or Edge still consume tons of energy night and day. Smart grids can help to supply them with as much renewable energy as possible. The only thing is that the sun doesn't shine at night and winds can blow at night but cannot be guaranteed to do that.
To reduce the CO2 footprint, we know solutions like storage of chilled water or ice in containers, heat storage by storing hot water in the ground. But the real next thing will be storage of renewable energy in batteries.

For that, a lot of means for innovation are going to R&D of battery storage. There are two immediate advantages: a set of batteries can replace a diesel generator (genset) and by connecting the batteries to a smart grid, they can be charged when renewable energy is available. To some extent, these batteries could also provide energy back to the smart grid or be used for peak shaving.

In California, a datacenter is using Tesla batteries instead of a genset to overcome power outages of the public grid. The battery capacity can range from 0,5 MW to several MW's and can handle temperatures between -15°C and +50°C. They deliver a peak load during 4h and a normal load during 6h. One set of batteries of 1 MW needs 100m². There is 15 year warranty but prices are 'on request'.

We will probably see battery farms arise in the near future supporting not only electrical cars but also smart grids and datacenters.

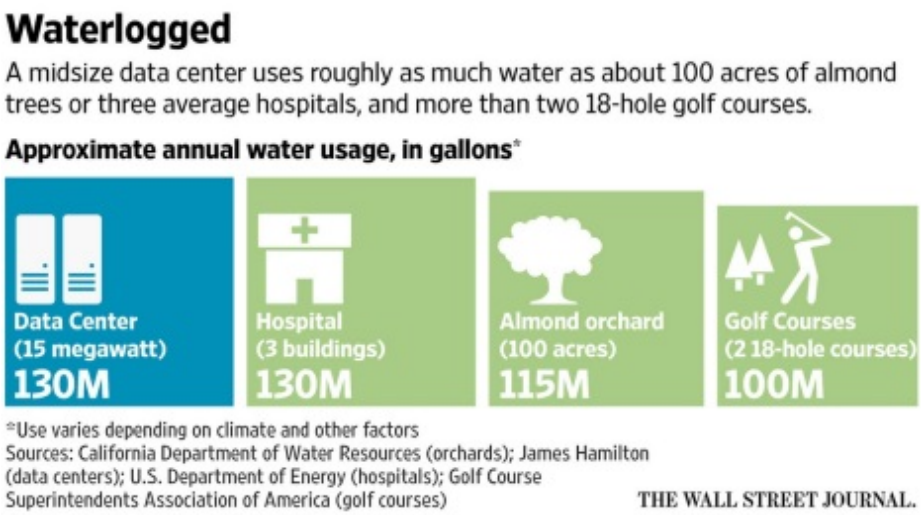
Facebook, Intel, Nokia, Microsoft, Google and many others still support the Open Compute project which aims at reimaging hardware, making it more efficient, scalable and flexible.

10th anniversary of the European Code of Conduct Data centres

In 2007 a group of people calculated the European datacenter consumption to be 56 TWh and estimated it to grow up to 104 TWh in 2017. Being aware of the impact on the environment and afraid of European legislation to come, some actors came up with a set of best practices to reduce energy consumption in datacenters called the European Code of Conduct on Datacenter

CODE OF CONDUCT
DATA CENTRES

Endorsers like Ingenium oblige themselves to apply these in their datacenter projects. Datacenter owners



applying this set of rules pay lower energy bills and hence, have a lower impact on the environment. So they must
not be convinced to become a Code of Conduct Participant. Free of charge to download. Just Google it.

This year, the code celebrates its 10th anniversary and we have come to version 8. So the code is still alive and kicking. In the meanwhile, large parts of this code are now part of CLC/TR 50600-99-1, EMAS and CENELEC standards.

PUE (Power Use Efficiency) has also been standardized as ISO/IEC 30134-2:2016.

The next thing the code is focusing on is on optimizing edge datacenters by turning down appliances and hence power and cooling, if they are not used.

Water Use Efficiency with grey water

Water may seem to be in abundance but in most countries, this is not the case. Besides energy, the next big wave to focus on will be the efficient use of water.

Nowadays, water is sold relatively cheap by the utilities but this may change in the near future.
In the PUE metric, water is no part of it although the production of clean water also costs a lot of energy. In some European countries, 12% of the power distributed by the grid is used for the production and distribution of water.

A metric called WUE Water Use Efficiency, was launched recently. More and more people are conscious that water will rise in cost and are already investigating how they can reduce the use of water. Not only production and distribution but also the treatment of waste water costs money and has to be paid by the (datacenter) user.

In India, some datacenters have been tested to work on grey water. The tests were successful and some cooling devices are working on grey water. Up to now, they didn't experience any negative effects like chemical degradation of machinery in contact with the grey water.

Short facts and figures on European datacenter