DCD

October/November 2017
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The MACHINE itself

The state of artificial intelligence in the data center

London withstands Brexit
The British capital remains a top colocation market

Olympus unveiled
Microsoft bets on open source hardware

Data center detectives
Getting to the root causes of failures

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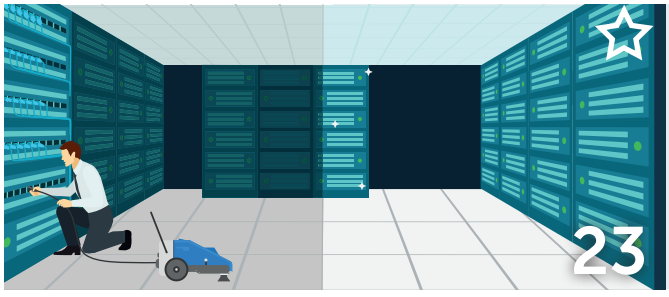

EDITOR'S PICK

Dirty data centers
What do corpses and metal whiskers have in common? Both can be a risk to a data center - unless you know how to keep your bits clean

From the Editor

Plenty of scope for human ingenuity

If AI and machine intelligence develops as rapidly as people suppose, my days writing these columns may be numbered. Enjoy my words while you can: some day soon, we could all be reading the thoughts of a bot.

Till AI takes the writers' jobs, *DCD* will keep probing the future needs and developments of data center technology - including the rise of intelligent systems.

In fact, Sebastian's rundown of intelligence in the racks (p16) is reassuring. Machines are picking tasks up quickly, but still definitely the junior partner.

And everything else in this issue owes it to human ingenuity.

When a data center goes wrong, someone needs to face the consequences

The edge is changing the way our networks reach users and devices - but our Dallas event heard that it's being rolled out before it is fully defined (p38).

Don't let anyone tell you edge can be solved by a standard set of products and services. It's a new world where new applications and new infrastructure collide with the traditional requirements of cost and reliability.

It's more networked and more automated than anything we've ever seen, and the standards and regulations are not there yet.

London can take it: The British capital is one of the top four colocation markets in the world, and home to *DCD*, but there are big questions over its future status. At our London Zettastructure event in November, Brexit will be high on the agenda.

Penny Jones of 451 Research (p28) says there's no immediate cause for concern. London has a well established business process along with plenty of capital and fiber. But as to the future, only time will tell.

Microsoft's Olympus makes a return visit to Zettastructure this year, so Max caught up with how much progress the open webscale hardware project has made in the past year (p31).

Microsoft has bet its cloud service on hardware designed by partners. Let's see how it turns out.

Data center detectives are there to probe the reasons for any failure (p32). When a data center goes wrong, someone needs to face the consequences, if only to make sure it doesn't happen again.

This is sadly becoming more important. In Texas, Houston's data centers rode out the floods and storms, but preparing for risks (p35) is just as important as recovering from disasters.

Dirt and dust could cause more damage than floods and hackers, Tanwen discovered (p23). Said dust could come from surprising sources including corpses and metal whiskers. Luckily, the tools are there to keep grit from destroying the hardware.

bit.ly/DCDmagazine

15%

The amount by which Google claims DeepMind's algorithm was able to cut its data centers' PUE

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DCD Global Editor

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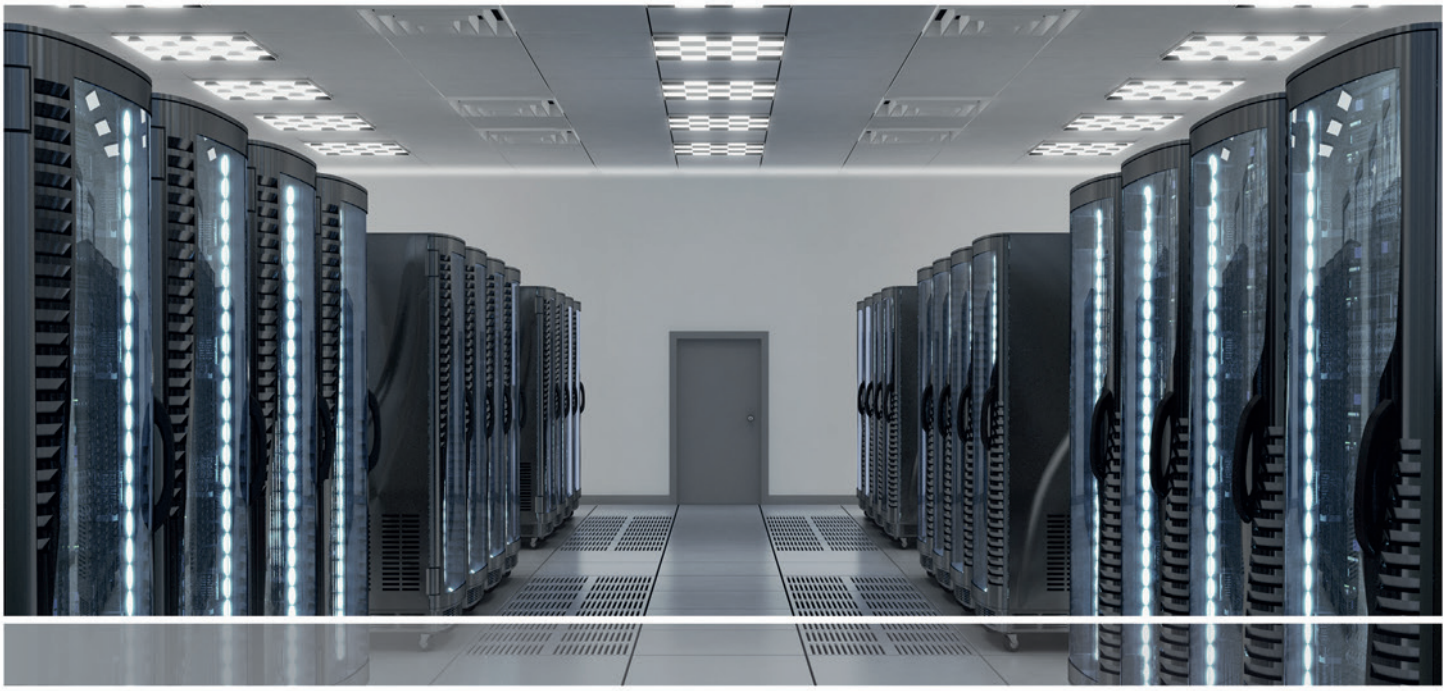

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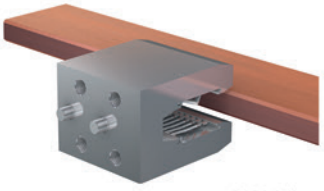

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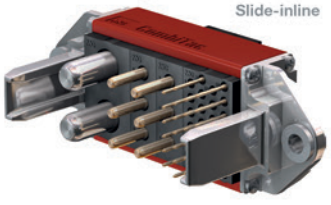

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White space

Data center news from around the world, right at your finger tips

A record-breaking six months for the US data center market

Investment in North American data centers reached an all-time high of $18.6bn in the first half of 2017, according to a study published by real estate specialist CBRE.

The analysis, which looked at how much was spent on data center assets, acquisitions, new builds, leases and wholesale contracts in the United States, found that in the past five years, the market has generated $45bn.

Asset sales alone amounted to $4.39bn in the first half of the year, the most significant of which was Equinix's purchase of a number of Verizon's data centers for $3.6bn.

The total of all acquisitions - not counting transactions where the parties involved did not wish to reveal their value - amounted to $13.77bn. The biggest acquisition to have taken place so far in 2017 was of course that of DuPont Fabros by Digital Realty for $7.6bn, followed by Cyxtera Technologies' (formerly BC Partners and Medina Capital) $2.8bn purchase of CenturyLink's data center portfolio.

In the whole of the US, 284MW of wholesale capacity was found to be under construction in the first half of the year, 131MW (46 percent) of which was already pre-leased.

Northern Virginia led with the most new data center projects, having seen 52MW of net capacity added in the first half of 2017. The state reached total capacity of 608MW - almost 400MW of which was made up of DuPont Fabros and Digital Realty sites - making it the biggest market in the country.

The second biggest, the Dallas/Fort Worth area, saw a 23MW net increase in data center capacity in H1, followed by Phoenix and Silicon Valley, where capacity grew by 14MW.

Vacancy rates were found to be lowest in Silicon Valley and Chicago, where competition for real estate is high.

Rental rates remained stagnant, however, as they have since 2015, with prices ranging between $125 and $145 per kW per month, a rate strongly affected by customer requirements. But total cost of ownership affected site selection more than rates.

bit.ly/therightindustrytobein

News in brief

Digital Realty completes $8bn DuPont Fabros merger
The merger between two massive data center operators is now complete.

FBI to open Idaho data center
The 25,000 sq ft facility will be built to Tier III standards by JE Dunn Construction, creating 350 jobs. It will open in 2019.

Hewlett Packard Enterprise plans 5,000 job cuts
The move comes as HPE struggles in the face of strong competition across its business.

Hyundai opens connected car data center in China
The Guizhou site will serve as the foundation for the company's China-focused Car Cloud.

Vantage sets its sights on Ashburn, plans 108MW data center campus
Vantage is planning a massive data center campus in Ashburn, Northern Virginia, the company's largest expansion to date, comprising five buildings spanning 1,000,000 sq ft (92,900 sq m) and costing $1bn.

Facebook plans $1bn data center in Virginia

Facebook is planning to build a $1 billion data center in eastern Henrico County, Virginia.

Governor Terry McAuliffe said that Facebook will spend $750 million on construction and $250 million on multiple solar farms.

"Working with companies like Facebook and many others, we are advancing Virginia's position as a global leader in the technology economy," McAuliffe said.

Switch raises $531.3 million in $17 per share IPO

US data center operator Switch has raised approximately $531.3 million in its Initial Public Offering - more than the company originally planned.

Switch announced its intentions to go public in September, aiming to price 31.3 million Class A shares at between $14 and $16 each, but ended up going for $17.

The IPO, the second largest American tech IPO of 2017 after Snap, gives the company a market value of $4.2 billion.

The company, Switch Inc, plans to use the new cash infusion to buy out investors in Switch Ltd and take control of it as a holding company.

CEO and founder Rob Roy will maintain control, using a multi-class share structure where his have 10 times the voting rights of common shares.

bit.ly/agooddayforswitch

Switch rings the bell
Source: NYSE

Microsoft Azure outage caused by fire suppression accident

An unexpected release of inert fire suppression gas during routine maintenance at one of Microsoft's European data centers set off a series of unfortunate events, causing a seven-hour outage.

On its Azure report page, Microsoft explained that after the gas was released, it caused the Air Handler Units to automatically cease operations, which in turn led to the ambient temperature rising - which then caused some systems to automatically shutdown.

The outage meant that some North European Azure customers had issues connecting to, or managing, their cloud resources between 13:27 and 20:15 UTC on 29 September.

"During a routine periodic fire suppression system maintenance, an unexpected release of inert fire suppression agent occurred. When suppression was triggered, it initiated the automatic shutdown of Air Handler Units (AHU) as designed for containment and safety. While conditions in the data center were being reaffirmed and AHUs were being restarted, the ambient temperature in isolated areas of the impacted suppression zone rose above normal operational parameters," the company reported.

"Some systems in the impacted zone performed auto shutdowns or reboots triggered by internal thermal health monitoring to prevent overheating of those systems. The triggering of inert fire suppression was immediately known, and in the following 35 minutes, all AHUs were recovered and ambient temperatures had returned to normal operational levels."

Microsoft continued: "Due to the nature of the above event and variance in thermal conditions in isolated areas of the impacted suppression zone, some servers and storage resources did not shutdown in a controlled manner. As a result, additional time was required to troubleshoot and recover the impacted resources."

bit.ly/accidentalgasrelease

Vox Box

Peter Gross
Vice President
Bloom Energy

Why should we be excited about distributed power generation?
If you look at the entire utility infrastructure, there are major concerns at every level. If you remember events like Katrina, Sandy, Fukushima, etc; if you consider the risk of cyber threats directly addressing the utility infrastructure - it's all raising interest in distributed generation. Data centers are so dependent on power that companies are trying to get more of a control of their power destiny.

bit.ly/energysgrossprofits

David Murray
President
Hydro-Québec Distribution

Should data center location scouts look to Quebec?
We want to attract data centers to Montreal and the Quebec province, and we have some major players coming in now due to the temperature and energy rates.
We want to be the one-stop-shop for these people - the demand is just ramping up, so we're trying to meet the timing that customers demand.

bit.ly/energyinthenorth

One Belt One Net: Singapore magnate plans $5bn data center company

Singaporean billionaire Oei Hong Leong has revealed plans for a US$5 billion (S$6.7bn) data center business, One Belt One Net.

As the name suggests, the company aims to take advantage of China's One Belt One Road initiative, a vast, multi-trillion dollar infrastructure project spanning some 60 countries.

"Over the past decade, in the field of artificial intelligence, electronic payment and other high-tech areas, Singapore is not really in the leading position," Oei said. "Now in the big data age, to catch up and to lead is imperative."

He continued: "The large-scale data warehousing company will be beneficial to attract the world's science and technology investment funds and start-up companies inflowing to Singapore and being concentrated in Singapore, so that Singapore will become a new information technology center and investment center."

It remains unclear how the new company will raise funds - Oei is himself worth $1.36bn, according to *Forbes* - but Oei said that money raised will primarily be spent on building facilities, procuring machinery, equipment and cloud computing services and software, as well as employee recruitment and training.

Oei hopes that One Belt One Net could "tremendously improve" the Singapore Exchange (SGX), adding: "It may create listed companies such as Tencent and Meitu, which are social media gaming companies and artificial intelligence companies. It will improve the stock's activeness and gradually bring the emerging industries of science and technology into the companies listed in SGX.

"This type of changes is very meaningful and positive."

The One Belt One Road initiative primarily connects Asia and Europe - with Oceania and East Africa also included. It is expected to cost between $4 trillion and $8 trillion.

bit.ly/onebelttorulethemall

Peter's Alibaba factoid

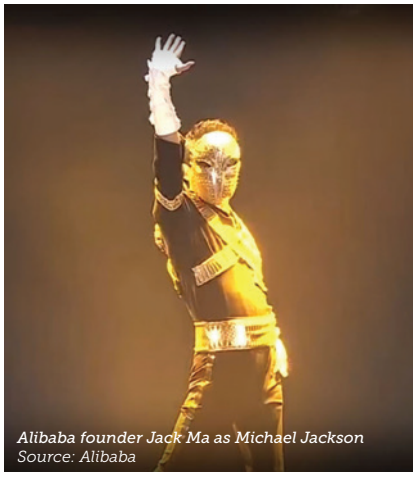
Every November 11, Alibaba holds 'Singles' Day,' the largest shopping event in the world - last year saw sales hit $18bn

Alibaba plans second European data center

Chinese e-commerce giant Alibaba is debating where to locate its second European data center, as it tries to expand its cloud services outside of mainland China.

Leading the pack are London, UK and an unnamed city in Sweden, Lin Luo, Alibaba's deputy director for international government and public affairs, told *Bloomberg*. Alibaba opened its first European data center in Frankfurt in November 2016, in partnership with Vodafone.

bit.ly/jackmasmoves



Alibaba founder Jack Ma as Michael Jackson
Source: Alibaba

Microsoft buys 64.5 acres of Silicon Valley land as it considers large data center

Microsoft has has bought 64.5 acres of land along State Route 237 in San Jose, the 'Capital of Silicon Valley' in California.

The company has two potential uses for the $73.2 million acquisition on file with the city of San Jose: either to build a four-story 49.5MW data center there, or to use it for light industrial development. 'Option 1' proposes 1.2 million square feet (111,483 sq m) of light industrial development, and 'Option 2' would build a 436,880 square foot (40,587 sq m), 49.5MW data center with a PG&E substation, accompanied by 728,000 square feet (67,633 sq m) of light industrial development.

"We continuously explore opportunities to meet the needs of a future based on cloud computing and Internet services, so we're thrilled to find a great one in the heart of Silicon Valley," Christian Belady, GM of Microsoft Cloud Infrastructure and Operations, told *Mercury News*, who were first to report on the purchase.

County documents reveal the data center proposal would construct a four story facility, which would be completed by 2020.

The facility would have a power usage effectiveness (PUE) of 1.2, and would be LEED Gold certified, allowing it to meet environmental regulations.

Despite being home to some of the world's largest technology companies, Silicon Valley has relatively few data centers, due to a lack of new building opportunities in an area where land is much contested.

bit.ly/datacentervalley

Ireland's state energy company dubs "power-hungry" data centers a risk

Ireland's 95 percent state-owned Electricity Supply Board has highlighted the risks presented by a huge number of new data center projects that will tax its infrastructure.

In its interim financial statement for the six months to the end of June 2017, it called the issue a "principal risk" for the company.

When asked to clarify by Ireland's *Sunday Independent*, a company spokesperson said that "the planning applications in place for power-hungry data centers" pose some challenges for ESB Networks.

"To put it into context, the current load in Dublin is around 1,200 mega volt amps (MVA), which has grown over the last 90 years, and there is about 1,400 MVA in data center applications and enquiries in train.

"This level of demand growth is unprecedented and would almost double the demand in Dublin over a five-year period," the spokesperson said.

In an effort to deal with this growth, ESB is building two new 220kV power stations to add to its existing five stations, including one at Grange Castle, West Dublin.

bit.ly/powerpoor

Luxembourg government forces potato farmer to sell land to Google

The last hold-out in a land sale to Google has relented after the Government of Luxembourg threatened to take his potato farm anyway, paving the way for the search giant to proceed with a €1bn data center.

Google has looked to build in the nation for some time, in what would be the biggest investment in Luxembourg's history, but struggled to find land - ultimately warning it would pull out if the government didn't help.

Deputy prime minister Etienne Schneider told the *Financial Times* that a small plot of potato farmland near Bissen, in central Luxembourg, almost led to the deal falling through.

The plot belonged to three brothers, two of which were happy to sell, but one was apparently estranged and didn't want to engage in the deal.

Schneider told the paper: "The problem was not the price for the potato farmer... There was a party of three that inherited the land from their parents but they didn't talk to each other - one didn't talk to the other two.

"The two wanted to sell it and the one didn't." He continued: "I decided as a minister that we'd buy the two-thirds and there is a law that allows you to get the third out of it. He accepted to sell instead."

Google had already agreed on the price "because we're negotiating since the beginning of the year," Schneider said.

"They said what I need to do is get the land. Now it's their turn to decide to do the investment."

Despite Schneider's frequent conversations with the press, Google has yet to confirm it is even interested in Luxembourg, let alone planning the €1 billion ($1.14 bn) data center the politician has promised.

Elsewhere in Europe, Google operates data centers in the Netherlands, Ireland, Finland, Belgium, Germany and the UK.

In Denmark, it spent 65m Danish Kroner (then-US$9.86m) earlier this year on a 73.2 hectare plot of land that could potentially be used for a data center.

bit.ly/thestarchreality

Virtus plans "London's largest" data center campus

British retail and wholesale colocation provider Virtus, a subsidiary of ST Telemedia Global Data Centres, is set to launch two facilities in London, hoping to create the city's largest data center campus.

The new facilities will bring Virtus' total load capacity to 100MW across six sites, with an approximate 50MW of power supply for further expansion.

The campus will be located on an eight-acre site in Stockley Park, along the main fiber route joining data center hubs of Slough and London. It will comprise two buildings totaling 34,475 sq m (371,085 sq ft) including 17,000 sq m (182,980 sq ft) of technical space, with additional room for offices.

Space is currently being fitted out in the first facility, London5, for customers having already signed contracts with the company.

To satisfy capacity requirements, Virtus has reached an agreement to supply the campus with an additional 110MVA of incoming power from multiple connection points on the grid.

bit.ly/brexitwhatbrexit

Aurora to become the first US exascale supercomputer, coming 2021

Intel and Cray are set to build the United States' first exascale supercomputer at the Argonne National Laboratory, with a target delivery date of 2021.

'Aurora' was originally set to be released in 2018 as a 180 petaflop pre-exascale project, but it appears the two companies were struggling to meet the deadline. Instead, the contract has been extended by three years and the target capability expanded to 1,000 petaflops (1 exaflop).

The original plan for Aurora was to be based on a Cray Shasta system featuring the upcoming Knights Hill processor, but it is not known whether the exascale system will use the same building blocks.

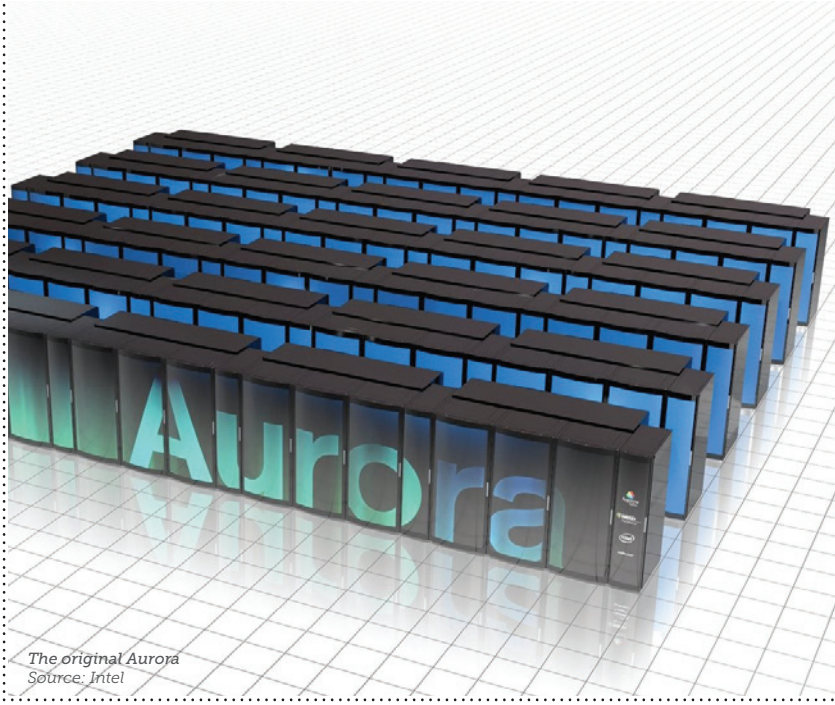
Sources told *The Next Platform* that the architecture is less a novel approach to computing - like quantum computing or neuromorphic chips - and more of a "reimagined" way to design chips.

HPC Wire reported that a number of people at the Department of Energy were not pleased with Intel as the prime contractor and Cray as the subcontractor.

The partners were expected to miss their target next year, with the scientific community said to have been counting on its delivery. Canceling the project or opening it up to new bidders would have caused even more delays.

The pre-exascale version was announced alongside the 'Summit' supercomputer from IBM, Nvidia and Mellanox, a ~200 petaflop system that could become the world's most powerful supercomputer when it launches in early 2019.

bit.ly/americafirstatsomething



The original Aurora
Source: Intel

Peter's supercomputer factoid

The fastest supercomputer in the world is currently China's Sunway TaihuLight HPC system, which has a LINPACK benchmark rating of 93 petaflops

AWS to open Middle East data centers by early 2019

Amazon Web Services plans to open a local region in the Middle East by early 2019, launching three 'availability zones' (otherwise known as data centers) in Bahrain.

The company will also launch an AWS Edge Network Location in the United Arab Emirates in the first quarter of 2018, likely in a third-party data center, to handle its CDN CloudFront.

"As countries in the Middle East look to transform their economies for generations to come, technology will play a major role, and the cloud will be in the middle of that transformation," Andy Jassy, AWS CEO, said.

"Some of the most gratifying parts of operating AWS over the last 11 years have been helping thousands of new companies get started, empowering large enterprises to reinvent their customer experiences, and allowing governments and academic institutions to innovate for citizens again. We look forward to making this happen across the Middle East."

H.E. Khalid Al Rumaihi, chief executive of the Bahrain Economic Development Board, added: "AWS' commitment to expanding its presence into the Middle East and North Africa region, from Bahrain, is a major enabler for technology and data-driven business across the GCC.

"The ability to store and share data at speeds the Gulf has never experienced before has the potential to help companies gain competitive advantage, allowing them to compete more effectively at a global level."

Bahrain's Information and eGovernment Authority plans to adopt AWS for its entire operation, migrating 700 servers to the cloud and decommissioning its existing infrastructure.

According to Amazon, the announcement was welcomed by political leaders and royal families in the Gulf Cooperation Council (GCC) states, each of which have their own modernization initiatives.

bit.ly/eastboundandup

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Data protection at the edge in Turkey DCD>Turkey Istanbul

Dec 5 2017 // **Wyndham Grand Levent**

New data protection legislation has led to a surge in data center building within Turkey - which has intensified this year thanks to government incentives for energy and networking. The President of the Turkish Personal Data Protection Authority will describe how the regional data center sector will develop, backed by speakers from banks and service providers.

dcd.events/conferences/turkey

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The MACHINE itself

As data centers become living brains, is the role of the human diminished? *Sebastian Moss* investigates

Sebastian Moss
Human Reporter

Machine learning, a subset of artificial intelligence, is about to transform everything - if you believe breathless reports from the government and in the media. It will change or replace the workforce, create new businesses, and revolutionize existing industries with new innovations, strategies and dangers.

Data centers are standing by to provide a home where those AI systems will be trained and run. But how will the algorithms transform the data centers themselves? Machine learning promises to unlock efficiencies, but that will mean handing over control to the machines. Are we ready for that?

"You can call it AI, you can call it machine learning, you can call it different names - but at the end of the day what you're trying to do is predict a future outcome based on past data," IBM's VP of analytics development, Dinesh Nirmal, told *DCD*.

The tech giant turned to its largest enterprise customers with their own private data centers, and asked them what they hoped to achieve with this ability to peer into the future. "The two main things that came out of it were improved uptime and efficiency," Nirmal said.

With that desire in mind, data center predictive analytics company Romonet last year updated its offering to include new machine learning capabilities.

"The current machine learning aspects are at the initial data processing stage of the platform where raw data from sensors and meters is normalized, cleaned, validated and labeled prior to being fed into the predictive modeling engine," Zahl Limbuwala, Romonet's co-founder, said.

"The biggest improvement for customers is an unparalleled ability to see what exactly is going on in their data centers."

With data being produced by all kinds of instrumentation systems - electrical power management systems (EPMS), data center infrastructure management systems (DCIMs), branch circuit monitoring systems (BCMs), environmental monitoring systems, building management systems (BMS) sensors, the BMS itself, and more - Limbuwala said that facility operators can suffer 'snow blindness' from the information overload.

The machine learning platform improves the 'signal-to-noise' ratio to such an extent, he said, that: "We [and our customers] often find surprises within the way their data centers are running."

DCIM company Vigilent also hopes to use machine learning to discover surprises within data centers, having embraced the technology more than eight years ago. The company uses machine learning to make predictions and then uses those predictive capabilities to "take actions automatically," Vigilent's founder and CTO, Dr Cliff Federspiel, told *DCD*.

"Some DCIM systems have the ability to use tools like computational fluid dynamics on the thermal side for making certain kinds of forecasts, but as far as I know, there isn't really a whole lot of data-oriented decision-making capabilities in DCIM systems, and in particular there aren't ones where the decision-making is automated."

After Vigilent sets the system up in a data center, it usually spends a week monitoring the facility. Then automation is turned on, and the customer measures the difference "to get an idea of what the system is doing for them from the point of energy savings. Then, over time, the system automatically makes changes to the state of various types of cooling equipment, temperature set points, flow rates and things like that."

Vigilent claims that facilities usually see a 35 percent reduction in the energy spent on cooling, but have had "some dramatic examples where it's been as high as 75 percent, particularly in market sectors that are very conservative and have an extreme level of redundancy," Dr Federspiel said.

"If they don't have a smart system, they often just run everything, no matter what, no matter how much overcapacity they have. So in cases where the customer either has a very low load, or they're very conservative, they end up just using a lot more power than they need to to keep the environment right."

Intelligently managing capacity is an area where machine learning can come to the fore. In the case of Tegile, the hybrid storage vendor has begun to use a cloud-based predictive analytics engine, IntelliCare, to monitor and manage its flash arrays.

"Today we collect data from all our 3,000+ arrays every hour," Tegile CEO Rohit Kshetrapal said. "As we collect the data every hour, this allows us to predict three things - component failure, performance and balancing of the array.

"We can also tell you a year in advance when you're going to run out of space."

Ilia Zintchenko, CEO of Mindi, also hopes to predict performance, failures and more with the help of AI. His London-based company has operated in stealth mode since being established over a year ago, and has huge plans for its AI system, 'Autopilot.'

"What we're building is an AI-based framework to provide what we call 'anti-fragility' to IT environments," Zintchenko told *DCD* in the company's first interview with the press.

"So basically minimizing the effects of unexpected events - whether that's predicting them or reducing the number, or alleviating them altogether. Those events could be hypervisor failures, software failures, hardware failures, power outages, cooling system problems, security breaches, general resource contention and so on."

Initially, though, Mindi is aiming to deal with resource contention: "When you have multiple workloads running on the same servers, what usually happens is the 'noisy neighbor' problem - one piece of workload starts to use all the bandwidth on the server, or all the I/O or CPU, and that really slows down all the other workloads.

"What our software does is predict the resource demands of applications running in a data center and then use live migration to actually move that around the computing environment in real time to minimize these resource contention problems."

> "Humans aren't very scalable - particularly skilled and experienced people"
>
> **Zahl Limbuwala**

Looking further, Mindi hopes to optimize data center server utilization, since many enterprise facilities regularly operate at just 20 percent utilization. "In that case you can start to actually play around with the voltage and frequency of the CPU, memory, the GPU, the motherboard and so on to really drastically reduce the power consumption without actually affecting performance too much, simply because 80 percent of the CPU is not used anyway," Zintchenko said.

"But if you are making use of the servers in a better way, you have a lot more money and footprint to save by reducing the number of servers by, let's say, 30 percent, rather than just reducing the power by 30 percent."

Intelligently balancing tasks can not only reduce the number of servers needed, but also the energy costs, a joint research initiative by scientists from Northwestern University and the Argonne National Laboratory uncovered.

"We found that for different machines, even with [the] same power setup, they have variations in power consumption and temperature," Northwestern PhD student Kaicheng Zhang said. ▶

▶ "So this difference and variation can be exploited intuitively by putting high demand applications on cooler nodes, and low-demand applications on hotter nodes, to balance the peak temperature and improve performance," Zhang continued.

The team then tested this 'COOLR' concept on Chameleon, the US National Science Foundation's cloud computing testbed, reducing fan power consumption by 17 percent. But the group aims to test it out on a larger system, Professor Seda Memik, of the computer engineering division at Northwestern, said. "In this case, the machine learning algorithm shines when the system goes large scale and it's harder to use human knowledge."

But with human knowledge called into question, so is the species' usefulness in the data center.

"Humans aren't very scalable - particularly skilled and experienced people," Romonet's Limbuwala told *DCD*.

"Automation and data driven systems, standardization, robotics, et cetera will eventually reduce the need for many skilled humans to be physically present at a data center site."

Vigilent's Dr Federspiel concurred: "There's already not that many people in a data center. One of our big markets is telecoms, and they have thousands of buildings, many of which are run as 'lights out' and have been for a long time."

But Ian Dixon, vice president of operations at colocation company Colt, had doubts over whether AI is ready to take over from humans just yet.

"We tend to operate with automation providing information and humans providing interpretation and action. I think we can get more intelligent data, but at the moment I'm not a big fan of the data center taking control of itself," he said.

Talking to *DCD* at a Colt facility just outside of London, Dixon gestured at the surrounding servers: "Look at the complexity of the technology on this site, it's the same as on a microchip, just a bit bigger. There's so much interconnectivity and so much information, but it's not made by one vendor, it's made by multiple vendors."

For Colt, the priority right now is ensuring the company gets information from the systems in terms of condition-based maintenance.

"That to me is the way we should be going, but you need rich information to do that. We need improved alarming from systems, improved information, improved correlation of alarming and so on," Dixon said.

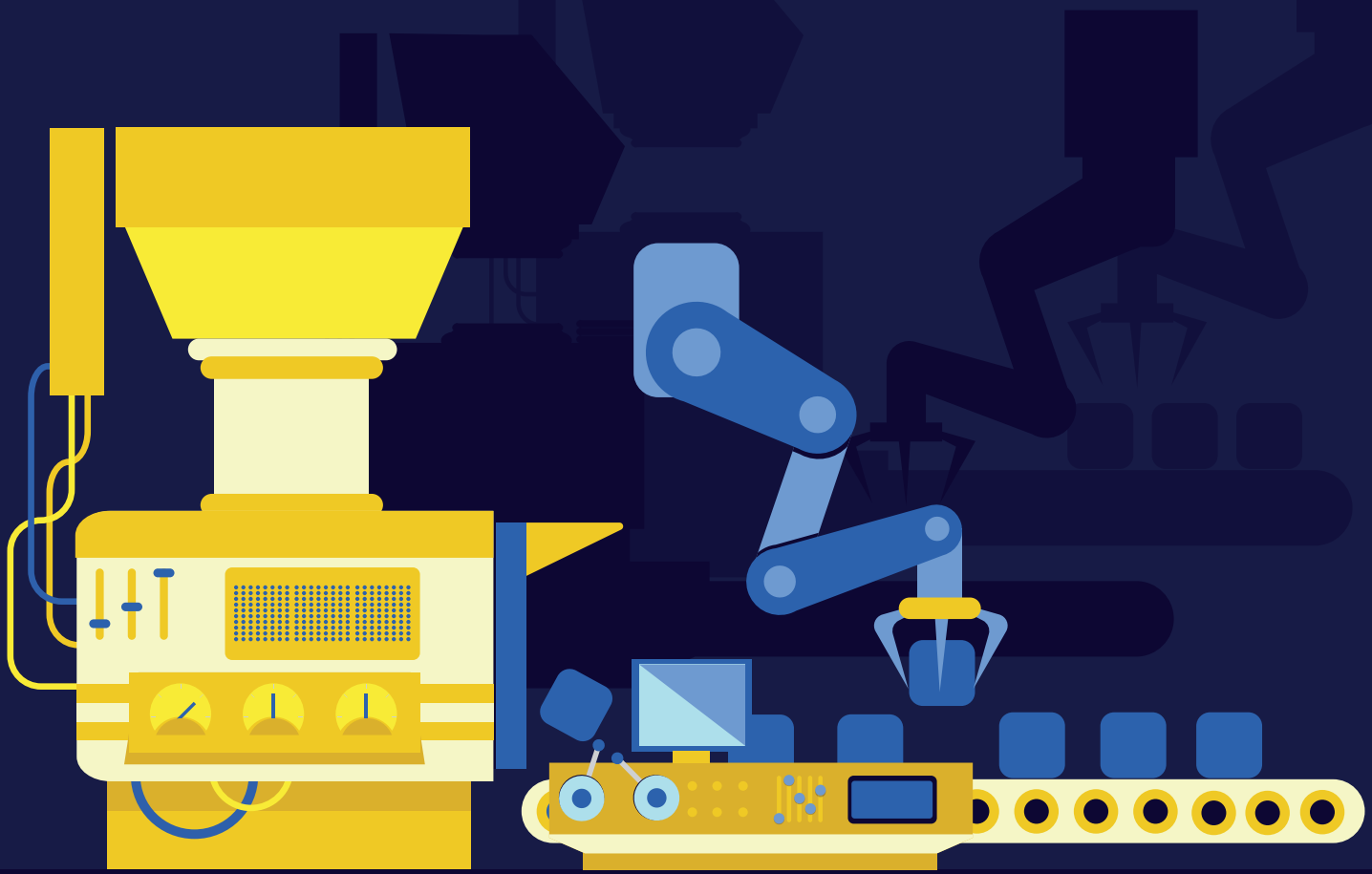
"In terms of intervention, I'm still sitting on the camp of 'I want a human pushing that button.' We've still got manned sites and I see that for a few years yet."

Dr Federspiel understood the trepidation: "When we were getting the company going, there was a lot of apprehension about letting an AI operate your data center, so we offered a recommendation system as well as the automation one."

Vigilent's VP Bob Thronson added: "We have over 500 data centers and telecom exchanges we're currently deployed in globally - virtually all of those use the automatic control system."

For IBM's Nirmal and his survey of large customers, there's only one long-term objective: "How do you make self-managing, self-healing and self-optimizing data centers? That's the goal that every data center is aspiring to."

And, perhaps in that future, all that will be left is the machine itself. ●



Voice of Vlad

Our in-house IT genius *Vlad-Gabriel Anghel* explains how to tell AI, ML and DL apart

Often used interchangeably, artificial intelligence, machine learning and deep learning are terms that can be seen everywhere. But what is what? While the point IBM's Dinesh Nirmal makes in the article is true - AI, ML and DL work towards the same goal of predicting future outcomes based on past data, they are not exactly the same.

The easiest way to visualize this would be a set of Russian nesting dolls. Artificial Intelligence represents the first doll and it's the one you see when approaching the concept today. AI as a research field began back in 1956 at a Dartmouth College workshop where attendees thought that a machine as intelligent as a human would be achievable within the next generation. It was not long before they realized that computer hardware limitations would stretch that timeline far beyond their initial expectations.

The second doll is Machine Learning. At its core it represents the practice of parsing data using algorithms, learning from it and trying to predict or decide a future outcome on a real-world problem. Currently it gets the most attention from all the subsets of AI as it looks to be the most promising form of AI for businesses. Successful machine learning systems can make predictions about an outcome and learn to recognize patterns on their own. IBM's Deep Blue win over Garry Kasparov in 1997 was achieved using hard coded rules and was dependent on programming. As such it does not qualify as an ML system.

The third doll is Deep Learning. A somewhat newer term when talking AI, deep learning is a branch of machine learning that models high level abstractions in data using a deep graph with many processing layers. One example would be the AlphaGo project from Google's DeepMind division. It uses a tree search algorithm to find the best possible moves at any given time. The software determines if it is a good or a bad move based on millions of hours of play time that it has been trained on.

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Max Smolaks
News Editor

Mesosphere is building a single OS to run dozens of data centers

Mesosphere is building a single OS to run dozens of data centers.

In 2009, a group of PhD students from the Reliable, Adaptive and Distributed systems Laboratory (RAD Lab) at the University of California, Berkley, developed a software platform for management of computer clusters.

This platform aimed to solve a single challenge: how to make the most of limited data center resources like compute, memory and storage, avoid overprovisioning and yet ensure reliable operation of all applications and workloads.

In 2010, it was accepted as an Apache Incubator project under the name Apache Mesos, and today, it is used by the world's largest online platforms including Twitter, Netflix and eBay.

Mesosphere Inc was co-founded in 2013 by Benjamin Hindman, one of the original creators of the Apache Mesos project, to commercialize the open source technology and make it accessible for organizations that haven't reached the size – and levels of expertise – of Uber or Airbnb.

Mesosphere took the core of Mesos and built the Data Center Operating System, or DC/OS, integrating a wide variety of open source projects along the way. "You can compare DC/OS to the platform that runs Amazon Web Services, minus the Infrastructure-as-a-Service layer," Hindman told *DCD*.

DC/OS uses the features of Linux to abstract server resources, pool them, and apply them in the most efficient way possible: it's an intelligent overlay that can be used to manage your traditional IT with its virtual machines, and now, application containers. "The really exciting news about version 1.10 is it features Kubernetes. It's one of the easiest ways to install and manage Kubernetes in your data center," Hindman said.

Back in the days when Mesos began, there was no Kubernetes, and there was no Docker, so the team had to create their own container orchestration system called Marathon. It was written in Scala, and relied heavily on the properties of Java virtual machines. Later, Marathon was taught to orchestrate with Docker, and with version 1.10, Mesosphere can finally support all of the popular container frameworks.

"You no longer have to make a choice when it comes to the orchestrator, you no longer have to make a choice when it comes to the platform, and you can choose any

cloud you want and move between them, so you will never get locked in."

And if it looks like Mesosphere are collecting open source projects like they are trading game cards, you're not far off the mark. "We probably have about 100 open source distributed systems that we have enabled on DC/OS today," Hindman said. "When I worked with Airbnb, it took three weeks to get [Apache] Kafka up and running, and production-ready. Now with DC/OS, we have codified the learnings; we have essentially taken the *O'Reilly* books for these projects, and put the operational knowledge described in these books in the code.

"And this code enables Kafka to run in production today for a quarter of the Fortune 50, two out of three of the world's largest car makers, five out of ten largest North American banks and many other customers, including the government. They all rely on our data services so they have the ultimate freedom of choice when it comes to cloud; they can still leverage cloud, get more flexibility and cost control, but more importantly, they get access to the latest and greatest, production-proven open source distributed systems."

Hindman believes that the future of data centers will be defined at the edge, not the core, so the role of distributed software systems will become increasingly important.

"Edge computing is becoming much bigger, and it has nothing to do with your home sensors - it's more about the autonomy of cars and 5G. A connected car today produces about four terabytes of data for every eight hours of driving. That data needs to be stored and analyzed somewhere. Is all of this data going into an Amazon data center? Probably not.

"We've seen companies building up data centers at the edge that can run some of these computations on subsets of data. And it's very convenient if the APIs are the same as the ones that are running in a centralized data center – and that's what our software allows you to do." ●

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DIRTY DATA CENTERS

Tanwen Dawn-Hiscox
Reporter

The particulates know what you did last summer, and they're coming for you, warns *Tanwen Dawn-Hiscox*

Technical cleaning is unlikely to be at the top of any data center operator's priority list. If it's there at all, it's probably only grudgingly so.

That's not to say that, over time, the industry has learnt nothing: providers realized early on that contaminants in the air would damage IT hardware, that static-producing carpets had no place in a server room, and cables belonged in subfloors. They also realized that restricting access to data centers was a good idea for cleanliness - as well as security.

But even now, being meticulous is not a given: data center operators wanting to skimp on costs have been known to reduce the frequency of their cleans to a bare minimum.

And while most people's attitudes have matured, said Mike Meyer, director of ABM Solutions' data center maintenance business, contaminants are still making their way into data centers. Best practice can remedy this, he told *DCD*, but some operators still tend to cut a few corners here and there.

So what contaminants affect data centers? Particulates as small as half a micron (a millionth of a meter, or 1/400,000 of an inch), can damage servers, storage and networking equipment by causing them to overheat and short circuit.

These particulates can come from anywhere, from a visitor's shoe soles to fragments eroded from the inside of air conditioning ducts or data hall walls, or dust from packaged items unwrapped inside the data center.

Tim Gentle, the general manager of technical cleaning company Australian IT Services, also regularly finds errant insects and lost critters that roam - or have ceased to roam - under the raised floors when on a job.

Another, perhaps less common source of damaging particulates are zinc whiskers.

Zinc whiskers are fluff-like accumulations of micron-sized elemental zinc that grow on electroplated surfaces. They develop spontaneously when zinc atoms separate from the steel, pushing the coating away from the surface at a rate of 250 microns a year. Zinc is a good conductor, so when whiskers reach 500 microns, they become a threat to microcircuits, causing short circuits, voltage variances and signal disturbances.

Most commonly, they grow under older raised floors, whose underside is made of steel galvanized or electroplated with zinc to avoid rusting or oxidation.

Many data centers have removed their zinc coated raised floors, but zinc whiskers can still enter through other means, such as zinc coated cable baskets, nuts, bolts, steel conduits and metal railings.

ABM Solutions told us of 30 to 40 zinc whisker cleaning projects it had done in the last eight years. Recently, one customer reported 142 power failures caused by the metal particulates.

As the industry has learnt about whiskers and other issues, cleanliness has become part of the design process. Modular data centers, for example, are typically well sealed to keep contaminants out.

However, other considerations like operating costs and energy efficiency can worsen things rather than improve them. For instance, free cooling saves energy by using outside air to remove heat, but it means the data center is more prone to ingest particulates ▶

from the outside world. Examples of this include: sea salt from marine air, dust from leaves in the autumn, industrial pollutants hanging in the air, et cetera.

One source of contamination took ABM Solutions' staff by surprise. Technicians at a Dutch facility had been tackling air quality problems for some time, but could not identify the cause - until they realized what their neighbors were introducing into the air.

"It was actually human remains," said Meyer. "There was a crematorium across the road. [The operators] thought they had the best filtration in the world, but their design allowed for fresh air, and what they were bringing in wasn't fresh air, it was from the crematorium."

Something similar, albeit less morbid, happened to Microsoft at its data center in upstate New York, according to Meyer: "They had all the filtration they could possibly think of, but then someone had a fire in a field and [Microsoft] had smoke coming into their data center. It's not your typical contamination, but it is contamination and a result of fresh air cooling. Fortunately enough, they just powered off their data center because they are who they are and they've got resilience built in."

The process of cleaning a data center involves air quality testing, decontaminating access floors and subfloors (not to mention ceilings and walls), micro-vacuuming and anti-statically wiping components, cables and the internals of equipment before they are installed in a facility.

But all this work is pointless unless airflow is taken into account, Meyer told us, because changes can disturb dust which has settled and been forgotten: "You have all this dust settled in one corner of your data center, and you don't clean the subfloors, so it's spick and span on the surface, but then you go and look under the floor panel in the corner, and you've changed a year of airflow dynamics underneath that floor. It's used to following a path and all it does is redistributes all that settled dirt. It's like the erosion of a river: with more water coming down it just erodes the sides of the bank, and that's exactly what happens with airflow."

For Gentle, data center cleaning is procedural. It takes specialized equipment, but also specialized knowledge, like how to clean a CRAC unit without bringing any water into the room, or how to lift a tile properly, how to clean DRUPS and UPS routes, and what security concerns to consider.

And even with the best of intentions, cleaning can sometimes cause more harm than just letting things be - by disrupting airflows, wetting technical rooms, or tarnishing the air quality with polish and vinyl when buffing the floor in an uncontrolled environment.

Thus, it's a mistake to call in generalist contractors for a clean before a facility is handed over, says Meyer: "They don't appreciate the difference in requirements.

"Construction companies are falling short by using generalist cleaners and thinking they're cleaning to a high standard, but if you start putting a particulate count machine in there, you start measuring air quality at .5 micron."

Despite this, it is hard to tell whether dirt is a major cause of downtime, he says, because the industry keeps failures quiet. Manufacturers, though, have adapted their guidelines to stipulate how to clean their hardware and to what standard and, for Meyer, this is proof that contaminants and downtime are directly correlated: "It's quite a secretive industry, so even if there's been a failure due to lack of maintenance, they very rarely publicize the cause. You'll hear a server went down and some connectivity was lost on their mobile provider or something like that, and it'll be down to a hardware error or a hardware failure.

"The maintenance company is a long way down the chain, and the information goes back to the hardware vendors and original equipment manufacturers (OEMs) - and now the OEMs have written their specifications down into their site. So as far as being related to specific failures, we don't have any exact information, but we know that it happens."

Thankfully, it's not all doom, gloom and corpses clogging up servers. The data center industry is booming - and so is technical cleaning.

For Gentle, increased competition means that operators care about keeping their facilities pristine: "particularly in the colocation area, they want data centers to sparkle because they're are all looking for market share and a lot of presentation is about looking at how you care for your client's precious stuff," he said.

In Meyer's experience, it is still a work in progress. Some medium sized companies are reluctant to pay the cost of cleaning their data centers properly, but most operators do understand the need for regular cleaning. What really stands in the way of perfection is both a lack of awareness and an absence of legally enforced standards.

Manufacturers and customers typically rely on the ISO Standard 14644-1 Class 8 for cleanroom and associated controlled environments - an air cleanliness classification which rates a facility according to how many particles of specific sizes exist per cubic meter. In this case, particulate matter measuring .5 microns must not exceed 3,520,000 per cubic meter.

"So what we're starting to do is educate the market through the data center alliance as well as briefings and networking events and so forth, and I think we've had quite a good uptake. We've also been working with end users and tenants, especially in the colo industry, to actually start asking for these services in their SLAs," Meyer said.

"We find that a lot of it is client driven initially. The industry is forcing colo operators that didn't want to clean. They are quite apprehensive initially, they feel that it's an expensive, unnecessary service - but once we're actually cleaning we see our services upscaling and they don't tend to doubt us anymore."

Companies like ABM Solutions and Australian IT Services hope that through extensive staff training programs and "educating the market," consistent cleanliness in the data center is possible, and that dirty downtime will become a thing of the past.

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Sify's propositions to the DC demand market are multi-pronged. It has recognized that the data center is no longer a standalone entity. Instead, it now brings parallel demands of robust connectivity and security. In short, it is not just the DC stack but the connected entity that attracts customers

In today's hyper-connected world, the global business environment is changing at warp speed and businesses and countries must out-compete each other and keep pace with shifting consumer behaviors. Organizations that still treat IT as a siloed business process have to invest time and effort managing the infrastructure and co-ordinating with vendors for upgrades and changes. If only there was a partner to lend a helping hand, so the organization can focus on what it does best: its core business.

Chennai-headquartered Sify is one of India's most comprehensive ICT solution and service providers. Founded in 1998 as India's first private ISP, it played a vital role in the start of India's digital transformation, then scaled up the value chain, providing telecom, data centers and cloud services as a truly integrated ICT player. Sify is agile, taking on any challenge and offering customized solutions to large, complex enterprises, SMBs, the Government and PSUs, as well as verticals in BFSI, manufacturing, retail, healthcare & pharma, education, media and IT/ITES. With a 'bring it on' attitude and a scalable portfolio of services, Sify enriches and simplifies professional lives.

All Sify's data centers are "hyper connected" - with dedicated dark fiber, metro rings and multi-mesh connects.

Sify's data center at Rabale has zero latency access to Amazon DX, and hosts the AMS-IX (Amsterdam Internet Exchange). The network today connects 45 DCs across India with Tbps capacity. Sify's cable landing station in Mumbai terminates international data on high capacity undersea cable owned by Middle East and North Africa (MENA) and Gulf Bridge International (GBI).

The Sify Data Center Architecture

SDA Ver 4.0 is the guidebook on how to build DCs in India, paving the foundation for 15 DCs built for external customers including six built for Indian states.

As well as availability of colocation space, clients look at the ecosystem of offerings, including the hosting and managed service stack.

Sify's unique proposition is its strong partnerships with global and domestic players, and its track-record of 100 percent uptime has been a strong ace.

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International customers are extremely demanding on physical security: guards, smart cards, man traps, and biometric access are just a basic need now. The next levels would be iris scan, palm scan and voice-modulated/controlled security.

Gartner has recognized Sify in its highly sought after Magic Quadrant - Cloud Enabled Managed Hosting for four consecutive years. Amongst Sify's multitude of awards, the Business Superbrand of the Year 2016-17 and WCRC's Brand of the Year stand out.

sify

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Brexit fires the data center crucible

London is a crucible for data centers. It's the largest colocation data center market in Europe by far, but has multiple issues hanging over it. Where better for a regional data center event to gather more than 1,500 of the industry's leading professionals?

As we write this, the UK's Brexit strategy is unclear, but data center operators need to know if Britain will be in the single market and whether EU regulations such as GDPR will still apply in the long term. So far, there has been little impact, but Mitul Patel, head of EMEA data center research at CBRE expects things will have become clearer by the November event.

"Following the triggering of Article 50 in Q1, we have not seen a decrease in demand in London to date," Patel told us. "We may get a clearer view of its impact on decision-making towards the end of this year as details on Brexit become clearer."

London's data center market saw record growth in 2016, the year of the Brexit referendum, said Patel. The city's colo space grew by 49MW that year, against a previous five-year average of 22MW. Other European data center hubs such as Frankfurt, Paris, Amsterdam and the Nordics are angling to replace London.

This is partly due to the unprecedented expansion of cloud providers, as enterprise IT follows a move from in-house shops to colocation spaces, and eventually to the cloud.

As the giant cloud providers don't generally own their own space in London, colo service providers are handling both stages of the migration.

"Colocation, cloud and managed service providers are jockeying for position in a fast changing market. They're chewing up what's left of the enterprise-owned assets and bringing a new meaning to what purpose-built means," said George Rockett, CEO and co-founder of DCD. "Add Brexit and GDPR to the mix and it's potentially explosive."

As well as the move from in-house to colo and cloud, a burst of new technologies including smart and autonomous vehicles, big data, mobility and the Internet of Things is putting a strain on legacy technology. Migrating enterprise IT from old environments to new ones while lighting up new services is a massive challenge.

"The journey towards a digital world has to consider traditional and cloud-native setups," said Gunnar Menzel, chief architect at Capgemini, also speaking at the event. Do you optimize an existing environment, or use migration as a cue to switch to something different? The answer will depend partly on your industry - with banks tending to lag behind startups with less history and fewer regulations. Menzel and others will present ideas and answers at the event.

"We're going to explore the bleeding-edge of innovation from autonomous vehicles to the future of energy supply," said Merima Dzanic, conference producer at DCD.

Speakers come from Deutsche Bank, RBS, HSBC, Facebook, Switch, Data4, IBM, Google, EnterCloud, Microsoft, LinkedIn, Nissan, Dropbox, Groupon, Verizon, Schneider Electric and many more.

Last year the event moved to Old Billingsgate, one of London's most exciting venues, with scale for more than 100 exhibitors and the industry's most renowned conference program, while still providing intimacy for networking and big discussions.

End-users and operators of data center or cloud infrastructure may qualify for a free ticket: contact us to check your status. Early registration is encouraged as limited tickets are available.

Free passes
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London weathers Brexit fears

Penny Jones
Principal analyst
451 Research

Well-managed supply and a mature approach to digitization have helped the British capital remain the fourth largest colocation market in the world, says *Penny Jones*

It would be easy to assume that colocation providers across London must be struggling right now - but they have proven that this is not the case.

We have Brexit, the falling value of the pound, and concerns about European data regulations. Despite this, ongoing colocation bookings show strong growth in demand for digital services which surpasses these concerns.

Over recent years, colocation providers have rethought their go-to-market strategies in the light of digital transformation, and this is helping them capture this demand - so much so, that the market recorded its best year yet in 2016 in terms of supply growth. And things look like they will continue on a similar trajectory well into the future.

This is a scenario we have seen before. The financial crisis of 2008 did not rock the industry as was initially expected, and nor did the fresh economic concerns the UK faced in 2010. The only time we saw a dip in supply was in 2013, arguably caused by too many providers bringing supply into the market the previous year.

A number of factors have contributed to the market growth through 2016: a rise in consumer content, increasing use of mobile business services, ongoing requirements for additional storage, an incoming wave of hyperscale cloud, and managed service providers, systems integrators and others using public cloud to deliver next-generation services.

At the same time, carrier points of presence have increased in density and size, data regulations are arriving, and many enterprises have data centers which are reaching the end of their life, and need to connect to cloud.

The list is long, and I could go on. It seems that these trends will continue to drive a requirement for data centers regardless of whether the UK is in the EU or not. That said, the UK's multi-tenant data center (MTDC) industry is likely to face some challenges that could dampen growth moving forward.

The London MTDC market had a record 2016 in terms of operational supply being added to the market. Providers added around 463,000 square feet - up from almost 339,000 square feet in 2015. The total floor space is divided roughly equally between wholesale and retail.

Retail is slightly higher than wholesale, and the division of power usage is skewed further in favor of retail, as retail sites tend to be built out more densely. Figures can be misleading however, as some some halls offer either depending which the customer requires.

Through 2016, we saw projects by ARK Data Centres, Colt Data Center Services, Equinix, KDDI Telehouse, Custodian Data Centres, NTT Gyron and Volta contribute to market growth.

451 Research predicts - on the back of known and expected projects and current utilization rates - that the market will grow a further 423,000 square feet in 2017.

And continuing demand will see utilization rates remain around a stable 77 percent and but grow towards 79 percent through the year (in 2016 the average was 76 percent - up from 75 percent in 2015). We have already seen 4D, Pulsant, Ark, LDeX and Equinix bring space online this year and expect Kao Data Centres will launch its new campus, and anticipate further activity from Virtus Data Centres, Digital Realty, NTT Gyron, Zenium and Equinix.

The London market is the most mature colocation market in Europe, and it is the fourth largest by operational supply in the world. The city is also home to a mature group of enterprises, which are progressing with their digital strategies, taking advantage of hybrid cloud.

Hyperscale cloud providers have drastically altered the demand and supply dynamics for MTDC providers across London. They have shifted the focus for retail colocation providers to larger 1-2MW deals, and encouraged wholesale operators to provide access to connectivity-rich ecosystems or peering environments.

They have also drastically altered pricing. The pull of the hyperscale provider has been so great that in some cases they have been able to command their own pricing at much lower margins than other large customers.

Many MTDC operators have anticipated these larger cloud providers will eventually pull in higher margin business from the second tier cloud, MSP and SI customers, and in time enterprises. This second wave of demand is now starting to take place.

In terms of enterprise demand, financial services customers continue to be healthy users of colocation, especially in locations that house trading engines. The UK is also at the forefront of online shopping and the retail sector has increasingly been moving towards colocation and the cloud. Many

MTDCs and service providers are also making way for increased demand for digital video, gaming, virtual reality and IoT as the UK increasingly adopts 5G technology. The film industry - traditionally concerned about security and IP, is also starting to see secure connectivity through colocation providers and leverage third parties for storage.

Brexit will pose some challenges - largely around requirements for data sovereignty and compliance with European Union data regulations, which over time could lead to some workloads being split between the UK and Europe. The wider industry is also concerned about the impact of the falling value of the British currency, and possible impact to industries such as financial services, which depend on access to the European Single Market to trade.

The cost of energy is also high in London, along with the cost of real estate, and in key locations – such as Slough, where SEGRO manages the Slough Trading Estate which has become the second largest concentration of data center operators in the city - space is also limited. This, coupled with the growing connectivity ecosystem in the estate led by Equinix, has seen prices in Slough come more in line with those in the Docklands in recent years.

Typically, we have seen providers with well-formed ecosystems and good access to connectivity and peering options charge a premium for colocation in London. And increasingly connectivity is becoming one of the key considerations for companies launching RFPs in the market. As a result, we have seen wholesale providers increase their focus on retail-colocation connectivity options - either by tapping into well-connected sites or by offering them themselves.

We have also seen flexibility in contracts become more common across the board, for power use, first right of refusal, or the ability to scale up or down as enterprises move towards hybrid cloud approaches or systems integrators move workloads closer to customer locations.

Not everyone finds the UK market easy to crack, especially wholesale operators with longer lead times. IO Data Centers made its exit this year selling its relatively new site in Slough to Equinix. Infinity SDC has also been slowly selling off its wholesale estate with a site going to Virtus Data Centres and another to Zenium Technology Partners.

This has not deterred new market entrants, including Kao Data (which will launch its new wholesale campus in Hertfordshire later this year) and retail colocation operator Nigsun Telecom (which is offering wholesale voice coupled with colocation from a new data center called NCS1 in Stevenage). We also saw former Terremark CEO Manual Medina rebrand the CenturyLink data center estate to Cyxtera having acquired its data center assets and at the same time CenturyLink putting its acquisition of Level 3 Communications into action – a move that could provide it with a significantly expanded European network presence, and a portfolio of MTDC sites yet again.

Yet again, the market is changing its shape for colocation providers, but it is still growing, and from the looks of forecasts for the coming few years, it is likely to continue to have legs well into the next decade.

This article was adapted from the 451 Research London Multi-Tenant Data Center Market report published in August 2017. The full report is available using the link below
bit.ly/451london

About Europe's most anticipated digital infrastructure transformation event

Digital infrastructure underpins our hyperconnected world. The continuous growth in cloud demand and IoT technologies, which are mission-critical for the digital business, is set to dramatically transform data center architectures in 2017 and beyond.

With the growth of hybrid IT, ownership of IT infrastructure is radically shifting, disrupting business models and the ecosystems of digital infrastructure providers, moving us towards the serverless data center of the future.

This year's DCD>Zettastructure will explore the bleeding-edge of innovation from the prism of autonomous vehicles that stretch the notion of latency to the impact of AI and machine learning that's set to become mainstream, to topics of open compute, edge, energy efficiency and upgrading and retrofitting current infrastructure in support of hybrid IT environments.

The event brings together the full ecosystem of operators, technology specialists and end-users helping them make informed technology decisions in a dynamic digital infrastructure landscape.

Brexit will be on the agenda at the DCD>Zettastructure event in London, along with all the other issues that currently face the data center industry

bit.ly/londonzetta2017

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How is Industry 4.0 impacting data center strategy?

Wednesday 15 November
15:00 GMT, 16:00 CET

Speaker: Kasey Shah, Nissan

Moderator: George Rockett, DCD

Our panel of data center end-users from the manufacturing sector will discuss how they manage the delta between innovation cycles and investment cycles, what part the cloud has to play in their capacity calculations and how they are managing the cyber-security threat as they all move towards the fully automated smart factory.

▶ **Register to attend:** bit.ly/2yN1dQX

3 key steps to successfully managing your IT Infrastructure

Thursday 2 November
12:00 PDT / 14:00 CDT / 15:00 EDT

Speaker: Thomas Humphrey, Schneider Electric

Moderator: Bruce Taylor, DCD

IoT represents a new age of computing, and it's all about the edge. From personal devices to autonomous vehicles and drones, today and tomorrow's technologies will remain bandwidth intensive and latency sensitive. In order to keep pace, businesses must rethink the level of redundancy of the physical infrastructure equipment at the edge.

Join Schneider Electric and our panel of data center experts as we discuss 3 simple steps to take control of your distributed IT infrastructure and edge computing solution.

▶ **Save your seat today:** bit.ly/2ggcwdK

Is your data center ready for the cloud era?

Wednesday 22 November 14:00 GMT / 15:00 CET

Speakers: Sushmita Singal, PwC

Richard Northrop, Juniper Networks

Moderator: Stephen Worn, DCD

"64% of CIOs, VPs and IT Managers put security and automation at the top of their buying criteria in their path to the cloud"*

During this one hour webinar, Sushmita Singal, Director at PwC, will share the key findings from a recent survey of over 200 IT decision makers. She will be joined by Juniper Networks' Richard Northrop, who will discuss the trends uncovered by the research and identify how these translate into the key requirements for a cloud-era data center. If you want a secure, automated, agile and open infrastructure that is cost-effective, then don't miss this webinar.

*Architecting the enterprise data center for the cloud era, PwC, 2017.

▶ **Save your seat today:** bit.ly/2hRyozP

For more information please contact **webinars@datacenterdynamics.com**

Please note, the information is correct at the time of going to print.

Olympus unveiled

Max Smolaks
News Editor

One year after it was launched, how close to reality is Microsoft's hyperscale hardware architecture project? *Max Smolaks* takes a look

Microsoft's Project Olympus raised some eyebrows when it was launched under the auspices of the Open Compute Project (OCP) - at DCD's Zettastructure event in November 2016. One year on, let's see how it is progressing.

Olympus was something we had never seen before: a collaborative project that saw a major American corporation asking for advice on what hardware it should use as the building blocks of its cloud data centers.

Simultaneously a rack architecture and an open development model, Olympus has a broad focus: it includes 19-inch rack design, servers, power supplies, power distribution and even firmware.

Microsoft, being a massive data center builder and an expert in hyperscale hardware, got the ball rolling and outlined the general requirements that hardware components would have to satisfy. It then invited the wider industry to participate and improve on its suggestions - an idea borrowed from the open source software community.

What made Olympus different from the traditional OCP process was the fact that Microsoft opened its blueprints to the community when they were just about halfway ready - much earlier in the development cycle than other hardware projects. The community could then download, modify, and fork the hardware designs, just like it does with Linux distributions. This year, this strategy has started paying off.

Olympus has signed up an impressive number of partners, including major chipmakers, component vendors like Broadcom, Mellanox, Samsung, SK Hynix, Rittal and Schneider Electric, and server builders like Dell, HPE, Quanta and Inspur.

The universal server motherboard developed by the project does not discriminate, and supports chips that are just emerging from Intel, AMD, as well as those based on designs from ARM - from Qualcomm and Cavium.

The 1U server design presented at the Open Compute Summit in March 2017 taps into some of the most important trends in hyperscale hardware. It features three generic PCIe slots that can serve a variety of functions, and is managed through industry-standard Redfish APIs. It supports DDR4 memory and uses fast but tiny M.2 form-factor SSDs to store the operating system. It has three PSUs with integrated batteries, two redundant fans and enough space to house an optional remote heatsink for high wattage CPUs.

The community added designs for a specialized GPU accelerator for machine learning, HGX-1 - a box designed to support eight of Nvidia's latest 'Pascal' cards. Up to four of these can be linked into a single system using the recently launched NVLink interconnect technology, creating a monster with 480 billion transistors and 122,880 cores.

Project Olympus is solidly based on Microsoft's idea of a dual-feed, three-phase AC power supply topology which assures the power load is balanced across the blades, minimizing the risk of rapid power swings that occur with sudden shifts in workloads.

The power is delivered through an exotic-looking PDU that runs the length of the rack like a spine, and uses a special cord adaptor which handles different regional power plug designs. The PDU also includes a rack controller.

"I am excited to see the rapid transformation in hardware design to an open source hardware development model with the OCP community. We learned a lot from this new model and will leverage it to improve future designs. We also appreciate the continued support of the global industry partners that have contributed to Project Olympus," commented Kushagra Vaid, general manager for Azure Hardware Infrastructure at Microsoft.

Vaid will detail the latest advancements in Project Olympus and provide an update on deployment plans during DCD's Zettastructure event in London on November 7 and 8 at Old Billingsgate.

WATCHING THE DATA CENTER DETECTIVES

Prevention is better than cure but sometimes the worst happens. *Andrew Donoghue* meets the specialist forensic engineers who can root out the causes of a data center failure

Andrew Donoghue
Technology writer and analyst

Designing and building highly resilient data centers is an expensive business, but then so is downtime. Figures from data and IT security research organization Ponemon Institute show that the cost of the average outage increased by 38 percent from around $500,000 in 2010 to more than $700,000 in 2016.

However, the researcher's 'Cost of Data Center Outages' report revealed that the maximum cost for an outage could be as much as $2.4 million. Some recent outages - at an airline industry's facility for example - may have been even higher, with estimates running into the tens of millions.

Given the direct financial impact, as well as after effects such as reputational damage, there is usually a thorough investigation when an outage does occur. While some companies may opt to keep the matter behind closed doors, others prefer to call in specialist outsiders to manage the process. The benefit of bringing in a third-party is that the internal facilities or IT team may not have the resources or skills to conduct an in-depth investigation while also working to restore service after an outage.

There is also the risk in some cases that internal staff may try to deflect blame or obfuscate the causes - especially if human error is a factor. Without a rigorous investigation and reporting procedures, the likelihood of a repeat event inevitably increases.

When there is a good indication that an outage was primarily facility rather than IT related, one option is to call in a mechanical and electrical (M&E) specific forensic engineering services team. For example, Schneider Electric, as with some other large data center technology suppliers, can dispatch a team to a site if the failure is believed to involve its equipment. "If there is a catastrophic failure then we have a process dedicated to deal with that," says Steve Carlini, senior director of data center offer management, Schneider Electric. "A bit like car makers that go and look at accidents right after they happen, we have teams that are dispatched to the site in the event of an incident and will start digging into what is going on."

UK data center engineering services specialist Future-tech provides a similar service but its investigation usually has a wider scope. "We are called into sites where there has been an outage to establish the root-cause and, in many cases, produce a resolution to harden the site, or affected infrastructure, against a similar event," says James Wilman, Future-tech's CEO.

Both organizations have seen increasing demand for forensic engineering investigations in the recent past. "Over the last 12 months we have completed five or six of those [investigations] in sites ranging between 1MW and 5MW, although one has been considerably larger than that; a couple have also been very high-profile," says Wilman.

According to Schneider's Carlini, as data centers have gotten bigger so has the demand for forensic investigations. In particular, there has been a rise in the number of arc-flash (dangerous electrical discharge) incidents, the investigation of which requires specially trained staff and equipment.

"Data centers are getting much, much larger than in the past," Carlini says. "In a small building with normal size breakers, the facility manager can simply reset a tripped breaker, for example. When you get very large facilities, you have to bring in the certified people with 'special suits'."

Although the ultimate source of an outage may be M&E related, the process of determining the root-cause often starts with the IT equipment.

"The team might start with the actual components in the server or element of IT equipment that have failed," says Wilman. "They will identify what those components are, the reasons why those components have been affected in the way they have, and then go back up the power chain until they find something that could have caused that event to happen."

There is a wide range of factors that can contribute to, or directly cause, an outage. Issues with the power chain, specifically UPS failures, were the leading cause of data center downtime in 2016, according to the Ponemon report. Human error was the next highest cause, followed by issues with cooling or water systems, weather-related incidents, and generator faults. Finally, IT equipment failures accounted for just four percent of incidents, according to the research.

However, in practice it can be a challenge to separate out one specific cause. The reality is that outages may be down to a cascade effect of various issues. "For example, a piece of aging equipment develops a fault but this in itself doesn't cause an outage as the system has redundancy," says Wilman. "Then an operative attempts to isolate the faulty equipment but, due to out of date information or a lack of training/knowledge, incorrectly carries out the bypass procedure and this causes further issues with the result of dropping the critical load."

The outage may also involve multiple pieces of equipment and getting to the ultimate source of the problem may require input from all of the technology suppliers concerned. "Sometimes when the issue is not clear, the customer will ask for representatives from all companies with equipment involved to get together and figure it out," says Carlini. In this scenario he believes that monitoring tools - such as data center infrastructure management (DCIM) - can be helpful. "As you can imagine, these meetings can get unwieldy, given the number of people involved. That's why it is important to have monitoring systems in place so that there is a data trail."

Having identified the source, or sources, of the outage, the next step is to record the findings in a detailed report along with recommendations on how to avoid a future incident. The whole process can take days, or a matter or weeks, depending on the complexity of the facility but also the timeline set by the owner or operator. The resulting report is often a highly sensitive document especially if human error is to blame. "On occasion the atmosphere can feel a little hostile as staff think we are there to catch them out or find a scapegoat," says Wilman.

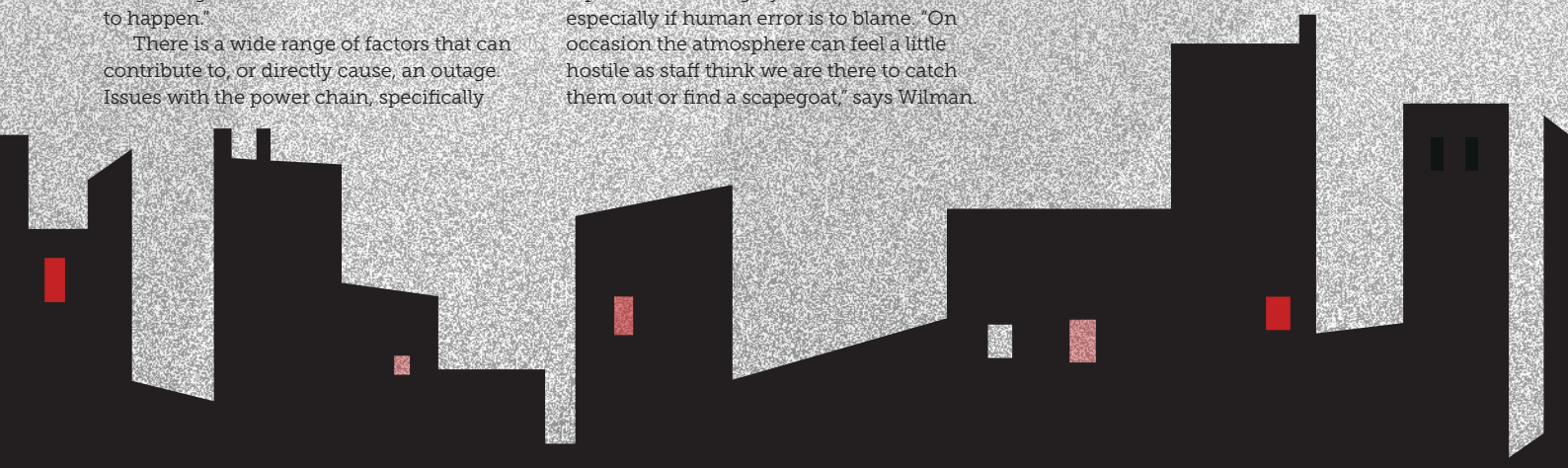
"This is not the case though, as the only agenda is to identify the root-cause and help prevent further outages from happening."

But while apportioning blame may not be a priority in most incidents, it becomes paramount in the case of a deliberate attack. According to the Ponemon report, there was a dramatic increase in the number of deliberate security breaches - including distributed denial of service (DDoS) attacks - from just 2 percent in 2010 to 22 percent in 2016. In this scenario, meticulously tracing the root-cause of an incident could help protect against future attacks but also aid law enforcement agencies in identifying the perpetrators.

As long as there is downtime there will continue to be a strong need for forensic engineering services. However, the technology landscape continues to shift. The way that data centers are monitored and managed is evolving. Use of DCIM tools - while not as all pervasive as some suppliers hoped - is increasing, which in the long-term should make it easier for operators to self-diagnose outages. Equipment OEMs are also embedding more intelligence and software into power and cooling equipment to enable proactive and preventative maintenance, which should also help reduce the likelihood of equipment failure.

Fundamental approaches to resiliency are also shifting with more operators - led by large cloud operators - investing in so-called 'distributed resiliency' where software and networks take a bigger role in ensuring availability rather than redundant M&E equipment. The performance of an individual UPS, generator or perhaps even an entire site, becomes less critical in this scenario.

However, the counterpoint to this trend is if a service outage were to occur in such a highly distributed system then tracking the ultimate cause would require some serious detective work. ●



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Be prepared for trouble

With extreme weather comes associated risks. Don't let complacency ruin the data center, says *Chris MacKinnon*

Chris MacKinnon
Canada
Correspondent

Bad weather is inevitable, and so are the risks it carries with it. Recent hurricanes like Harvey and Irma have wrought destruction in the form of floods, power outages and building rubble. These possibilities push risk to the forefront of any data center manager's agenda.

Headquartered in Florida, vXchnge has first-hand knowledge of planning for, and dealing with, natural disasters such as hurricanes. According to Ernest Sampera, chief marketing officer, it's critical to have a disaster recovery plan and contingencies in place (including redundant operations) in case a data center is shut down due to a natural disaster.

"But most importantly, all data center operators should be concerned with employee safety," Sampera told us. "Data centers need to prepare for disaster recovery without the aid of those employees experiencing the disaster themselves.

"**Data center operators** should have employees from outside the affected region handle the disaster recovery to ensure they are focused on customer uptime and keeping employees safe."

Michael Wise, information security auditor at KirkpatrickPrice, says with the impact of hurricanes like Harvey and Irma, risks in relation to natural disasters such as flooding have taken a new level of importance for data center operators. "Harvey brought with it unprecedented flood waters for the Houston area," Wise explained, "and it highlighted risks that floods pose to data centers. Data centers that experience floods have to contend with the inability for personnel to get to facilities because of roads being impassable."

Wise says another risk is how flood waters will impact emergency power delivery in the event of a utility failure. This risk includes the availability of fuel and spare parts for emergency power systems. "Hurricane Harvey emphasized the necessity for having a disaster recovery plan and ensuring that all operation staff ▶

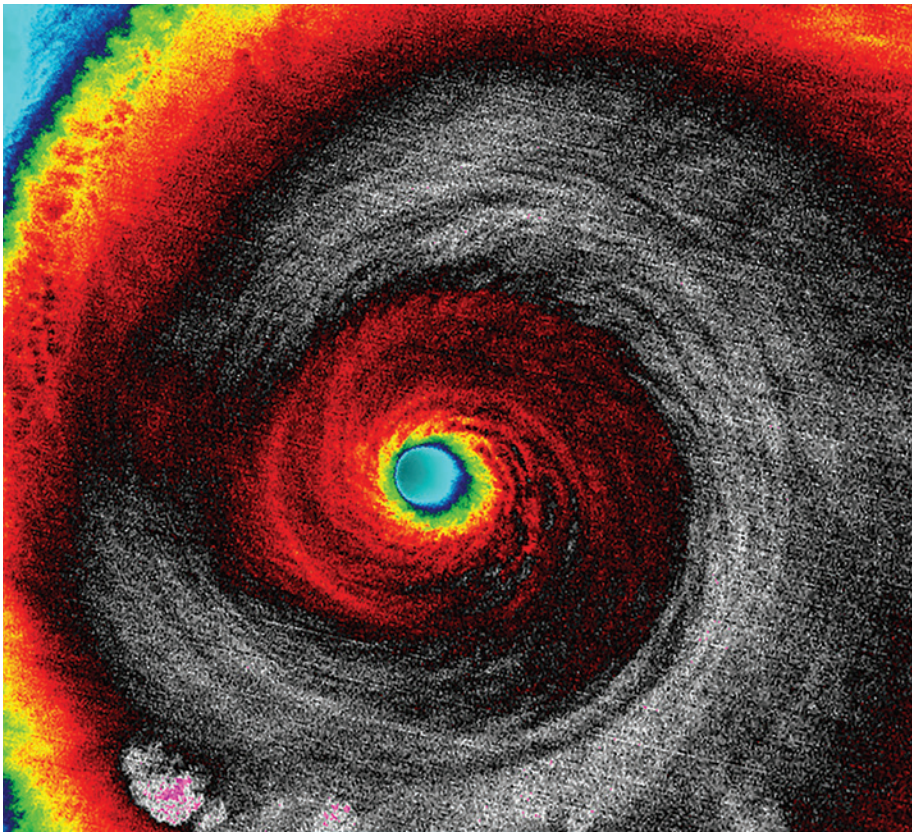
know their roles and responsibilities in the plan."

So how can data centers be risk-proactive when it comes to natural disasters? Keith Klesner, senior vice president of North America for the Uptime Institute is an evangelist in this area. "During the site selection process, organizations should always consider natural risks of individual properties. Certainly this year, natural disaster risk is on the rise with multiple extreme weather events. However, some site location risks can be mitigated, but investment on the scale of tens and hundreds of millions of dollars in a data center and associated equipment should consider site risk as a fundamental criteria." He added the shift from compute residing near corporate headquarters to lower risk and lower cost regions has proven effective for many enterprises.

Broadening the scope, Sampera says data center operators must be prepared for all disaster recovery scenarios. He elaborated: "Data center operators must have various scenarios mapped out and must consistently practice for potential disaster scenarios a number of times to ensure all employees know the procedures for disasters. It's important for data center operators to also understand their supplier's protocols, and to make sure there is diesel fuel available in the case of electrical power failures."

Along the lines of general risk, data center managers should continually protect and educate themselves. But to Keith Klesner, there's no easy way to do this. He says it's a difficult endeavor because there are scores of "experts" who can provide long lists of deficiencies, best practices and criteria for data centers. He explained: "distilling the information, analyzing the data and building consensus within your own organization are the key measurement of success. You need to be able to analyze your information and be prepared to accept some level of risk as weighted against cost, performance and overall business impact." Klesner says these assessments require a multidisciplinary approach with numerous stakeholders across a business.

Michael Wise agrees that data centers should be completing risk assessments regularly, where they take a deep dive into potential risks that can threaten a business. "Through the use of a good risk assessment process, the data center can analyze and find strategies to deal with exposed risks. Additionally, data centers should be frequently certifying all personnel on procedures specific to the data center operation. Making sure data center personnel have an intimate knowledge of site specific procedures is a key component of handling risks."



But don't look only at the outside, Wise says. "When analyzing risks, data center operators need to make sure they are not only looking at external risks, but internal risks as well. Analysis needs to happen not only on how a data center will respond to a natural disaster, but how it will respond to things like human failure as well."

Taking a well-rounded approach is also a prudent move, Klesner adds. "Risk management requires engineering, finance, business and communications skills. The data center industry must continue to grow the skillsets of data center professionals to better support IT and applications critical to our business and economic growth."

27 trillion gallons of rain

The amount of precipitation caused by Hurricane Harvey

Using an exhaustive approach is a common recommendation. Sampera says that the best way for data centers to protect themselves from risk is to have experts in all areas of data center operations: security, maintenance, compliance and disaster recovery.

He cites vXchnge as an example - it hires experts in these areas and partners with leading security providers such as Level 3 and AT&T to ensure clients have knowledgeable and highly capable teams in these core areas.

Overall, however, Sampera says it's very important that organizations meet the operators of their data centers and ask about their commitment to providing unparalleled, physically and digitally secure service and their uptime guarantees.

He elaborated: "The data center's facility manager should have disaster prevention and recovery experience and be well versed in the standard operating procedures. Reputation is important, but establishing a personal relationship with your data center operator is equally important."

In Sampera's opinion, it's vital for customers to understand, review and discuss the practices and frequencies of the data center operator's MOPs and SOPs. He says customers should also ask to review their data center provider's disaster recovery plan. "If your data center operator does not have a detailed disaster recovery plan, it's time to walk away." ●

Introduction to DCIM

Managing the data center better

Data Center Infrastructure Management (DCIM) offers a host of capabilities that appeals to different groups of IT and facility personnel. The aspects that resonate most with facility managers would undoubtedly be those that will impact the cost, reliability and management of the data center.

Following are some capabilities offered by Delta DCIM solutions on this front.

• **Cost savings through energy management**: One of the highest operational costs of running a typical ddata center is the cost of the power to operate the servers and air-conditioning hardware. Delta DCIM's integration with the building's power feeds and ability to monitor IT and non-IT loads allows it to easily track the PUE or power usage effectiveness, within the data center, to facilitate efficient energy use.

Organizations with corporate energy efficiency initiatives can also look to Delta DCIM to better manage and optimize energy use across their entire infrastructure, and do their part for the environment.

• **Monitoring for increased reliability**: At the most basic level, the DCIM works in the background to collect comprehensive log entries of up to thousands of individual devices and components within the data center. The entries include parameters

such as energy consumption, humidity and airflow. The resulting archive facilitates easy analysis and the creation of a virtual model of the infrastructure that maps the relationships between these components. Such model also enables proactive maintenance such as using an analytical engine to scour for inefficiencies or weak links, and can make a world of difference when performing a failure analysis.

• **Better capacity planning**: A data center's efficiency is highly dependent on capacity planning, and entails detailed load calculations under normal and peak load conditions. Facility managers typically use capacity planning tools to determine the resources and power draw that a data center must support based on estimated current and projected operations.

Information such as current resource use and cooling patterns that a DCIM can provide would be a 'shot in the arm' for standalone planning tools. Moreover, being able to accurately predict when a resource will be exhausted can ensure that expansion plans are closely aligned with actual demand.

Using DCIM in IT

Originally a tool for facility managers, the breadth of capabilities offered by a DCIM solution like Delta's makes it extremely useful for IT professionals too. Some view DCIM as an extension of traditional IT-centric monitoring tools such as PRTG Network Monitor and Nagios, given its ability to integrate with physical systems in the data center environment.

• **DCIM for asset management**: DCIM can deliver a snapshot of the active equipment within the data center. A lesser understood aspect of DCIM is its ability to quickly locate a malfunctioning server or network hardware within the data center. Failure to locate swiftly would result in a higher mean time to repair (MTTR). Needless to say, such failure can have serious impact on overall reliability.

Asset management also involves having detailed information about its precise configuration and usage. For instance, a physical server may host multiple virtual machines that would be disabled should it be shut down. DCIM allows IT personnel to track down under-utilized servers or equipment that is powered on, but not hosting active services.

• **Keeping an eye on connectivity:** Physical devices aside, DCIM can also integrate with the network to offer insights into the port-to-port connectivity in the data center. This could include the location of top-of-the-rack networking switches and core switches, their positions in the network topology, and pertinent cabling and patching independencies.

This can be crucial for isolating and identifying connectivity problems, and guard against tempering in colocation environments. With the growing use of software defined networking (SDN), such insights become more important as a physical circuit can serve as the backbone for multiple virtual links.

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Peter Judge
Global Editor

Life on the edge

Data-hungry gadgets and users are forcing us to change how we build our information networks. The edge has already been built, says *Peter Judge* - while we are still defining it

Everyone agrees the edge is where it's happening. All the big shifts, from Smart Cities to the Internet of Everything, depend on fast networks tied closely to real-time sensors and greedy end users.

"It's where the rubber meets the road," said DCD's Bruce Taylor, opening the Edge summit at DCD>Colo+Cloud in Dallas in September 2017. But gathered experts made it clear that the actual shape of the edge is still being determined - even while it is being built and delivered.

Each of the conflicting definitions of the edge are too simple to cover all the needs. For instance, some argue that, since it will require data storage and processing being delivered in multiple identical autonomous units, all the edge needs is small containerized data centers that can be installed at locations including cell towers, shared office buildings and malls.

Crown Castle International, for instance, manages thousands of cell tower locations in the US, and plans to host digital services from them, using equipment from Vapor IO, but this is still evolving, said Alan Bock, Crown Castle's VP of corporate development: "As an industry we have to push it out there and see what works."

While small facilities and micro data centers are often labeled as "edge," the actual edge that emerges may be very different: "I don't think edge is a location or a size - it's an application," suggested Joe Reele, vice president, data center solution architect at Schneider Electric. "The definition is in how it is used, not the technology. Edge is about putting something closer to a group of people that will allow them to work efficiently."

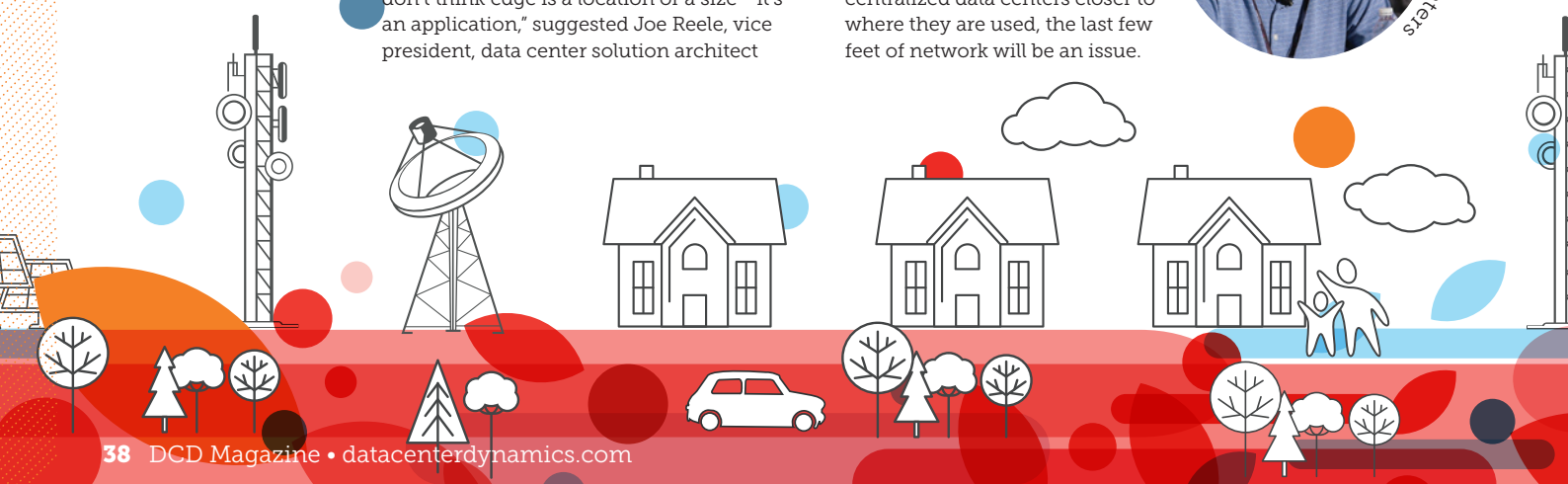
In his view, if a traditional multi-MW data center switches over from hosting old-school enterprise software to a webscale firm's end-user applications, it will become an edge facility.

The edge could be even more diverse than that: there will be different technologies for different applications, said Shawn Mills, president of Green House Data: "Edge instances will be in a lot of places you wouldn't have expected five years ago. It will morph depending on the requirements."

That's going to be a big ask from the vendors, because users will want things specialized and cheap... and reliable. "No one will pay a high price per Watt when we have thousands of edge facilities," said Mark Bailey, lead MDC architect at Dell EMC. "Edge is not going to be a product: each user will demand a tweak that meets their precise need."

Specialist edge products will certainly include tiny chunks of IT resource, new technologies such as liquid cooling, and new ways to connect.

The network may be the biggest defining difference between edge implementations and centralized data centers. When IT resources move from centralized data centers closer to where they are used, the last few feet of network will be an issue.



Mobile data networks will be crucial. Most of the sensors involved, and most of the users, will be untethered. Network providers, scrambling to offer more bandwidth, are full of promises about 5G - even while they debate what technologies will actually be involved.

However good 5G turns out to be, the edge will be more limited by network speed than by other IT issues - because wireless confronts network designers with fundamental speed limits in a way fiber optic cables don't.


Joe Reele / Schneider Electric

Caroline Chan, VP and general manager for Intel's 5G infrastructure division, brought a view from the wireless world.

"In data centers, you market to abundance. In wireless, we market to scarcity," said Chan. "God doesn't make spectrum any more, you have to take what you have got and get everything you can out of it.

"You have Moore's Law," she said. "We have Shannon's." While Moore's Law predicts a continuous increase in the computational power of microprocessors for some years to come, Shannon's Law (or the Shannon-Hartley Theorem) shows there is a finite limit to the signal that can be carried on a given channel, due to the presence of noise.

Along with network links, another issue that is only just being addressed is security. All these sensors and controllers must be safe from outside interference, and privacy will require us to encrypt the data sent to and from the edge - even though this will eat into the available bandwidth, said Mills.

Autonomy will be the other defining factor of the new edge infrastructure. It will also be managed remotely, just because any other approach would create a monster that cannot be maintained, warned Chris Crosby of Compass Datacenters. "It's about truck rolls," he explained. Repeated visits by engineers would destroy the economics of any edge infrastructure project.

It's also going to be risky: "Make a mistake in a micro data center, and you just made that mistake a thousand times, said Hugh Carspecken, CEO of DartPoints. "Issues of resources and payment will be magnified."

Edge data centers will face constraints from compliance to regulations, warned Carspecken. Indeed, eBay's head of critical infrastructure Eddie Schutter said that this will be the real definition: "The edge will be the last node that is regulated."

10-100kW
The IT load of an edge data center, as defined by IHS Markit

Managing the edge will be an issue, said Jeff Sharpe, product manager at embedded systems maker Adlink, because infrastructure builders will still want to buy from multiple vendors and have a reliable product. "It's becoming more of a challenge for OCP, and standards makers like ETSI, to herd cats and make things more reliable."

Edge will certainly need to be dependable, because we will rely on it, warned digital sociologist Julie Albright. "More critical systems will be attached to networks."

If we really plan to let edge run our lives, we face a problem because existing reliability measures operate in a centralized way, with 2N hardware provision and site surveys - and this approach cannot be feasible for infinitely duplicated micro-facilities.

"At the end of the day, software is how you will accomplish resiliency," said Ty Schmidtt, vice president and fellow at Dell. "Edge will force convergence."

Already, the Uptime Institute has spotted the need for a new approach, and broadened its Tier certification scheme. Vendors and builders can now pre-certify their edge data center products and designs as "Tier-Ready," so service providers can roll out reliable infrastructure more quickly. Compass' 1.2MB data center pod design has been branded as Tier-ready, and Schneider is certifying its micro data centers.

Uptime's senior certification authority Pitt Turner thinks work like this could usher in standardized approaches, using a Protean panoply of fast-evolving hardware: "It's a different paradigm: every enterprise will use a different mix of four or five components." Generations in technology used to change roughly in line with human generations, he said, but now this can happen on a monthly basis.

Ironically, while the infrastructure industry is distributing its resources into the edge, the enterprise is racing into cloud services which do the reverse. Cloud may appear to make location irrelevant, but the cloud providers' business model is all based on the economies of scale which come from centralization.

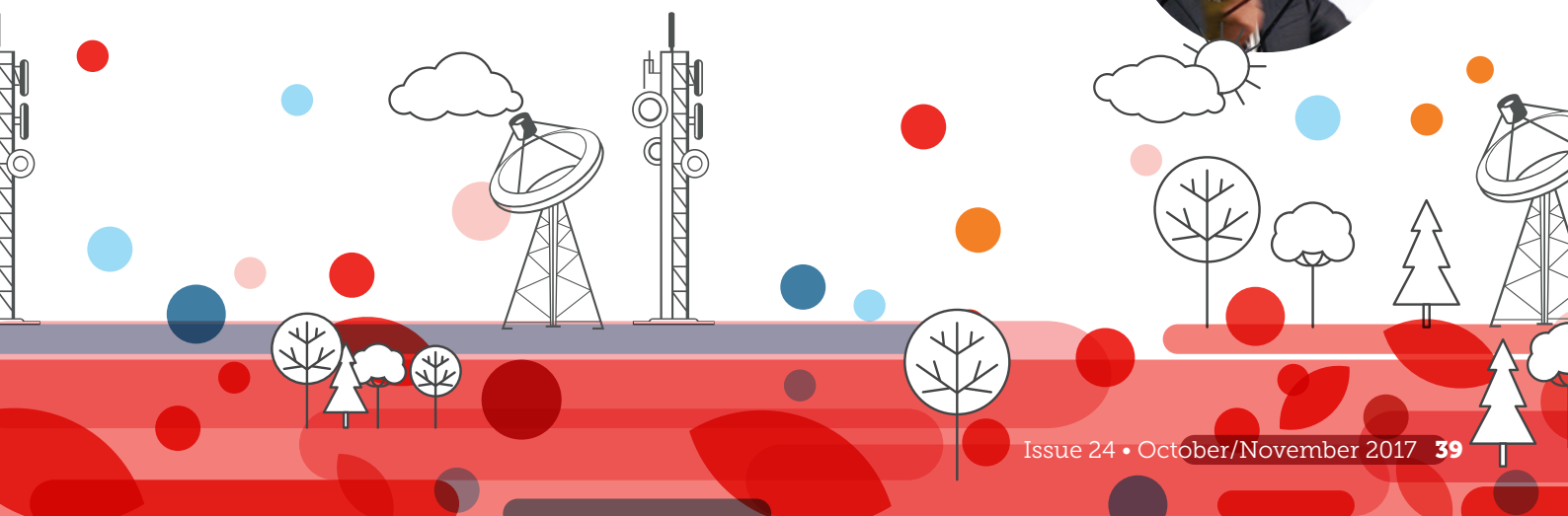
"Enterprises aren't thinking about the edge yet - they are sprinting in the opposite direction now," said Shawn Mills, president of service provider Green House data.

It's not a contradiction though: edge is an independent phenomenon. It's not killing the cloud. It could eclipse it, but it will have to carry over the benefits cloud provides.

"Data center technology is not going to go away," said Sharpe. "Edge is going to grow as applications are moving to the edge to improve my experience."

"It's about putting cloud benefits out to the edge," said Bock.


Thomas Humphrey / Schneider Electric



Hyperconverged: passport to the hybrid cloud

Dan Robinson
Correspondent

It's time to take hyperconverged infrastructure seriously, says *Dan Robinson*

Hyperconverged infrastructure (HCI) has become one of the hot areas of the IT industry over the past few years, promising a simpler and more convenient approach to deploying and operating infrastructure for running applications and services. Now the market is maturing as larger vendors move in on the HCI action, and the focus is increasingly shifting to a hybrid vision, making it easier for enterprise customers to extend out to the cloud.

Hyperconverged systems take the separate server, storage and networking components of traditional IT infrastructure and integrate them together into an appliance-like node. A cluster of several nodes is typically required to deliver a working infrastructure, but the idea is that they can be used as building blocks, with the customer simply adding more nodes as required to scale out.

Buying systems with integrated compute, storage and networking is easier for IT departments, and also advantageous for the suppliers, according to Clive Longbottom, founder and research director of analyst firm Quocirca.

"HCI was always going to be a means of a vendor being able to tie in a customer to more of that vendor's equipment, or at least to spending more with that vendor. If you go DIY, then you can buy your compute power from one company, your networking kit from another and your storage from yet another. HCI means that all your money goes in one direction," he said.

Hyperconverged systems were once viewed as a solution for applications such as virtual desktop infrastructure (VDI), where their close-coupled storage delivers better performance than using a SAN, but are increasingly being adopted by enterprise customers for a wide range of applications, especially delivering a private cloud (See *DCD 16, Sept 2016, p34*).

Since that time, the hyperconverged market has continued to heat up, with spending in this segment increased by 48.2 percent in the first quarter of 2017, according to figures from research firm Gartner.

Meanwhile, some of the early leaders in the field such as SimpliVity have been acquired by larger players, in this case by HPE, in order to bolster their own offerings in this space. Cisco has likewise announced its plans to acquire Springpath, while storage firm NetApp is soon to enter the market with a solution based on technology gained from its acquisition of SolidFire.

Hyperconverged systems are also now becoming part of a broader effort from the larger vendors to deliver a true hybrid cloud solution. With hyperconverged systems well suited to operating a private cloud, we are now seeing the emergence of platforms that aim to combine this with a high level of consistency between on-premise infrastructure and that delivered by some cloud service providers.

Examples of this approach include Microsoft's Azure Stack and VMware's Cloud Foundation, two new platforms which take differing approaches that play to each vendor's respective strengths, but end up with a broadly similar outcome.

Azure Stack is regarded by Microsoft as an extension of its Azure public cloud that customers can deploy on their own premises or have hosted for them by a colocation provider. It is currently only available pre-integrated with certified hardware configurations from four major vendors - HPE, Dell EMC, Lenovo and Cisco.

The decision to support only pre-built systems disappointed some Microsoft customers, many of whom wished to deploy Azure Stack onto hardware they already had in their data center. Microsoft countered that this is the only way it can guarantee the platform will perform optimally.

"By tying Azure Stack into defined HCI systems, Microsoft is protecting itself, knowing that the systems will perform in a predictable manner. However, the systems have not hit the shelves as yet - we'll have to see how the market responds," said Longbottom.

While Microsoft does not guarantee that every single feature of Azure will be replicated on Azure Stack, it is designed to deliver the same experience as the

Azure public cloud, down to the same pay-as-you-go billing model and the same user portal for provisioning services.

Microsoft's vision is that Azure Stack will enable customers to run some workloads on-premise, such as those with strict regulatory or data governance requirements, while others can be deployed to its Azure public cloud. The key is that the same development tools can be used, and the code can be used on-premise or on Azure without any modifications.

Meanwhile, VMware's Cloud Foundation is described by the firm as a software-defined data center (SDDC) platform for both the private and public cloud. It combines VMware's vSphere, vSAN and NSX components into a software stack that can be deployed either on premise or operated as a service from a public cloud platform.

On-premise deployment calls for certified hardware from select vendors, as with Microsoft's Azure Stack. Options include the VxRack SDDC platform from VMware's parent company Dell EMC, but also Fujitsu's Primeflex hardware and what VMware refers to as "vSAN Ready Nodes" - systems qualified to operate vSAN as a software defined storage service.

The public cloud deployment options for Cloud Foundation see it being supported by AWS, IBM's SoftLayer (now rebranded as Bluemix), Rackspace and CenturyLink on their respective clouds. The end result is effectively a private cloud, but one that is running on infrastructure managed by the cloud provider rather than the organization.

VMware already provides a management suite, vRealize, which provides cross-platform management covering on-premise VMware infrastructure and resources deployed onto public clouds. Having VMware infrastructure at both ends should make it easier to manage everything from the one console.

Nutanix, one of the pioneers in hyperconverged systems, is also getting into the hybrid game with Xi Cloud Services, but with a slight twist. Although this upcoming technology will see its platform operating from one or more public cloud providers, Nutanix appears to have more of a focus on using this to offer point solutions that will integrate seamlessly with a customer's on-premise Nutanix infrastructure, the first being a disaster recovery service.

In other words, hyperconverged infrastructure is still going strong, but the pitch from vendors has morphed into it being the customer's passport into the promised land of hybrid cloud.

"The promise of consistency between private and public cloud is now a strong argument, as organizations have been burnt in trying to build heterogeneous hybrid clouds. We can expect to see a very strong set of messages from all HCI vendors as to how their platform is the best one for private cloud going forward," said Longbottom.

Putting it all together

Hyperconverged infrastructure (HCI) integrates compute, storage and networking into one system, as detailed in the main article, but software is an equally important part of the overall solution.

A typical HCI deployment will comprise at least four nodes, each with its own internal storage rather than relying on an external SAN. Often this will consist of both flash storage and hard drives, in order to deliver a tiered storage architecture with the "hot" data served up from the flash storage.

However, a key part of HCI is a software-defined storage layer that pools together capacity from all of the nodes, plus a management layer to take care of issues such as load balancing.

These may be delivered as part of dedicated hyperconverged software stacks, such as Nutanix Acropolis and VMware's Cloud Foundation, while some operating systems have also started to gain many of the features required to drive hyperconverged hardware.

As an example, Windows Server 2016 features software-defined storage and network virtualization capabilities, and Microsoft recently unveiled a Windows Server Software-Defined (WSSD) program to enable hardware vendors to deliver qualified HCI solutions based on this.

The key thing is that hyperconverged is not just about hardware, but about delivering an integrated solution.

More at DCD>Mexico

DCD>Mexico on 26 and 27 September in Mexico City will feature digital transformation, and other issues affecting digital infrastructure, including:

High capacity UPS

The Autonomous University of Puebla (BUAP) wants to boost the performance of lithium-ion energy storage, using new materials for high capacity batteries, such as micro-structured silicon anodes, and sulfur-based cathodes. These ideas are being used successfully in Microsoft servers.

A look at safety

The number and complexity of attacks on Mexican infrastructure has increased, and attacks on IoT infrastructure could be fatal. To address these risks, FEMSA says companies must have a corporate policy with different layers of security, and educate users.

For further details, visit: bit.ly/DCDMexico

Mexico's digital leap

More and more organizations based in Mexico are implementing digital transformation projects. *Celia Villarrubia* shares some success stories

Celia Villarrubia
Assistant Editor LATAM

Digital transformation has been proven to give organizations a competitive edge. In Latin America, companies are finally realizing the need to climb on board this trend.

In Mexico, 81 percent of companies have already implemented transformation projects, or plan to do so soon, according to a study of digital transformation in Mexico by digital education expert ISDI and the company Good Rebels. More than 80 percent plan to put more resources into digital transformation in the next few years.

The role of digital transformation will be at the forefront during the DCD>Mexico event on 26 and 27 September in Mexico City. "Mexico is the spearhead of digital transformation in the region," says Carlos Lopez-Moctezuma, director of new digital businesses of Mexican bank BBVA Bancomer.

Medium and large companies are best placed to face this new scenario, but even they have a long way to go.

"Their movement towards digital transformation is much misunderstood," says Juan Carlos Martinez-Soto, CIO of Sodimac Mexico. "Why misunderstood? Because many only want to systematize their companies, rather than transform them."

In Martinez-Soto's view, transformation involves reviewing all processes of an organization,

aligning its employees, investing in technology and understanding what the client wants.

Experts believe that transformation is needed to avoid losing ground to the competition: it is a "global technology adaptability race," says Óscar Franco, director of Information Technology at the auto parts provider Grupo Ciosa. If companies are not doing it yet, they are late, and the competition may already have started - because the customers are waiting.

In the end, the customer is a key part of the process, and in some industries where changes are becoming established, the user is developing: "Customers are already digital natives, they are now permanently connected and demand immediacy. For this new consumer, we must develop a new generation of products and services," says Lopez-Moctezuma, head of innovation at BBVA Bancomer.

The country needed a connected university, where society's youth could work securely

The cloud serves as an essential tool and forms "part of an overall strategy to build a more efficient operation," said Jorge González, executive director of IT for 20th Century Fox Latin America.

In the case of the film distributor, cloud computing brings many benefits to a company which processes five million files per year, and has been looking for more efficient ways to distribute content securely for ten years. Fox has migrated completely to the cloud: 100 percent of its applications are web-based and all user information is stored on clouds provided by suppliers like Amazon and Microsoft, which deliver services in all countries where it operates.

Fox's facilities have become communications centers, although the company still has three global data centers in the US and Europe, for those services that are still waiting to migrate, or are in the process of migration.

The financial sector has led the way in the adoption of digital transformation, as a way to cope with growing competition from technology based companies and the FinTech ecosystem. The industry also faces disruptive forces such as artificial intelligence, blockchain, crowdfunding and cloud, which could "drive a reconfiguration of the banking business model," says Lopez-Moctezuma of BBVA Bancomer.

BBVA Bancomer got ahead of the technological wave and began its digital transformation years ago with a new user experience in bank branches, says Lopez-Moctezuma: "We are now digitizing traditional banking products and services and creating native digital services."

To support this strategy, the company uses on-premise cloud services. Its Tier IV Gold data centers are the basis for the short term, but the bank's longer term goals can only be met by cloud, he told us.

Mexico is leading, but all BBVA Group subsidiaries in the region are following the process, with the aim of becoming the "bank of the future."

In the automotive industry, Grupo Ciosa has distribution centers (Cedis) throughout Mexico. Until mid-2016, each Cedis had a small data center, making a total of 17 across the country.

For savings and efficiency, the company decided to consolidate its data centers and centralize everything in the headquarters at Guadalajara, while also reducing that facility to half its size, and replicating it in the cloud. Grupo Ciosa uses cloud services provided by Telmex from its Triara data center in Queretaro.

"We started with a private cloud for our web services, but within 30 days, we enabled public and shared services, and we now have redundancy in both clouds," says Franco.

Moving to a single centralized data center, Grupo Ciosa saved in electricity consumption and infrastructure equipment, while improving security, allowing it to focus on innovation.

Home improvement chain Sodimac Mexico, a part of Chile's Falabella group, also bet on the cloud to provide systems, applications and information to all its business units in the region: "The cloud allows us to enable applications anywhere, almost immediately anywhere, while centralizing our administration," says Sodimac's Martinez.

The firm uses both both private and public cloud: "We keep applications and core systems in the private cloud but we open to the public for operations and noncritical information, which allows considerable savings," adds Martinez.

Next to the cloud strategy, the group has a regional level with seven data centers, including two in Chile.

On its way to the digital world, Sodimac wants to forget legacy applications and get closer to the customer.

"Only companies that automate processes and tasks, and reach a complete digital strategy will survive or lead markets," concludes Martinez. ●

Some high rise data centers

- The iAdvantage MEGA-i data center is a 30-story building with a total gross floor space of over 350,000 sq ft (32,500 sq m) in Chai Wan, Hong Kong. It uses standard cooling
- Telehouse North Two in London is an eight-story building uniquely designed with six floors of adiabatic coolers
- HostDime has a seven-story, 88,000 square foot (8,175 sq m) data center in Eatonville, Florida
- Equinix is due to open AM4, an eight-story tower with six floors of data center space in Amsterdam

Pie in the sky?

Paul Mah
SEA Correspondent

Tall data centers could be the answer to a shortage of land. But in Singapore, they also have to be efficient. *Paul Mah* reports

When there's no land available, the only way to build is up. A government-backed project in Singapore is considering how to maintain the island city-state's role as a data center hub by building multi-story data centers and keeping them energy efficient despite the local climate.

Spurred by a possible shortage of land for data centers, the Info-communications Media Development Authority of Singapore (IMDA) and Keppel Data Centres are conducting a feasibility study for a high-rise green data center building, touted as the first of its kind. But is it really needed?

Singapore is unquestionably a data center hub, but it faces two major limitations: its hot tropical climate, and a scarcity of land. Last year, the Singapore authorities made an effort to address the former issue, announcing an experimental tropical data center; this latest move is a clear bid to address the latter point.

The study will explore the possibility of saving land by building a data center more than 20 stories high, using innovative architecture that can significantly reduce energy use or increase efficiency, to improve the PUE rating of Singapore's best data centers by as much as 20 percent.

It will also look at the internal design elements of a high-rise facility operating in a tropical climate. The project will use a network of sensors, better server rack and data hall designs, and new approaches to using physics for energy efficient cooling.

But is the cost of land an issue? Based on publicly available data by the Singapore Land Authority (SLA) and using industrial land as a guideline, cost ranges from just below a thousand dollars per square meter to a few thousand dollars depending on location.

This means that data centers built in remote parts of Singapore could enjoy land prices that are a fraction of those at more central or popular locations. However, it is worth noting that not all industrial land is ideal for data centers.

As in the city of Hong Kong, there are clusters of data centers across the island nation of Singapore, and the situation is compounded by considerations such as distance from military and civilian airports and distance from the petrochemical hub on Jurong Island. Proximity to the few data centers which have exceptional connectivity – or the ability to lay a conduit to them - is also an important consideration.

And while the government parcels out land carefully, it is also a staunch supporter of the tech industry through agencies such as the EDB, JTC Corporation and IMDA. This has shown some success: Google broke ground on a Hong Kong site, but later withdrew, citing cost and trouble acquiring "spacious land." But thankfully, the company is scheduled to complete a second, larger facility adjacent to its first in Singapore later this year.

The initiative makes sense when viewed not as a reaction to soaring land costs, but as an attempt to maintain Singapore's edge in the long term. Jabez Tan, a research director specializing in data centers at Structure Research says there is still "plenty of space" for new data centers at the Tanjong Kling campus in Jurong West.

"The [announcement] is not necessarily a reactive sign that there's an immediate shortage of land for data center builds, but more of a proactive step in working towards a longer-term plan to maximize the limited land in Singapore to accommodate enough data center capacity to support Singapore's long-term growth," he told *DCD*.

Competition within the region is increasing, said Tan, with some large public cloud players locating their compute infrastructure at adjacent markets "with more readily available land," such as Malaysia.

Glen Duncan, a senior research manager of infrastructure in the APeJ region agrees, pointing to the new VADS Iskander Puteri Core data center in Johor Bahru: "Other competing physically close options to Singapore are beginning to emerge as well. These may offer practical and more cost-effective alternatives... [and] prove attractive to some enterprises for certain workloads." But does a larger floor space equate to the ability to lower PUE? Several analysts and data center experts told *DCD* there is no evidence that a high-rise data center will automatically result in a lower PUE, though they also felt it is an idea worth exploring.

Building a low PUE data center is a complex undertaking that requires significant engineering skill, according to Duncan, particularly in high humidity environments like Singapore. And this will only be exacerbated by the inherent challenges of a high-rise data center.

"Multi-story also creates its own challenges [as] the concentration of ICT equipment into a single space is very heavy and a standard floor often cannot carry the weight. Multi-story designs often require significant floor reinforcement," he explained.

Ed Ansett, the cofounder and chairman of i3 Solutions Group says a high-rise data center can result in a better PUE: "It certainly can do. The high-rise data center can achieve an exceptionally low PUE provided it adopts a different approach to cooling."

The Singapore government commissioned a 16-month 'Green Data Center Technology Roadmap' research study from i3, published in July 2014.

"Power and cooling costs dominate data center construction cost, typically [more than] 70 percent once the data center is fully fitted out. [The] adoption of technologies and techniques taken from the roadmap can substantially reduce the construction cost," Ansett told *DCD*.

But, for the idea to work, it must be more than just a taller multi-story data center. Polled for radical ideas, Heng Wai Mun, the executive director at OneAsia suggested the possibility of heat recovery for data centers.

THE GDPR HORROR SHOW

In May 2018, General Data Protection Regulation - a set of laws that govern data protection, privacy and security - will come into force across the European Union. Guidelines will be breached left and right, billions will be spent on fines, the rule of law itself will be questioned, and hordes of freshly unemployed marketing professionals will wander the desolate digital landscape - I might be overreacting, but more than half of businesses affected by GDPR will not be ready to comply with its requirements (Gartner).

Way back in 2012 when the legal documents were first drafted, the world was a different place: it was less reliant on databases, and an average business did not have to worry about being raided by cyber criminals - since it had no valuable information to steal. In a rush to replace the previous EU directive on personal data, adopted way back in 1995, the lawmakers created a complex, all-encompassing framework. Revelations about the extent of American spying that surfaced in 2013 (thanks, Edward) did nothing to soften the stance of the EU.

As a result, GDPR includes strict rules on what 'consent' means; it calls for re-evaluation of privacy policies and asks for anonymization of data, even when used for testing. It introduces the controversial 'right to erasure' - a mechanism through which citizens can take down online content - and demands that service providers report a security breach that affects customer data within 72 hours of discovery.

Any customer will gain the right to request all data about themselves that's being held by a business, to be supplied within a month. The entire process of handling personal data will need to be thoroughly documented. In addition, businesses that process such data on a large scale will need to appoint a data protection officer - presumably, the first person to be fired when things go south.

Personal data in this context can constitute anything: a name, an address or an email. There is no place to hide, since GDPR automatically supersedes various national laws, and the fines will leave the financial department in tears: up to four percent of the worldwide annual turnover.

GDPR is the burning wrath of the European Commission

GDPR is the burning wrath of the European Commission, a merciless crusade borne out of desire to keep 28 countries true to the vision of respect for the individual and their rights. But there's a problem: it is 2017, and every business is a digital business. Everyone and their uncle maintains a database of customer engagements, and each of those is subject to GDPR.

Luckily, the text makes a clear distinction between data 'controllers' and 'processors' - with colocation and cloud providers falling into the second category, and not having to worry about most aspects of GDPR, other than security.

But come 2018, we will see thousands of instances of non-compliance across enterprise data centers, every week, across every European member state. Local information commissioners will need to recruit an army to deal with this avalanche. And that, in a way, is a comforting thought: when half of those subject to GDPR fail to comply, your own business is insignificant, a grain of sand on a massive online beach. Statistically speaking, you will probably be alright.

Dr. Max (N. Furter) Smolaks
News Editor

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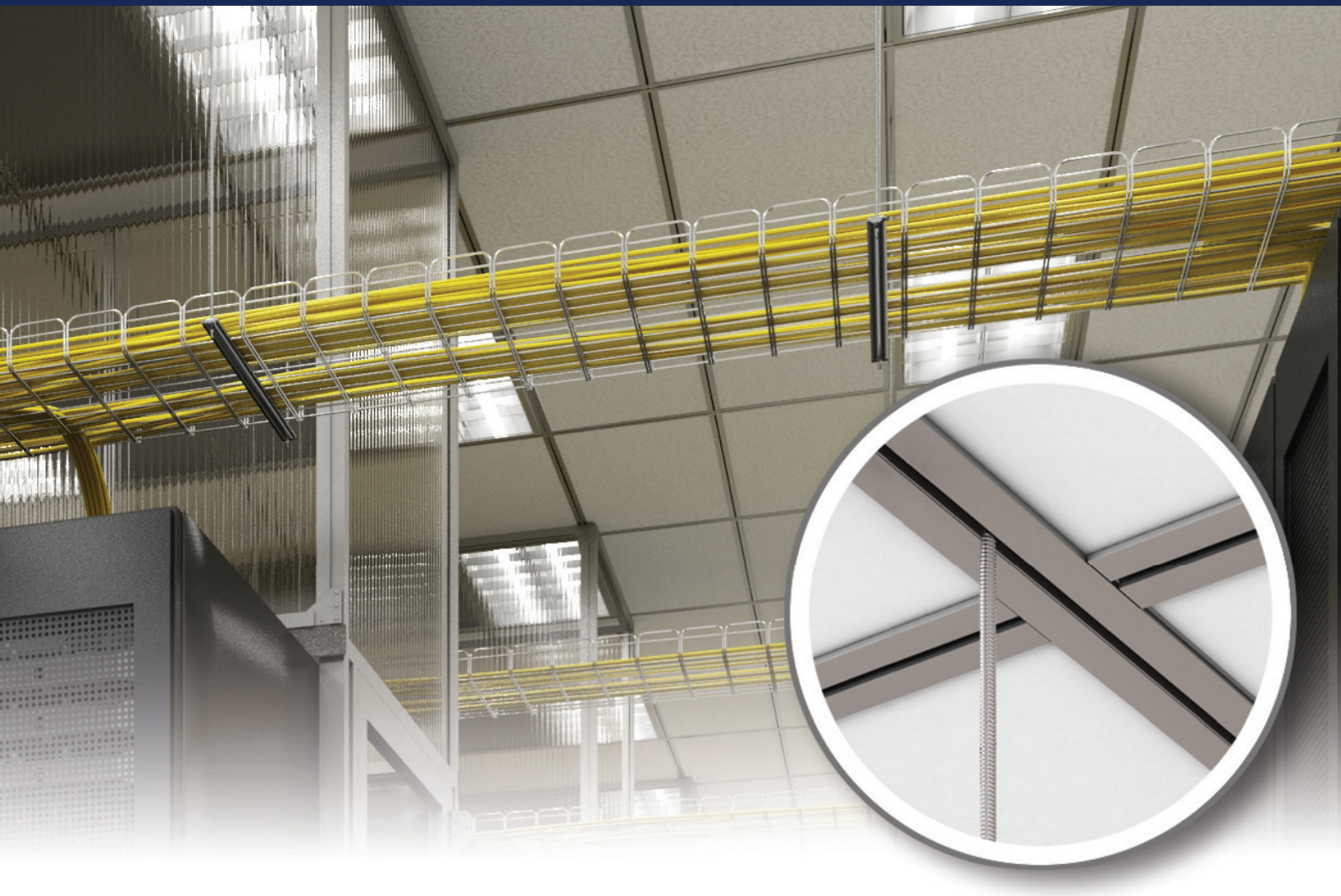

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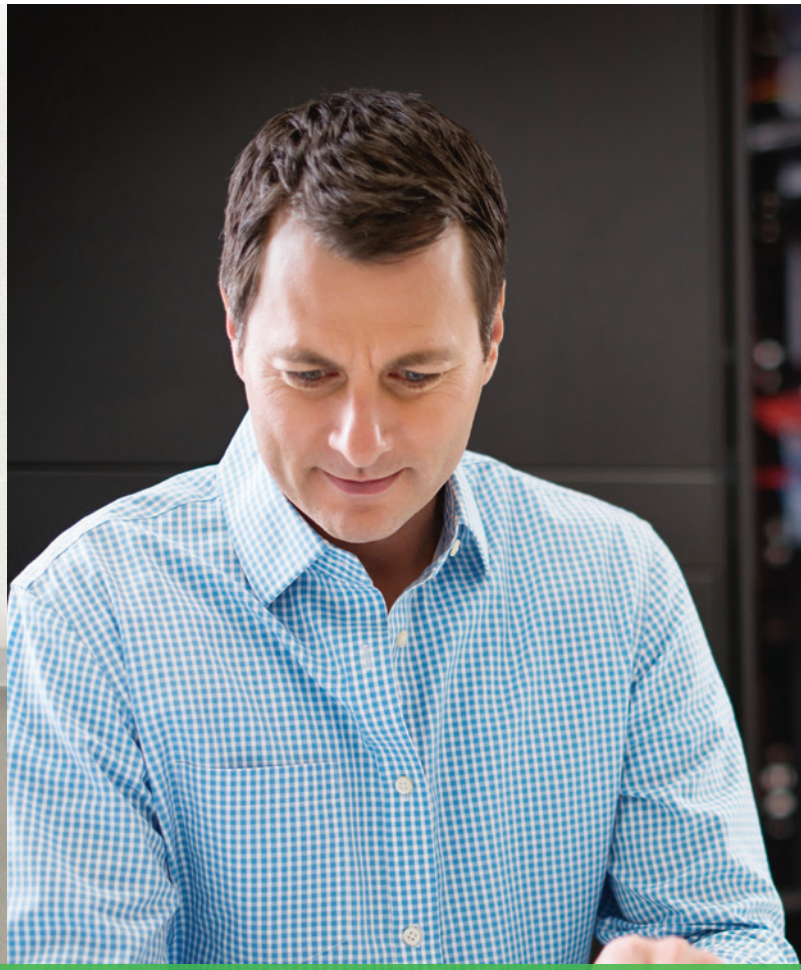

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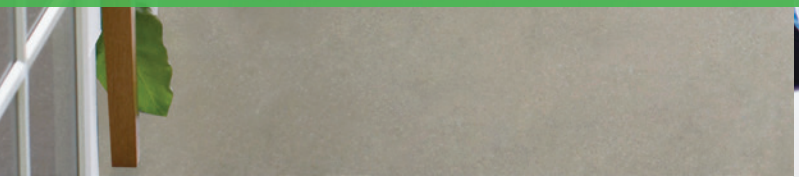

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