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The age of the Zettastructure

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Cover Story
The age of the Zettastructure
 Unimaginable demand fuels exponential growth
20

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October 2016

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10 INNOVATORS IN THE CLOUD

Virtualization has changed the way we do IT. Here are 10 people playing key roles in the cloud.



DIANE GREENE
 Google
 In 1998, Diane Greene co-founded VMware, the company that popularized server virtualization and arguably made the cloud possible. VMware was bought by EMC in 2014, and Greene joined EMC in 2016. Since 2016.



PAUL MARITZ
 ex-Microsoft, EMC, Pivotal
 A former executive at Microsoft, EMC and Pivotal.

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Our tracks guide your path through DCD magazine, website and events

- **Colo + Cloud**
- **Power + Cooling**
- **Design + Build**
- **Security + Risk**
- **Core>Edge**
- **Servers + Storage**
- **Software-Defined**
- **Open-Source**

Meet the team



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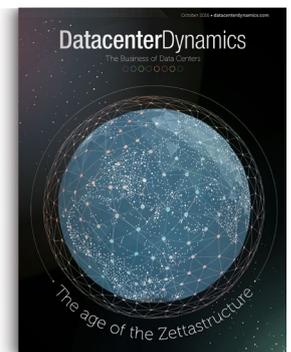
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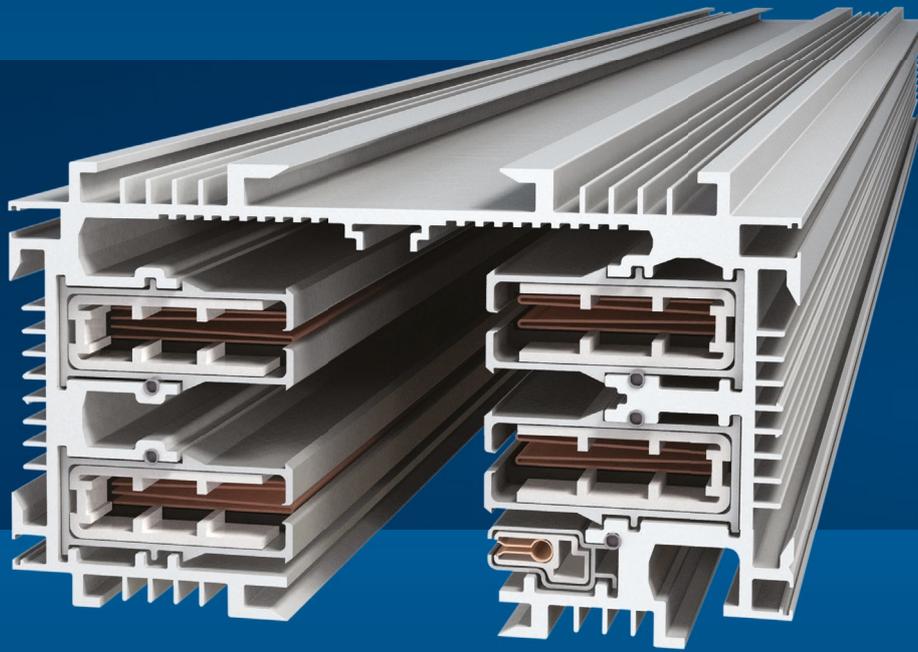


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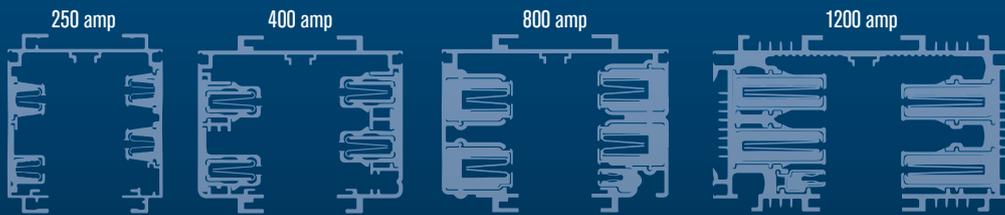


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Zettabytes were unimaginably huge a couple of years ago. Now the internet carries three zettabytes a year and is on track for 10 a month by 2019.

Adapting to this level of change is difficult, especially when other ground rules are changing. The infrastructure is becoming software-defined, and storage is shifting to newer media and platforms. Workloads are shifting between in-house facilities, colocation spaces and cloud providers, and the underlying tech is making those jumps ever easier.

The flexibility at the top layer makes it possible for underlying hardware to change, so we're seeing faster developments in processors, as well as in the technology of racks, cooling and power distribution.

On top of that, the "edge" is rising and the Internet of Things (IoT) is changing what we think of as data centers. All this makes up what we call the 'zettastructure' (p20). We take an in-depth look at three parts of the story.

Intel's Rack Scale Design (p29) is shaking up the physical layer, while international fibers (p22) are redrawing the digital map of the world.

And, finally, storage has to be the fundamental part of the picture (p25). Where else are we going to put all those zettabytes?

In November, we have our annual London show, and this year it's dedicated to all things zetta. In this issue, you'll find a rundown of the different routes we'll take into the territory of zetta.

You'll also get a preview of the event itself (p35), this year at a venue that has lots of heritage. Once used as a disaster recovery center, the Old Billingsgate Fish Market was the largest fish market of the 19th century before it became an office building and now an events venue. We know people who went into the guts of Old Billingsgate, and we'll tell their story.

We take cloud innovators for one of our regular roundups (p32). Our list of 10 people may be different from yours, so let us know if we've missed anyone important.

•
Peter Judge – Global Editor

 @Judgecorp



The rules are changing, and flexibility at the top layers makes it possible to change underlying hardware

86%

The proportion of workloads in the public cloud by 2019 (Cisco Cloud Index, 2016)



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Apollo buys Rackspace

Managed cloud company Rackspace is being sold to private equity firm Apollo Global Management for \$4.3bn, taking the company private. The deal values the company at \$32 per share, 38 percent more than the stock price on August 3.

Dell swallows up EMC

In the largest tech merger ever, Dell has closed its \$60bn acquisition of storage and security giant EMC. The two companies now form Dell Technologies, a privately owned business with \$74bn in revenue.

HPE offloads software

Hewlett Packard Enterprise (HPE) is spinning off software assets including Autonomy, to be merged with UK infrastructure software firm Micro Focus, in a transaction valued at \$8.8bn that leaves HPE shareholders owning half of the new combined company.

Noise from fire-suppression test crashes Romanian bank

ING Bank's regional data center in Romania was taken offline at a busy period by a loud noise caused during a test of its fire-prevention system.

When the Inergen fire-suppression system was turned on, the release of the system's inert gas created a shock wave that damaged dozens of hard drives. More than one million customers were affected by the downtime, which lasted 10 hours, before services were shifted to a backup data center, according to news reports.

Daniel Llano, head of ING Retail Banking, said in a statement (translated): "We inform you that today, September 10, at 13:00, the data storage system started generating operating errors."

Llano explained the cause: "Yesterday, during a planned test of a fire-extinguishing system in our data center, Inergen [inert gas] flooding affected more seriously and unexpectedly our servers and data storage system."

"It was as high as their equipment could monitor,

over 130dB," a source told Motherboard. Another said it was "like putting a storage system next to a [running] jet engine."

A similar shockwave knocked out a Glasgow city council facility last year.

Ed Ansett of i3 Solutions Group warned about such failures in a presentation to DCD Converged. He says that fire-suppression system's "nozzles should be baffled or placed away from the storage racks."

<http://bit.ly/2cJQfEn> ●

VOX BOX / DCD VIDEO



Mark Seymour
Director
Future Facilities

What is the Green Grid's Performance Indicator?

PUE has achieved a huge amount of improvement in the data center industry, in terms of energy spent in the infrastructure, but it's just one view. The Performance Indicator is the obvious next step. It enables the industry to look at performance not just in terms of energy efficiency, but more holistically. It's not just money or efficiency, it's also business need.

<http://bit.ly/2c0loLF> ●



Doug Sabella
CEO
Nlyte Software

After 10 years, what did you need to add in Nlyte 8?

We acquired FieldView last February. We had already been partnering with them, and had customers in common, but now we've brought the systems together. Software-defined data centers will have unintended consequences at the physical layer; we can mitigate those consequences, sharing information between the virtual folks and the ITSM folks.

<http://bit.ly/2blfqdy> ●



Google moves towards zero waste

Google has announced a “zero waste to landfill” goal for its data centers, which means that no rubbish from its facilities should end up in municipal waste sites.

So far, six of the company’s data centers have hit the 100 percent diversion rate out of a total of 14 sites. Instead, waste “is diverted to a more sustainable pathway, with no more than 10 percent of it going to a waste-to-energy facility, unless waste-to-energy can be proved more valuable than alternative diversion paths,” said Google’s program manager of data center sustainability, Rachel Futrell.

The six data centers that reached zero waste to landfill are Dublin, Ireland; Hamina, Finland; St Ghislain, Belgium (left); Changhua County, Taiwan; Singapore; and Mayes County, Oklahoma.

In Mayes County, Google is using a trash compactor that gives accurate weight data for tracking and reduces the number of pick-ups by a contractor, Futrell said.

In July, Google bought 236MW of output from two upcoming Nordic wind farms; in June it said it would buy renewable power in Taiwan; and in May it joined the Renewable Energy Buyers Alliance.

<http://bit.ly/2cq4Xxc>

Cummins uses Ceres fuel cells in DoE project

Power-generation specialist Cummins has partnered with Ceres Power to deliver a fuel cell built to specifications from the US Department of Energy.

Ceres Power will get \$2.6m for assisting on a \$4.9m project that aims to develop a 5kW cell powered by solid oxide.

A solid oxide fuel cell (SOFC) features a solid ceramic electrolyte material and produces electricity directly from oxidizing a fuel, such as natural gas or biogas. It can help achieve high efficiency, long-term energy stability and low emissions at a relatively low cost, but high operating temperatures can cause a slow start-up and short working life.

The Department of Energy (DoE) project is aiming for 60 percent efficiency, and will be scalable to meet multiple distributed power applications up to 100kW, designed for data centers. The product will rely on Ceres’ Steel Cell technology.

Cummins has experience in the market, having been awarded a \$20m-\$75m contract in 2001.

<http://bit.ly/2cWf0Wh>

DataVita Glasgow gets Tier III certification

Scottish company DataVita has become the first colocation provider in the UK to complete the Tier III certification cycle with the Uptime Institute.

The Fortis data center in Glasgow – set to become one of the largest in the country – has been certified as Tier III for both Design Documents and Constructed Facility to make sure the physical building meets the guidelines and all mission-critical equipment is concurrently maintainable.

Having completed design certification, DataVita is planning to obtain the optional, but arguably more important, operational sustainability certificate next year.

DataVita was established in January 2014 to operate the Fortis data center, which it calls Scotland’s largest purpose-built colocation facility. The site is located between Glasgow and Edinburgh. It will host 2,000 racks once complete, all powered by 100 percent renewable energy.



<http://bit.ly/2cYrzCS>



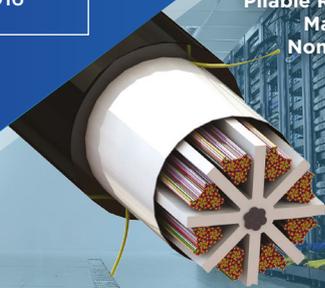
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Evernote moves to Google Cloud

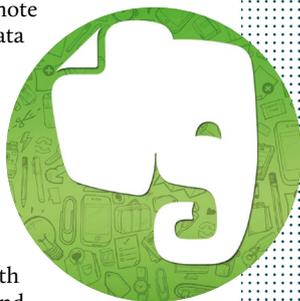
Note-taking application Evernote is set to close down its own data centers and move to Google Cloud Platform by the end of 2016, after using its own servers for eight years.

With over 200 million users and billions of notes and attachments stored with Evernote, the news is a boost to Google's bid to catch up with rivals Amazon Web Services and Microsoft Azure.

"In reviewing our options, the benefits of adopting a modern cloud solution for our data quickly became clear," Ben McCormack, Evernote's VP of Operations, said in a blogpost.

Google's deep learning technologies were a major draw for Evernote, with Anirban Kundu, Evernote's CTO, telling *ComputerWorld*: "AWS is strong on the machine-learning infrastructure side of things, but on the machine-learning applications, we thought Google was definitely head-and-shoulders above them."

<http://bit.ly/2cG7XbT> ●



Lifeline builds data center to survive electromagnetic pulse

Cloud and colocation company Lifeline Data Centers is finally set to open its Fort Wayne, Indiana, facility next year, after delays brought on by a desire to make the data center able to withstand the impact of electromagnetic pulse (EMP).

The process added over a year to the schedule, and an estimated \$2.5m to the cost, but it should mean that the \$17.5m facility can survive an electromagnetic pulse. The building will have 60,000 sq ft of raised floor space, adding to the company's existing 120,000 sq ft across its two facilities in Indianapolis.

"In early April of 2015, our owners Rich and Alex were at a convention where they spoke about something called EMP, which stands for electromagnetic pulse," said Nicholas Rudicle, VP of business development. "We decided that because we're building a new facility anyway, we might as well incorporate some EMP shielding into our design."

EMP events can come from solar radiation storms, or from nuclear warheads. The largest recorded geomagnetic solar storm in history, The Carrington Event, occurred in 1859, bringing down telegraph systems across Europe and North America.

A Carrington-level event is expected every 150 years or so, and could cost an estimated \$0.6-\$2.6 trillion in the US alone.

Nations are developing EMP weapons systems, including the Boeing CHAMP, a 2012 US defense project which successfully flew over and knocked out seven electronic targets with "little to no" collateral damage before intentionally exploding.

<http://bit.ly/2cy6K3b> ●

Rugged micro mobile units get resurrected

Elliptical Mobile Solutions, whose pioneering micro mobile data centers were once adopted by AOL, has been absorbed into a new outfit promising "instant" edge facilities.

From around 2010, Elliptical sold modular rack units with built-in power and cooling distribution, including units on wheels with their own electric motors. Despite a contract to build these for AOL, the company went into bankruptcy in 2015. Now a marketing firm has bought the assets and plans to put them to use in a new micro-modular venture called Instant Data Centers.

Elliptical marketed the units worldwide, and in 2012, AOL announced plans to use Micro Data Centers, made by Elliptical, for distributed capacity, in an early example of so-called "edge" data centers. But the company foundered, and went

into liquidation in January 2015. Now an internet marketing firm, Managed Admin, has bought Elliptical's intellectual property and is putting it into Instant Data Centers.

The plan is to "put the old team back to work and help the company grow," according to a statement from Managed Admin, quoted by *Phoenix Business Journal*.

The new company, led by CEO Russ Daily, argues that micro-modular data centers can be more efficient because there is no wasted space, and only cools down the hardware that requires it: "Do you bring your milk home from the store, set it on your kitchen table, then crank your air conditioner to keep it cool?" asks its website. "Then why do this with your data center?"

Instant hopes the concept will be more viable with today's interest in the network edge. Daily said Instant Data Centers will inherit around 50 customers from Elliptical, including NASA and NATO.

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ASHRAE 90.4 drops PUE

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has published a new version of its energy standard for data centers.

Standard 90.4-2016 includes recommendations on design, construction, operation and maintenance of data centers, as well as on the use of on-site and off-site renewable energy.

The standard caused controversy in 2015 after ASHRAE revealed a draft version that included provisions for

maximum permissible PUE levels. Following much debate, all references to PUE have been removed from the final version.

Standard 90.4 is a performance-based design standard in which mechanical load and electrical loss are calculated. Compliance with Standard 90.4 is achieved when the calculated values do not exceed the values contained in the standard for that location. An alternative compliance path is provided that allows tradeoffs between mechanical and electrical components.

The committee decided the Green Grid's PUE (power usage effectiveness) didn't do what the standard required.



"The PUE metric is actually based on measured energy use data rather than design criteria calculations," explained Ron Jarnagin, chair of the 90.4 committee. "We realized the design calculations contained in Standard 90.4 would not likely match up with the actual

energy use data, so this approach was amended."

Data centers will no longer be subject to the old ASHRAE Standard 90.1. The new standard will be updated as technology changes, ASHRAE said.

<http://bit.ly/2cD4Lxg>

Active Power makes one-minute flywheel

American backup power specialist Active Power has launched a flywheel that can keep the IT equipment running for as long as 60 seconds in the event of an outage, giving plenty of time to switch to an alternate power source.

The CleanSource 275XT UPS increases runtime by up to 78 percent over the current generation. To achieve this, Active Power increased the speed of the rotor from 7,700RPM to 10,000RPM while keeping the footprint and even the price in line with previous models.

"For us, there are really two ways to increase runtime on our flywheels: you either make it bigger, or you spin it faster," Anderson Hungria, senior product manager for UPS at Active Power, told *DatacenterDynamics*.

"We've made it bigger before, with our CSHD product – the 750kVA we launched a few years ago. In this case, we're spinning the wheel faster. It's the same wheel that we developed about 13-14 years ago, and the main goal was to increase runtime but keep everything else the same."

The amount of energy stored in a flywheel is proportional to the square of its rotational speed, so by increasing speed, the company achieved a considerable increase in runtime.

According to Active Power, today's flywheels present a viable alternative to lead-acid battery banks typically employed in data centers, with up to 40 percent lower total cost of ownership, lower probability of failure and much lower carbon emissions.

Unlike batteries, flywheels don't require dedicated cooling and don't need to be replaced every few years.



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68%

Percentage of firms not ready for EU General Data Protection Regulation (Vanson Bourne)

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Huawei launches Rack Scale Design servers



Chinese infrastructure giant Huawei has launched two product families based on the Rack Scale Design server architecture developed by Intel for hyperscale data centers.

FusionServer E9000 is a converged blade server for general-purpose computing, while X6800 is intended for high-density deployments and GPU-heavy workloads. Both servers were presented at the Huawei Connect 2016 event in Shanghai.

The E9000 has 16 slots in a 12U chassis that includes redundant PSUs, while the X6800 supports high-density server nodes in a 4U chassis.

Rack Scale Design (see p29) could be described as Intel's answer to Open Compute. It's a standardized architecture that enables traditional server vendors to sell equipment to hyperscale data center operators. All RSD hardware is controlled through Redfish, an open, industry standard API that helps enable simple, secure management of scalable platform hardware.

The same type of hardware is also pitched at telcos – the first ever RSD server was announced by Ericsson at Mobile World Congress in 2015.

<http://bit.ly/2cCCJ7S> ●

Aquila delivers liquid-cooled OCP racks for open supercomputing

Technology transfer company Aquila, together with Clustered Systems, has delivered Aquarius, a liquid-cooled supercomputing system built in standard Open Compute Project (OCP) racks.

The racks, first announced last year, are now available to order. The system adds liquid cooling from Clustered Systems to standard Open Racks. The cold plate system removes the heat from servers while allowing them to be easily removed and changed, providing high-density high performance computing (HPC) “without trade-offs.”

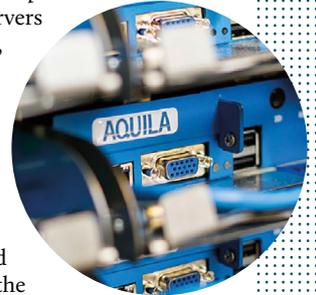
“The drive towards Exascale computing requires cooling the next generation of extremely hot CPUs, while staying within a manageable power envelope,” said Bob Bolz, HPC and data center business development at Aquila. “Liquid cooling holds the key.”

The system uses warm water to cool the servers, and reduces the cooling budget to less than five percent of the data center cost. Using a fixed cold plate instead of running liquid to individual heatsinks, the system addresses two barriers to water cooling: reliability and reuse.

By keeping the cooling to a separate circuit with a cold plate, the system minimizes the use of plastic hoses for piping water. There are no water pipes or plastic hoses near the processors, and water leaks are minimized. Effective and stable cooling for the servers should actually reduce the failure rate of the chips in the servers, Aquila claims.

Hot-swappable boards are supported by the OCP architecture, with a hot swap power board designed by Aquila to block any power spikes that may cause instability while adding or removing servers. Other systems with complex cooling circuits have hit problems because dissimilar metals in the circuit have caused corrosion, Bolz said.

The cold plate also means that existing off-the-shelf hardware needs only minimal changes to fit the new system, and warm water in the data center, such as the exhaust from existing rear door chiller systems can be used as input, so no additional cooling infrastructure is required.



<http://bit.ly/2cCJDFP> ●

Paris fallout shelter to be reborn as a data center

French service provider Online.net has turned a nuclear fallout shelter in Paris into a data center offering data archiving and long-term backup.

Located 26 meters underground, the C14 Fallout Shelter dates back to 1937, when Abri Lefebvre served as a passive defense shelter. The original facility was designed to host up to 90 people in underground rooms totaling 650 sq m.

In 1964, the Civil Aviation Authority took over and began to convert the facility into a much more ambitious

Cold War nuclear fallout shelter. The shelter's floor space was increased to 950 sq m, with a potential to house 300 people.

Also added were a closed-vent system, a power supply backed by a diesel generator, several blast doors, a water supply system, and an autonomous telephone exchange connected with other Parisian nuclear fallout shelters.

The shelter was kept operational and classified confidential until 1991, when it was discontinued as nuclear tensions subsided with the fall of the Soviet Union.

For the next two decades, the building was left abandoned, falling into disrepair as people found their way in.

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Huawei's plan to win the cloud

The Chinese giant has bet on OpenStack. This means customers can mix multiple clouds, and Huawei can promote its hardware, says *Paul Mah*



Huawei's cloud

- FusionCloud is Huawei's version of OpenStack
- Specifications are, at present, kept private
- Users can combine OpenStack instances in their private cloud and others in AWS



Paul Mah
SEA Correspondent
@PaulMah

Huawei is a company with a mandate to take on the cloud. That much was evident at the glitzy three-day Huawei Connect 2016 conference, which opened on August 31 in Shanghai, with keynotes in the 17,000-seater Mercedes-Benz Arena and an exhibition across the road at the Shanghai World Expo Exhibition and Convention Center (SWECC), and the Shanghai New International Expo Center (SNIEC).

At all three venues, scores of gigantic LED displays hung inverted from high ceilings to denote the cloud, as Huawei showed its diverse cloud ecosystem to some 20,000 attendees on the ground. At the same time, Huawei also took pains to highlight its efforts in building highly vertical cloud solutions with

partners as diverse as Schneider Elevator and General Electric.

Huawei has bet on the OpenStack platform, contributing heavily to the open-source project and creating its own distribution of OpenStack called FusionSphere to power its cloud platform. Company executives told *DCD* then that Huawei had put its weight behind OpenStack as it was ideal for implementing cloud computing.

So what is the company's strategy for enterprise cloud, considering that Huawei itself expects a hefty 85 percent of enterprise apps to eventually reside in the cloud?

"When you go to an enterprise customer, you don't walk in and say, 'We've got a server.' They only want to buy hardware if it meets a business problem. Same with the cloud," explained Ronald Raffensperger, CTO of data center solutions at Huawei.

"We changed to focus around some specific vertical markets, where we could identify the needs, find the partners necessary, and go to a customer and say, 'We can solve your business problem.'"

Raffensperger pointed to various cloud-centric solutions that Huawei has created around media, smart city initiatives and transportation offerings as examples of this rationale in action. He said demand for cloud solutions is big enough, with a sufficient geographical market, for Huawei to work with partners to put together a growing list of solutions to meet demand.

But where does this leave the enterprise? Does Huawei intend to release a cloud offering tailored specifically for enterprises? The answer on this front isn't so straightforward, however, if only because there is no such thing as a standard enterprise, according to Raffensperger. "There are no 'plain' enterprises; they all have specific requirements. We need to find the partners to [meet these requirements]," he noted. "Accenture and SAP are in many ways our strategy of going after the enterprise cloud. [Enterprises] can use the cloud as an infrastructure."

Ultimately, the absence of an enterprise-specific offering doesn't mean that enterprises are not buying into Huawei's ecosystem either. "We've sold FusionCloud to a lot of enterprises," said Raffensperger.

For industry-specific solutions, the company is not resting on its cloud laurels, launching 31 new cloud-based services at Huawei Connect 2016. Capabilities range from specialized compute offerings such as GPU and memory-intensive instances, to VPN and direct connect network capabilities.

While many of the capabilities would have been at home on the AWS Console, Huawei is adamant that it is only interested in creating the underlying technology for others to deploy, and has no plans to provide cloud services outside China, said Eric Xu, Huawei's rotating CEO, at a separate press conference.

Raffensperger said: "I think it gives them another alternative. If they are worried about security, privacy, control, service-level agreements (SLAs), and being able to ensure quality of service, then utilizing a cloud in your own premise, whether in their own hosting facilities or room, can have a lot of benefits."

He pointed to a mutually beneficial co-existence between private and public cloud deployments, and emphasized that

Huawei is really working to build a cloud that works across both the private and public cloud using OpenStack.

"The thing we like about OpenStack is that we are helping to build an environment of multiple clouds that are logically unified. You can go out to Amazon cloud services and get them in a unified way," he said.

To highlight the company's efforts to bridge public and private clouds, Raffensperger drew attention to the Tricircle project, which provides an OpenStack API gateway and networking automation, enabling multiple OpenStack instances in either hybrid or multi-site deployments.

"Huawei created what we initially called OpenStack cascading. It is a technology of how you can run multiple OpenStack instances across a larger cloud. We contributed the code to do that," he said. "You have OpenStack instances running inside AWS, and you can unify all of those. You can move workloads back and forth between them," he explained.

Of course, what is left unsaid is that enterprises could theoretically move the bulk of their processing onto their own private cloud for data privacy, or to keep operational costs down, even as they reserve the ability to burst unexpected capacity demands onto a public cloud service.

Finally, a pertinent question needs to be asked: will rolling out Huawei's cloud result in organizations ending up stuck to a proprietary cloud implementation?

"There are some things – such as management – that we have built that are unique to us," admitted Raffensperger. "We make sure that we keep all the OpenStack

interfaces intact so that customers don't get locked in. The strategy is to be as open as possible, and where we can add value to this, we do that as well."

For its ambition to "cloudify" everything, the company is keeping FusionCloud close to its chest for now. This may be from a desire not to antagonize its cloud partners, but it means that anyone wanting to roll out FusionCloud without Huawei hardware will just have to keep waiting.

"In general, we would like FusionCloud to run on our hardware. But if the customer has the hardware that has the right specifications, OpenStack allows heterogeneous storage and hardware, so you can support multiple vendors," said Raffensperger. "We don't have a strategy that says, put in FusionCloud where there is no Huawei hardware." ●

We would like FusionCloud to run on our hardware. But if the customer has the right hardware, OpenStack can allow multiple vendors

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Paraguay goes the modular way

With a prefabricated modular design, Tigo Paraguay is making a new data center for disaster recovery, reports *Celia Villarrubia*



Paraguay is not a mature market for data center services, but it has a lot of potential for future investment and is creating a lot of interest. In particular, the country is starting to demand colocation facilities for business continuity and disaster recovery. Aiming to meet this need, telecoms company Tigo Paraguay, a subsidiary of Europe's Millicom International, is building a data center in the capital, Asunción, to support its own needs and those of third parties, with some very interesting characteristics.

First, it is a hybrid. The site holds a prefabricated modular data center, designed by Flexenclosure of Sweden, alongside a conventional office building constructed traditionally, with bricks and mortar.

Second, this facility complies with international standards. It is the first data center in Paraguay to win Tier III design certification from the Uptime Institute. The global project is certified, including the modules and the local engineering. In future, Tigo aims to also achieve Tier III certification for the constructed facility. "It's the first time we committed to a prefabricated

data center, and we therefore wanted to comply with all standards," says Adrian Celma, head of IT and data centers at Tigo Paraguay. Tier III was the appropriate standard for a facility intended for disaster recovery, and it has proven invaluable, he says.

Tigo is investing some \$2.5bn over the five years up until 2020 to improve its infrastructure and boost access to broadband services. The company has already expanded its fiber optic network in Asunción to more than 400,000 households.

Within this ambitious investment plan, the facility Tigo is building in Asunción will be the first data center in the country to offer professional colocation services to external clients, including colocation, disaster recovery, infrastructure as a service and software as a service. It will also be the first Tigo data center designed using a modular architecture, meeting Tigo's need for flexibility. Precisely because of the immaturity of Paraguay's data center market, the company needed to avoid the risk of building a concrete mega-infrastructure project requiring high initial investment that would at first remain empty.



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The prefabricated data center is based on Flexenclosure's eCentre modules, which are designed, according to the company, to give better control of growth and greater predictability. They have been deployed by Vodacom in Tanzania and Mozambique, MTN in the Ivory Coast, and Burst Networks in Myanmar (formerly Burma). The Tigo project is Flexenclosure's first project in Latin America. "We are doing the project in two phases, which

helps us improve costs," says Celma. The two stages will total 760 sq m, with 280 sq m in the first phase, in a room made up of seven non-ISO eCentre modules, holding up to 110 racks. The rest of the space will arrive in a second phase with up to 140 racks, which Celma expects to start building in late 2017.

Deployment time was a major factor in choosing a modular design. "We can have this data center in six or eight months from the time of the purchase order. By contrast, a conventional data center of this size would take 14 to 18 months." Even that timescale is optimistic, he explains, as Paraguay relies heavily on sea transport. Because this data center is built in a factory, where it has been tested before delivery, the modular design ensures the quality of assembly. "We were in Sweden and had the opportunity to make the first tests of the data

center, and also monitor the time the modules take to ship to Paraguay. That has given us peace of mind," says Emanuel Sierra, manager of innovation at Tigo Paraguay.

The construction process proceeded on several fronts simultaneously. While Flexenclosure began making the modules in its factory in Sweden in mid-September 2015, the civil engineering work began in Paraguay. Tigo had to make a foundation to support the modules, which are located at a height of 80cm for wiring distribution, as well as the construction of concrete bases for generators.

The data center modules arrived in the country in late February, and Tigo began the process of physical installation. This was delayed for various reasons, including the El Niño phenomenon, and the data center should open in October. To complete the facility, Tigo needed to construct the portion of the facility adjacent to the modules and carry out complementary

work, including car parking areas and landscaping. The project is a unique building, and Flexenclosure will be in charge of the construction of the modules and generators, delivery, and selection of the civil engineering partner in Paraguay. Best practices from Tigo Paraguay will be implemented by other data centers that Millicom is running in Latin America, which offer services to third parties, particularly in Guatemala and

Colombia. Millicom already has three data centers in Colombia and plans to complete a new facility this year. Located in Medellin, it will be similar to those in Paraguay: a hybrid construction with the white space constructed from modular infrastructure. ●

• *This article first appeared in DatacenterDynamics.es. This extract was translated from Spanish and edited by Peter Judge.*

In Paraguay's immature market, a modular approach avoids risk

Latin America



Dimensions of a data center

- 3kW per rack average power
- 160 kW power for the first phase
- 2N + 1 redundancy
- Two 200kW modular UPS
- Two 240kW modular rectifiers
- Two 810kVA diesel generators
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The age of the Zettastructure

The zettastructure is evolving to handle the Internet of Things. It will change every part of our technology infrastructure, says *Peter Judge*



Peter Judge
Global Editor
@Judgcorp

DatacenterDynamics coined the term 'zettastructure' to express the magnitude of the change that is set to sweep the world's technology infrastructure.

A zettabyte (Zbyte) is a trillion gigabytes, or 10^{21} bytes. In 2016, the total capacity of all hard drives was roughly a sixth of a zettabyte. Ten years on, the Internet is carrying more than three zettabytes of data center traffic a year, and network giant Cisco predicts that by 2019, global data center traffic will be more than 10Zbytes per month.

There's more. Thanks to the so-called Internet of Things (IoT), it's not just people creating the deluge. More data is being generated by machines and objects – from cash registers to traffic lights – and Cisco's Cloud Index this year predicted that by 2019, the total amount of data produced by people and things will top 500Zbytes per year.

Where is it all going? Not all of it is kept, but in 2014, the world had 1.4Zbytes of stored data, and the total was growing so fast that hard drive king Seagate predicted a capacity gap in 2016, because the world's storage factories would not be able to produce enough drives. Thankfully, that doesn't seem to be the case – but all other predictions of exponential growth are coming true in spades, and Cisco reckons we'll have 3.5Zbytes stored by 2019.

Within this growth there are shifts. Data and workloads are rapidly moving off mobile devices and local hard drives, and out of private enterprise data centers into the public cloud. They can be consolidated more efficiently there, and the gap is widening. By 2019, in-house data centers will improve, from running an average of two workloads per server to more than three. Big deal. In the same period, public cloud servers will increase their capacity from five to eight or 10 workloads. At the same time, a new surge or "edge" capacity will be needed to manage IoT data and streaming media for the people and things in a locality. So it's all changing. Let's look at some specific strands of how that will work out.

Webscale data centers are built differently, and they are finally getting the racks they deserve. Giants such as Google have specified their own racks for some time, but now those ideas are emerging on the open market through initiatives such as the Facebook-led Open Compute Project (OCP), and the more proprietary offering of Intel's Rack Scale Design.

There are common features to all of this. Racks, or trays within racks, are becoming the new unit of computing, and they are sharing power and cooling more effectively with

data center distribution through the rack. Multiple Gbps of network are available, and more of that is delivered via fiber over open-switch architectures provided by SDN and NFV within the facility. Everything is accessible from the front of the rack, so the back can be arranged as a hot-aisle at temperatures uncomfortable to humans.

OCP's Open Rack takes it to a radical



some time, but there are signs of change.

Energy is a huge data center cost, so ARM processors, widely in use in mobile devices, have long been proposed as an alternative, although ARM fans have been frustrated at the sluggish progress of their chips in data centers, as vendors such as Calxeda and AMD tried and failed to make an impact there. The latest effort, by Fujitsu, takes ARM processors and tunes them with scalable vector extension (SVE) for the high performance computing (HPC) market.

Meanwhile, IBM has encouraged other vendors to adopt its OpenPower processor, again for specialist markets including HPC. OpenPower is being built into servers compliant with the OCP rack standards, and implemented by cloud providers.

Much of the real action is in GPUs, the graphics processing units originally created for acceleration cards used in gaming. As it turns out, the fast parallel processing required for speedy graphics is useful in more general activity. The world's fastest supercomputers are now all built using GPUs. Nvidia is ahead of Intel, and has been striking deals with other vendors, including one that teams its GPUs with IBM's OpenPower chips.

Networking has been shaken to its foundations by the arrival of software-defined networking (SDN), which allows topology, and functions can be centralized and expressed as software. This allows network functions virtualization (NFV), breaking the stranglehold of large network vendors and turning networks into the flexible resources that the zettastructure demands.

This is having a radical effect on the network within data centers, with functions aggregating into "white label" switches at the top of the rack, which can be defined on an open basis by groups such as OCP. This in turn is speeding the arrival of faster fiber links into the data centers and easing their integration with the world at large, where bigger fiber networks are being laid between countries.

Networks have become a key differentiator for data center providers that entice new customers by promising fast access to their existing customers through direct links within and between their premises. It's no exaggeration to say that without SDN and NFV, the zettastructure could simply not exist.

\$1.65bn
The budget of
Oak Ridge National
Laboratory

For a couple of years we've been hearing about the all-flash data center, which will switch its most-used storage to solid state, for swift access, and to save power. But hard drives keep evolving to remain one step ahead in price-performance, while behind the scenes future generations of storage are evolving, which will change the rules again.

Solid-state drives (SSDs) are now available in sizes up to 60TB, and a fifth of businesses expect to soon be using flash as their primary storage medium. Future developments include phase-change memory, coming from IBM, Intel and Micron, and ReRAM from vendors including SanDisk.

But beware of believing the hype: 3D Xpoint, promised by Intel, looks to have been shipped before it was ready, leading to an embarrassing climb-down.

If all your data is in the cloud, that's where the threat comes from. Data centers can now be attacked from anywhere, at any time. The toolkit of attackers includes distributed denial-of-service (DDoS) threats, where a data center can be swamped with apparently real traffic. There's also a continual effort to find weaknesses in the software that would allow access to the infrastructure.

There's an arms race between those looking for weaknesses to exploit and those patching them. At the same time, while specialist companies find ways to filter traffic and protect data centers from DDoS attacks, others are finding new ways to hit them. Some of these attacks enter the political arena. China, Russia and the US government are all known to have backed attacks on bodies within other nations. It's also known that the US hoarded unpublished weaknesses in software to use as cyber-weapons.

Meanwhile, there's also a new generation of physical attacks to data centers, based on their non-IT components. All too often, physical infrastructure has unconsidered interfaces to the Internet, which can be found and exploited, potentially shutting down a data center. Another devious trick might be to deliberately book new cloud instances in such a way as to overwhelm the power and cooling within a site.

These attacks have been overlooked in the past, but as the zettastructure begins to handle more real-world tasks in the Internet of Things, these attacks could actually threaten lives by sabotaging critical functions at, for example, hospitals or in transport systems.



extent, increasing the rack equipment's width to 21 inches. That's more than some large enterprises can stomach, so LinkedIn has produced and shared an alternative - Open19 - which can accommodate existing equipment.

The processors behind the zettastructure are changing. Intel has ruled the roost and server architectures have remained stable for

Fortune on the high seas

Lines are being drawn across the world that will shape the future of the Internet, Sebastian Moss reports



Sebastian Moss
Reporter
@SebMoss



To support the growth of global Internet traffic, investment is flowing into laying vast submarine cables that stretch across the oceans. Ships 140 meters in length, specifically designed for this complex task, plow the continental shelf, burying cables up to three meters under the ocean floor. Remotely operated vehicles scan the depths, looking for underwater walls, jagged rocks, trawl scars and sunken ships, searching for the perfect pathway across thousands of kilometers of hostile terrain.

This epic undertaking is fundamental to the continued expansion of the digital era, with an estimated 99 percent of all transoceanic digital communication being carried by these fiber optic cables. But with cables costing anywhere from \$200m to \$1bn to put in place, only a few companies can afford to do this, and where they decide to place their cables will have a profound impact on how the zettastructure is developed.

The average submarine cable has a design life of 25 years, but “the economic useful life, financial useful life, is something much shorter than that, probably about 12 to 15 years,” said Debra Brask, VP of Project Management for TE SubCom. “It’s mainly because technology changes and then the per bit cost goes down, so it almost becomes more expensive to manage the older networks.”

But for those 12 or so years, that cable remains the backbone of oceanic data transfer in its region and a whole ecosystem is built around it. “More and more cables, and more networks, and more clouds come in to collect

the capacity,” said Ihab Tarazi, Equinix CTO.

Whichever companies take advantage of cables laid now stand to reap the rewards for the next decade. Equinix, in particular, has eagerly jumped into the field, announcing its involvement in 12 different projects.

Perhaps its most technologically important project is the Monet cable, stretching from Florida in the US to Praia Grande in Brazil. Laid by TE SubCom, and funded by Google and several South American telecoms companies, the 10,556km (6,560 mile) long cable does something few submarine cables have done before – it travels directly into the data center.

“What we did is we worked with Google closely and built a new model that allows the two of us to be able to land the cable system in a data center without the need for a cable station or a network in the middle,” Tarazi told *DatacenterDynamics*.

“The biggest thing for us here is that the global backbone will point towards our data centers if we continue to execute and win more and more of these cables, which is very good for us and our customers,” he added.

Submarine network provider Aqua Comms has worked on similar technology for its own cables: “We can light from data center to data center,” said CEO Greg Varisco. “To be able to do that direct optical-to-optical lighting, you eliminate a lot of additional equipment and optical-electrical-optical conversions in the middle. That doesn’t happen in the cable stations any more.

“Now that’s important, because now you can provision quicker. You have just the

293
undersea cables are in use;
48 are under construction
or planned
(451 Research)

In 2001, before the dot-com crash, telcos spent billions on international fiber. In the new boom, the focus has shifted to cloud providers



two ends to do work. You can provision to turn capacity on and off quicker, and security-wise, you can encrypt from data center to data center.”

Future cables will likely follow this approach, but one question remains: How many new cables will there be?

We are in the middle of a boom, but it's unclear how long this will last. “Traditionally, it's been a very cyclical market,” said Brask. “In the past, what you would find is that there would be many long international cable systems built over the course of about three years.”

After this, feeder systems and smaller networks are built: “So you basically expand off those large pipes into these other smaller systems. But they're much smaller, so obviously the total market value goes down.”

The last submarine expansion was in the 1990s, driven by the dotcom boom. International operators laid cables frantically in order to corner an expected future market.

In 2001, traditional telecoms companies spent \$13bn on international fiber, but by 2003, spending was down to \$1bn, with a telecoms crash caused partly by the bursting

of the dotcom bubble, as well as by the invention of dense wave-division multiplexing (DWDM), which increased the data capacity of fiber 100-fold.

In the new boom, the focus has shifted from Western telcos to cloud providers, and Tier-1 carriers in Asia including China Telecom, China Unicom and Korea Telecom.

Google, Microsoft and Amazon are all heavily invested in building a huge submarine network that will support the zettabyte era. But will they too slow down cable expansion after this wave? “It's hard for me to tell. I don't know. It seems to me like it's different, but given that I have been in the industry for almost 20 years, I haven't seen it. I haven't seen it be different,” Brask said.

“You want to always try to strive to keep things as flat as possible and not so cyclical, but we just build the systems, we don't drive the demand,” she said.

Currently the demand remains high, but to place these cables takes time, money, and political wherewithal. “All of a sudden a government of a country can say ‘no you can't be here,’” said Brask. Permits, one of the most time-intensive aspects of cabling, can take over two years in countries like China.

Elsewhere, like Taiwan, there are defined cable corridors, but these corridors of power come with their own risks - a 2006 earthquake

in the country took out several cables and temporarily cut off communication to parts of China, Hong Kong, and Southeast Asia.

Legislation, military actions and the need to diversify routes will help define the pathway and landing points of these cables, affecting the nations that they land on and those around them.

The future will likely see some of those customers served via satellites. “There's new satellite technology, and we're going to make some announcements on some of them,” Tarazi said.

“These satellites put in now can use new coherent advanced optics - the same ones they use underwater - and with that you're going to be able to squeeze a lot more capacity into satellites, so we see satellite distribution as a second option for places that you cannot get to so easily with cable. But fiber will always be number one in its capacity, and satellites will be filling in the gaps in places that will be hard to get to.”

Brask agreed: “I think there's going to be a need for sure to have these systems for a very long time. I don't see what replaces fiber-optic cables. I see that you would have to have them to truly carry bandwidth between countries. To have a world wide web, and to use it to its fullest, you're going to have to have submarine cables.” ●



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Malaysia Increasingly Attractive Data Center Hub for Companies

Real Estate, Affordable Energy and Location make the country suitable for firms looking to build data centers in South East Asia

It's not uncommon for images of beaches, wildlife, densely-populated cities and Formula One racing to be conjured up when Malaysia is mentioned. Increasingly, data centers are mentioned in association with the South East Asian country given Malaysia's concerted effort to make itself a world-class data center hub by 2020.

That's because the country is particularly well suited to handle the expected influx of data center investment when compared to regional neighbours Indonesia and Thailand. This is because of the country's service orientation of Malaysia's economy, close proximity to the Asia Pacific region's major hub city (Singapore) and a concerted policy of attracting ICT and data center business in specially zoned and provisioned areas in the Kuala Lumpur metropolitan area (Cyberjaya) as well as the Sedenak Iskandar Data Hub (SIDH), which is fast becoming known as a data centre park with abundant, readily accessible and top notch infrastructure and utilities. The Data Hub is a government initiative led by MDEC.

Investment Advantages In Malaysia Apparent

Malaysia, which is already a major established investment hub for multinational companies in South East Asia, is also attractive to data center investors given that it is a mere 60 kilometres from Singapore which makes latency for those with operations in the city-state virtually a non-issue. Proximity to Singapore has been cited as an advantage by companies, such as NTT Communications, that have primary data centers in Singapore and recovery facilities in Malaysia.

Competitive real estate prices and the country's lower electricity tariff relative to Singapore and resource availability for potential data center operators compared with many other markets at a relatively similar level of development are also factors that make it



A depiction of Malaysia's Sedenak Iskandar Data Hub which is known as a resource-rich data center park

attractive for investors considering larger data centers in Malaysia.

Fast-Growing Data Center Market

These advantages are not lost on data center operators and led DCD Intelligence to project double-digit growth on a year-over-year basis from 2016 to 2020 which will make it the fastest-growing South East Asian country when white space is considered.

The type of data centers Malaysia offers matters to investors as well. The Malaysian data center sector is designed to meet the needs of both the IT needs of an emerging economy that typically grows at least 4% quarter-on-quarter, according to DCD Intelligence. That's in addition to the requirements of international clients using Malaysia to house their local or regional IT capacity. Malaysia's availability of suitable local outsourcing facilities and services, which has increased significantly over the years, is a core data center requirement and the country is better suited to meet those needs than ever. As such, DCD Intelligence expects colocation and outsourced space in Malaysia to grow 21% in 2016.

Investment dollars have flowed into the country as a result of the many cited

advantages. Huawei is one example of a company that clearly sees the data center advantages of Malaysia. The Shenzhen, China-based company opened the Asia Pacific Digital Cloud Exchange data center, a 90,000 sq. ft. facility of office and warehouse space for data hosting and logistics in Iskandar, last June. Huawei is using the data center to service its regional customers.

The data center sector is already an integral part of the country's economic transformation and will soon be a well-known part of the Malaysian landscape.



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Where are my zettabytes?

The way we store our data is changing. *Max Smolaks* attempts to predict what's in store for the industry



Max Smolaks
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Today, the total capacity of all the hard drives in the world comes to a little under a zettabyte, but according to Cisco, we'll need to store approximately 3.5Zbytes of data by 2019. Even if these predictions don't come to pass, it is obvious we'll need a lot more capacity in order to keep up with the social changes caused by technological progress.

We'll also need faster types of storage for specific workloads – the kind that leave flash in the dust. We'll need to decide which of the emerging standards will unite the industry, and which standards need to be killed off. We'll have to manage our data better and deploy systems that can track every single file that constitutes a zettabyte. To find out how the storage landscape will change, we've decided to ask three leading experts.

Ron Bianchini, co-founder and CEO of hybrid storage startup Avere Systems, says that most organizations continue deploying NAS boxes as individual islands of capacity. Instead, we'll need nearly unlimited storage pools located in the cloud and automated through software. "Rather

than having these islands of capacity locked behind the protocol engine, like NFS or CIFS, the idea would be to have a large pool of capacity, a large object store, and then put protocol engines in front of it for the different protocols you need, so that you have a big scalable storage pool, but then you have the protocols providing the functionality. For data reliability, for disaster recovery, we want geo-dispersed storage infrastructure," Bianchini added.

One issue complicating the adoption of such an approach is privacy regulation – quite a few governments around the world have realized that data about their citizens can be dangerous in the wrong hands and are now demanding that such data stays within the country's borders. That's great news for data center builders, but it is a headache for corporations that want to build storage pools that stretch across borders.

In order to solve this issue, we'll need to invest in copy data management – something that has been around forever but is especially relevant now, thanks to legal tools such as the EU's 'Right to be Forgotten,' which will require digital service providers to delete customer data from their systems on request. ►

► The Right to be Forgotten will become EU law in March 2018, yet according to a recent Compuware-sponsored survey of CIOs across Europe and the US, 30 percent of businesses are not confident they could track down and erase all of the data that relates to an individual customer. That's where copy data management software comes in – it tracks and minimizes the number of copies to simplify regulatory compliance, while also ensuring there are enough copies in enough locations for disaster recovery.

Dave Wright, general manager of SolidFire – an all-flash storage company that was acquired by NetApp for \$870m in cash, with the deal closing earlier this year – offers his own insight into the future of storage. Wright told *DatacenterDynamics* he believes in a future where the flash industry will standardize around a 2.5in SSD form-factor that supports NVM Express (NVMe) – a relatively new storage interface that will likely replace the SATA we know and love.

Wright also believes there's a bright enterprise future ahead for the M.2 standard for flash storage. Today, this tiny SSD form-factor is mostly seen as part of high-end ultrabooks – devices so thin they can't possibly fit a 2.5in drive – but it could be a boon to server designers since it also supports NVMe. “The other big trend we are seeing is the move to storage systems being primarily software-based, with industry-standard hardware,” Wright said. “And there are still people who are focused on proprietary storage appliances but that [trend] is really going to drive the need to adopt standardized form-factors in the marketplace because that's what customers are moving towards.”

That could spell bad news for EMC's DSSD D5 and SanDisk's InfiniFlash – two of the recently launched arrays that have ditched highly popular legacy drives in favor of proprietary flash

formats. Sure, these look cool and perform like champions, but they also prevent customers from finding a better deal on their flash. Considering the rate at which the price per GB has been falling, this might prove to be their undoing.

As the storage market realigns itself around software, today's dominant players will have to adapt or risk losing their dominance. “NetApp was a very appliance-centric company, and even though there was a lot of software IP, it was all delivered in proprietary hardware. They have really shifted as a company over time towards delivering more of their technology as standard software. At SolidFire, it has always been the case, and we have both appliance and software-only versions of our product.”

NetApp is not the only traditional storage vendor that knows where the wind is blowing: last year, EMC donated source code for the ViPR storage controller to the open-source community, its first ever contribution of a commercial product. So what does it do? ViPR, and its open-source twin CoprHD, abstract storage from disparate arrays into a single pool of storage capacity and support a wide range of third-party hardware.

“Most of the market is still buying integrated appliance solutions, and I think vendors will continue to sell a high volume of those solutions,” Wright said. “But the appliances, much like the SolidFire model, will be built around off-the-shelf hardware, so you can use the same software base whether a customer wants to buy an appliance or whether they want to provide their own hardware.”

And then there's the question of the all-flash data center – an approach to infrastructure that seemed to be the Holy Grail of storage just a few years ago.

According to Cisco we'll need to store about 3.5Zbytes of data by 2019

Gary Lyng, senior director of marketing

for data center business at Western Digital – a company that was threatened by the flash revolution until it bought SanDisk, the world's third-largest manufacturer of flash memory – offers the final piece of pragmatic thinking. According to Lyng, innovation in storage remains limited by the speed of manufacturing and the length of the hardware refresh cycles. “People always look towards the evolution of one sort of media, saying ‘X is going to replace Y,’ but the reality is, there is investment, there's also the rate of fabrication facilities, and although flash is very powerful in terms of additional performance, lower power and lower cooling, there are a lot of new technologies coming out down the line. You've probably seen some of the recent SanDisk announcements around ReRAM and the different approaches there.”

Resistive RAM (ReRAM) represents a new class of storage class memory (SCM) devices that promise to be thousands of times faster than flash, but with higher capacities and at much lower price than DRAM. Other types of SCM currently in development include Ferroelectric RAM (FeRAM), Magnetic RAM (MRAM) and Phase Change Memory (PCM).

Obviously, the industry has no need for several incompatible memory types to do the same job, and the number of contenders goes to show just how hotly contested this field is. Expect it to grab the headlines as the next big format war: think VHS versus Betamax, or Blu-Ray versus HD DVD. But this one will not be fought in living rooms and video stores; instead, it will be fought in the data center.

“One of the things you'll see more of – especially from Western Digital since we own the fabrication facilities and are the world's largest [storage] provider – is not only innovating within the media but also up the stack,” Lyng said. “So we've got vertical integration from the individual firmware on drives, whether SSD or HDD, then integrating it with scale-out object-based storage and unified file and object storage, and adding open APIs and tying them into that stack.” ●

2018

The year in which the EU's general data protection regulation comes into force



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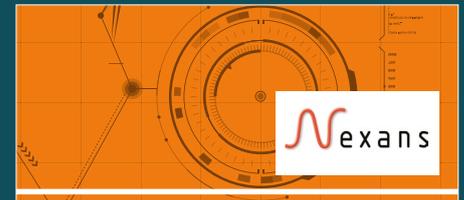
Qing XU, Technology & Applications Manager, Belden
Stephen Worn, CTO, DatacenterDynamics

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Stephen Worn, CTO, DatacenterDynamics
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Intel's hyperscale blueprint

If Rack Scale Design succeeds, Intel will be defining how data centers will be built.

Dan Robinson takes a look



Dan Robinson
Freelance

[@TheDanRobinson](#)

Intel has been talking about its vision for the software-defined hyperscale data center for several years, but with few tangible results. Originally dubbed Rack Scale Architecture (RSA), this has now been rechristened as Intel Rack Scale Design (RSD), with the recent release of the version 1.0 specifications. Systems that are compliant with these are expected to be available from key vendors before the end of 2016.

Like any organization, Intel knows the pressures now facing data centers from the massive growth in cloud services, plus new trends such as the Internet of Things (IoT) driving the need for ever-increasing volumes of storage and compute power to handle all of the data being generated.

With this in mind, Intel has presented RSD as a radical reshaping of data center infrastructure in order to make it more flexible and simpler to manage, and thus easier to scale out as required.

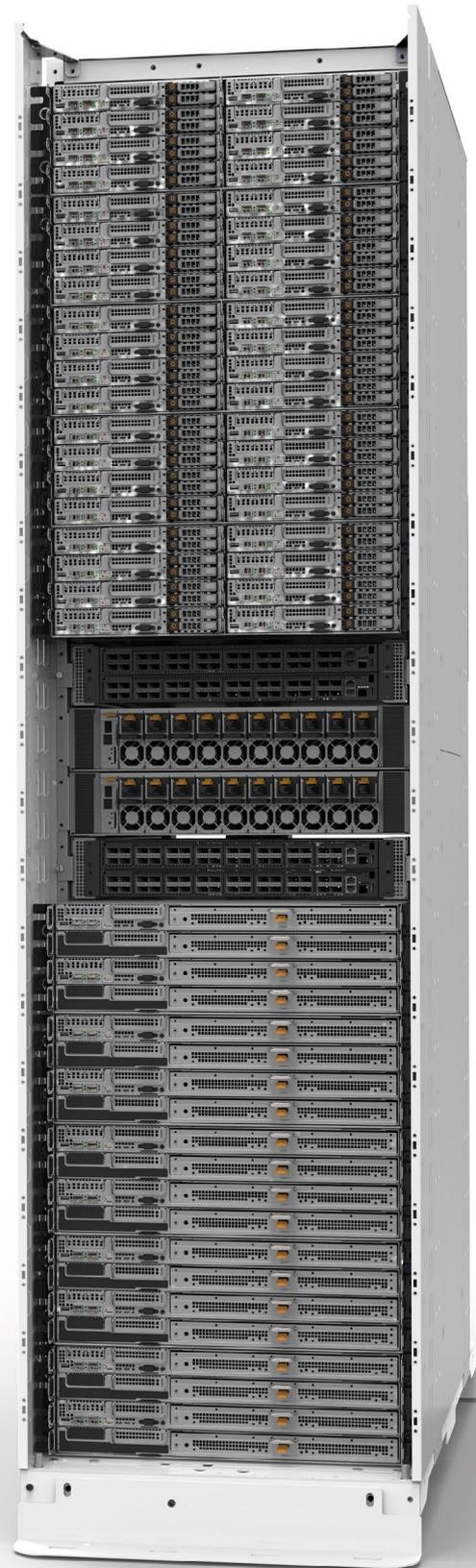
The aim was to disaggregate the compute, memory and storage from individual server nodes and form these into pools of resources that can be allocated under software control

to precisely match the requirements of each workload.

Getting to that end goal has proven a challenge for several reasons, one of which is that Intel also intended its high-speed silicon photonics optical interconnect technology to form a key piece of the puzzle, and that has been delayed due to manufacturing difficulties in getting both the laser and logic circuitry onto the same chip.

Another is that Intel's role in the IT industry has traditionally been that of a technology enabler, rather than an

The specifications call for shared power and cooling within the rack rather than in each node, in a similar vein to the OCP's Open Rack standard



Del's implementation of Intel's Rack Scale Design

► infrastructure provider selling solutions to the customer, and the firm has now realized that it has to take a more holistic approach to the entire infrastructure.

"In the past we used to take our ingredients, such as CPU, Ethernet fabric and memory technologies, and would plan those independently of each other," said Charles Wuischpard, vice president of Intel's Data Center Group, when DCD spoke to him at the Intel Developer Forum event (IDF 2016) in San Francisco in August.

"Where we are starting to head now is to say that to truly be a solutions provider, we have to start with the solution in mind, and then make sure that the portfolio of our products implements the right hooks and features. Rack Scale Design is a kind of system-level thinking, and to do it properly, it needs to incorporate the roadmaps of all our ingredients in a coordinated way," he added.

Intel also appears to be treading carefully, as it needs to keep its hardware vendor partners on side. If the RSD specifications prove too prescriptive, it runs the risk of firms such as Dell, Ericsson and Quanta Cloud Technology (QCT) drifting away and developing their own hyperscale solutions instead. "We don't want to end up in a situation where [the major vendors] are each building their own proprietary solution," Wuischpard said.

For this reason, the RSD 1.0 specifications largely focus on the top-level architecture and put in place a common management framework to drive the whole infrastructure. As the name suggests, Intel's Rack Scale Design revolves around making the rack the basic unit of compute. Each rack is made up of drawers, which are populated with modules comprised of either compute nodes or storage. Intel requires that each drawer has a pooled system management engine (PSME), which is a microcontroller responsible for configuration and identification of the hardware resources within the drawer.

Each PSME links to a Rack Management Module (RMM) and back to the overarching Pod Manager, where a Pod is the label used for a collection of racks that fall within a single management domain. Intel specifies that this management hardware should be connected using a separate network from the main production network fabric.

The Pod Manager discovers all the hardware within the Pod by querying the PSMEs, and exposes the resources to the orchestration layer above, which could be a commonly available platform such as OpenStack or a proprietary tool such as QCT's System Manager software or

Ericsson Command Center.

Intel claims that RSD exposes all of these resources through open application programming interfaces (APIs), and has based its APIs on the Redfish management specifications developed by the Distributed Management Task Force (DMTF) as a replacement for the Intelligent Platform Management Interface (IPMI). It has also released code for the Pod Manager, PSME and RMM under an open-source license.

The RSD specifications call for an Ethernet-based fabric within the rack, but leave it open as to whether a top of rack (TOR) or end of row (EOR) switch is used to connect to the backbone network. The specifications also call for shared power and cooling within the rack rather than in each node, in a similar vein to the Open Rack standard developed by the Open

Compute Project (OCP).

This is no coincidence, because there are parallels between Intel's RSD and the efforts of the OCP, which can be seen in QCT's Rackgo X-RSD platform, announced at IDF 2016 this summer.

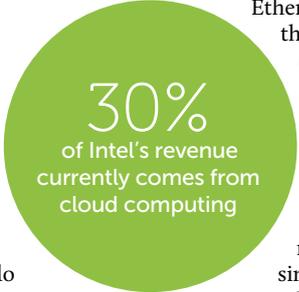
This is based on RSD but uses the 21in OCP Open Rack format rather than a standard 19in rack. Rackgo X-RSD can be populated with 2U four-node compute modules and 2U storage modules, the latter capable of holding up to 28 3.5in drives and four NVMe solid-state drives (SSDs).

Other hyperscale platforms based on RSD include Ericsson's HDS 8000, which features an optical backplane to interconnect modules in its rack, and Dell's DSS 9000, the latter due for availability some time before the end of this year.

While each of those suppliers is pursuing its own hardware designs, Intel claims this does not matter, because the common management APIs in RSD will allow for mixing of resources in a heterogeneous data center.

"They are all building their own hardware rack designs, but you can conceive of an environment where you have racks from more than one vendor, but run through the same software and composed into virtual servers made of compute from one vendor's rack and storage from another, and it wouldn't make a difference," said Wuischpard.

With RSD 1.0, the goal of full resource composability is still some way off, but Intel claims it already offers reduced costs for data center operators through simplified management. RSD 2.0, due in 2017, will add support for pooling of resources such as FPGA accelerators, with future updates set to upgrade the orchestration support and hardware telemetry capabilities. ●



30%
of Intel's revenue
currently comes from
cloud computing

Hyperconverged versus RSD

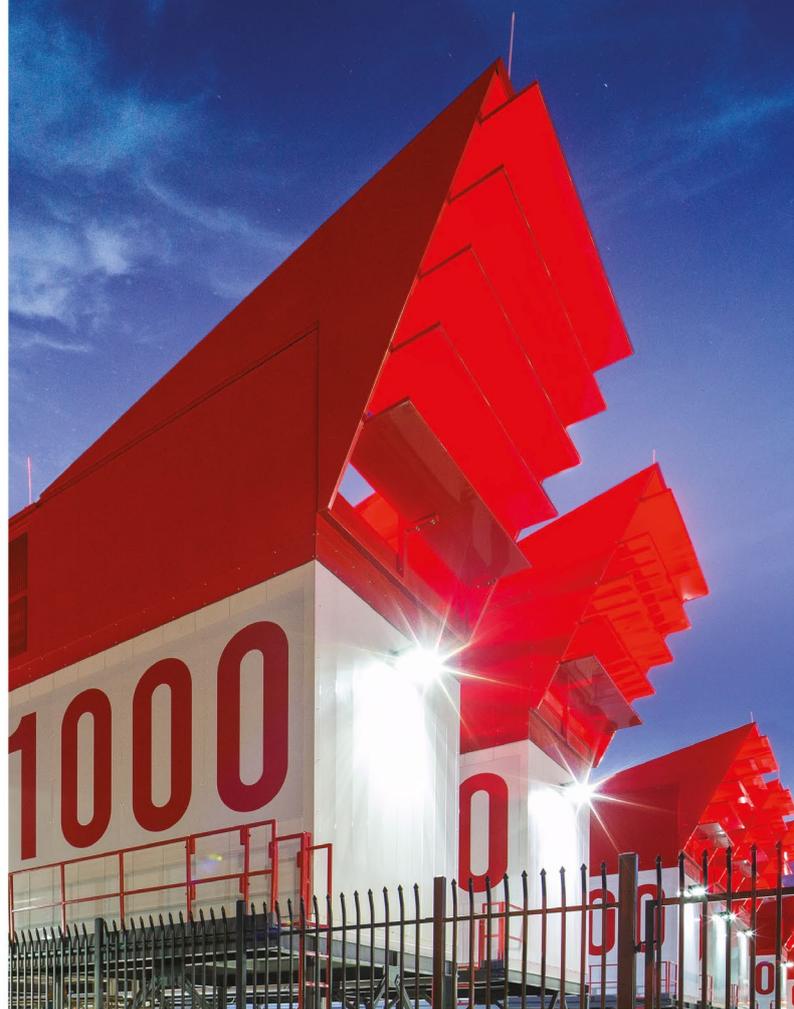
Intel's Rack Scale Design (RSD) and hyperconverged infrastructure are both aimed at delivering modern, flexible IT infrastructure that is simpler to manage and easier to scale, but take somewhat different approaches.

Hyperconverged infrastructure integrates compute, storage and networking into an appliance-like node that is designed to function like a building block. To scale, you just add more blocks, while a software layer provides management and a software-defined storage pool runs across clusters of nodes.

In contrast, RSD aims to unpack the traditional server, so that data center racks are filled with modules of compute and storage resources that can be dynamically allocated to create virtual systems with the required configuration. The obvious difference is that RSD treats the rack as its basic unit, rather than individual servers, and so is aimed more at the very largest-scale infrastructure deployments.

Another difference is that RSD infrastructure is intended to be modular and upgradable, so that individual compute and storage elements can be swapped out as required. For many data center operators, it is simply impractical to have engineers go around opening up large numbers of servers, and so upgrades currently tend to happen on a forklift basis, when the next server refresh cycle comes around.

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10 INNOVATORS IN THE CLOUD



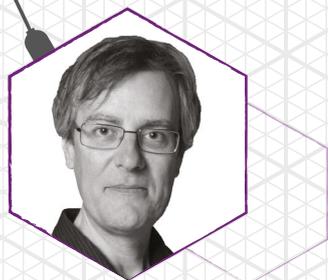
Virtualization has changed the way we do IT. Here are 10 people playing key roles in the cloud



DIANE GREENE

Google

In 1998, Diane Greene co-founded VMware, the company that popularized server virtualization and arguably made the cloud possible. VMware was bought by EMC in 2004, and Greene moved on in 2008. Since 2012, she has been on Google's board, and in 2015 became Google's vice president of cloud when Google bought her startup, Bebo. Under her leadership, she says Google's cloud services will compete with Amazon's and persuade enterprises and cloud firms to ditch their own data centers by partnering on technology.



TIM BELL

CERN

At the European science lab CERN, Tim Bell has used an OpenStack cloud to help push the frontiers of knowledge, sharing and processing the information from the Large Hadron Collider (LHC). CERN's experiments create more than 1Pbyte per second, in the form of images of particle collisions. CERN archives some 27Pbytes per year. Bell has been a leading user on the OpenStack board, publishing a blog outlining CERN's progress and sharing experiences. The CERN cloud now extends beyond CERN's Geneva home to a second site in Budapest, Hungary.



PAT GELSINGER

VMware (Dell Technologies)

The current CEO of VMware – and the third VMware CEO in this list – Pat Gelsinger currently has the responsibility of steering the cloud infrastructure firm under its new arm's-length owner, Dell. He became VMware CEO in 2012, and has presided over dominance in virtual infrastructure. Before joining EMC in 2009, he spent nine years as Intel's first CTO, and founded the very successful Intel Developer Forum.



MARC JONES

IBM SoftLayer

As CTO of IBM's SoftLayer cloud business, it's Marc Jones's job to create cloud products and services that compete with established players such as Amazon Web Services and challengers like Google. SoftLayer mostly provided bare metal cloud services before being bought by IBM in 2014. Since then, IBM has invested in more data centers to boost its global services. Before joining SoftLayer, Jones was director of software product development for Rackspace's cloud division.



PAUL MARITZ

Ex-Microsoft, EMC, Pivotal

A computer scientist, Paul Maritz worked at Intel for five years, before moving to Microsoft, where he became head of platform strategy in 2000. After a spell running a Linux company, he was “acqui-hired” into EMC, where he became head of VMware from 2008 to 2012. From 2013 to 2015, he ran Pivotal, EMC’s open-source cloud platform. He’s now on the board of Mifos, a body that aims to help developing nations by delivering open-source financial services to the world’s poor.



BORIS RENSKI

Mirantis

Boris Renski is a co-founder of the leading independent OpenStack cloud service provider, Mirantis. After running a Russian software consultancy, Renski started Mirantis with entrepreneur Alex Freedland, with the intention of commercializing OpenStack. While other OpenStack providers have stumbled, Mirantis has found its niche providing customized versions of the open-source cloud platform, designed for vertical markets. Renski is currently CMO at Mirantis.



CHRIS KEMP

OpenStack co-founder

As CTO of NASA, Chris Kemp helped start OpenStack, the open-source cloud platform that was originally a joint venture between the US space agency and Rackspace. OpenStack’s trajectory has been ballistic, and Kemp went on to found Nebula, the first OpenStack cloud company. It’s not all been plain sailing, though: when Kemp left, NASA abandoned OpenStack for Amazon Web Services. And Nebula closed when it became clear that large companies will lead the way on OpenStack.



MIKE RUSSINOVICH

Microsoft Azure CTO

Azure is Microsoft’s cloud operating system, and Mike Russinovich is its CTO. But his path to that role has not been direct. In the 1970s, he was a high school hacker and went on to a career of scrutinizing Microsoft operating systems, publishing tips and revelations on the sysinternals.com site (he also discovered the Sony rootkit). In 2006 he turned gamekeeper when Microsoft bought his company, Winternals, and made him CTO of its cloud operating system.



WERNER VOGELS

Amazon

Werner Vogels was one of the of instigators of Amazon Web Services and is now CTO and vice president at Amazon. He joined Amazon from his role as a research scientist at Cornell University, where he launched All Things Distributed, a blog about “building scalable and robust distributed systems”, pretty much a definition of the cloud. He still maintains that blog, while driving the continued dominance of AWS in the cloud.



HAIYING WANG

LinkedIn

Cloud computing is a major part of Huawei’s expansion plans, and these are based around the OpenStack platform. As cloud CTO, Haiying Wang had a major part in formulating this strategy. He says that his ambition is to “make OpenStack the standards cloud OS”. In the past year, he has moved to LinkedIn.



> Enterprise | New York



Ronald Swanson
Twitter Study



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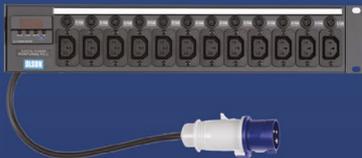
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THE ZETTASTRUCTURE EVENT

Building the Future

We have completely re-engineered our flagship London event to enhance the knowledge and networking opportunities that are the hallmark of DCD Events around the world. Let me introduce you in to the Zettastructure event.

We have a unique new venue, as you can see from our history of Old Billingsgate (p40). We also have a new conference format, with new types of vendor engagement. Finally, we have a vertically diverse, mature audience of the most senior professionals running data center infrastructure across Europe and the rest of the world (see page 44 for audience demographics).

Building a true ecosystem agenda

IT and data center professionals don't work in silos so this year's conference program is ordered around the DCD tracks. There's something for everyone. Whether you're at the tactical end of the spectrum defining what type of data center needs to get built or immersed in longer-term IT strategy for your organization, among our panel discussions and keynotes you will find a wealth of information to take back to the board room or project table.

Top 5 reasons for attending this year's event, based on self-reported registration data.

1. To keep up-to-date (78%)
2. To network with peers (57%)
3. To evaluate new suppliers (51%)
4. For the conference programme (41%)
5. To gain a competitive advantage (38%)

Where is this sector headed?

To the clouds and beyond! Zettastructure is the word we have created to describe the diversity and interconnection of future digital infrastructure. Bytes are to the Zettastructure as H₂O is to the planet's hydrological cycle - with data lakes, seas and oceans, clouds, waterways and jet streams. The huge challenge of data transfer and processing requires more than ever a holistic understanding of the digital environment.

It's not easy to cover this in a two-day conference program, but we try. On each morning of the conference we are testing a new format: Lightning Plenaries will present a series of expert opinions on a key topic that should resonate for the rest of the day.

Day One - What is the Zettastructure?

Who will be the dominant infrastructure providers and what technologies will come to define it? Telco, Webscale, disaggregation, convergence..?

Day Two - What happens when Information Technology meets Operations Technology?

The convergence of two very different mindsets is instrumental to mission critical success. We've spoken for many years about the need for a bridge between the logical and physical worlds: now there are battle grounds in security and availability, and this lightning plenary is sure to get the industry thinking.

We hope to see you there

If you are lucky enough to have snapped up a ticket already (DCD complimentary end-user allocation exhausted) or you are waiting on tickets from the sponsor guest allocation, we hope to see you on the 1st and 2nd November in London.

This year's event requires you to participate and to get out of your content comfort zone. Over the coming pages are some highlights and online at www.zettastructure.com you can find lots more.

You can count on some great coverage from the DCD Editorial team too.



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CONFERENCE HIGHLIGHTS

BIG DEBATES

In the Old Billingsgate vaults, four fire-starters join a moderator and up to 35 participants to explore a contentious technical or business issue for a full 60 minutes.

Can the data center become a net contributor to the European power grid - where are we on the journey to net-zero?



400GB, 5G...Are data centers likely to collapse from internal or external bandwidth demands?



Living on the edge - Hyperscale or microscale - what does the world need more of?



Is DCIM the cornerstone of the SDDC or just another nice thing to have?



► View more Big Discussions at www.zettastructure.com

CASE STUDIES



Groupon's story from cloud to colo- can you grow too big for the cloud?

Harmail Chatha, Groupon



Towards the software-defined data center

Nic Barnes, Bank of America



LinkedIn data center from 100G to Open19

Yuval Bachar, LinkedIn

ANNOUNCEMENTS

Exciting industry announcements from Microsoft, Schneider Electric, Tyco and many more exclusively unveiled at the event.

PANEL DISCUSSIONS

This year we have some of the sector's leading experts joining some of our most thought-provoking panels. Find out what they are thinking about...

What can enterprise IT architects learn from webscale infrastructure engineers?

Zaid Ali Kahn, LinkedIn
Ali Heydari, Baidu
Shane Sigler, Salesforce
Sriram Sankar, Facebook

Holding data centers to ransom - hyperconnectivity and the evolving security threat landscape

Ed Ansett, i3 Solutions
Dr. J.R Reagan, Deloitte
Massimiliano Falcinelli, International Atomic Energy Agency

How are big data and realtime data analytics changing research and HPC environments?

Dr. David Fergusson, Francis Crick Institute
Dave Brown, Genomics England
Brandon Butterworth, BBC

Life according to the enterprise IT strategists - how will IT infrastructure look like for the 2020 enterprise?

Gunnar Menzel, Capgemini
Kfir Godrich, BlackRock
Nic Barnes, Bank of America
Kasey Shah, Nissan

How can IT Operations cope with ever-shifting goal posts?

Riccardo Degli Effetti, Sky
Mike Coleman, Yahoo!
Jenny Hogan, Digital Realty

The Brexit effect, data sovereignty and other European curve balls - how turbulent will the waters be?

How will the big disruptors change the flow of investment into the data center sector?

TOP SPEAKERS



Kushagra Vaid
Azure Cloud Hardware Engineering
Microsoft



Pablo Jecic
Head of Cloud and Infrastructure Centre of Excellence
Vodafone Group



Cole Crawford
CEO
Vapor IO



Francois Sterin
Director, Global Infrastructure
Google



Maarten Ectors
Vice President IoT
Canonical/Ubuntu



Tanuja Randery
President, UK & IE
Schneider Electric



Lex Coors
Chief Data Center Technology & Engineering Officer
Interxion



Barak Perelman
CEO & Co-Founder
Indegy



Jack Pouchet
VP Market Development & Energy Initiatives
Emerson Network Power



Urs Iten
Director, Global Portfolio Management, Data Centers
Siemens



Kfir Godrich
MD, Global Head, Technology
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► If you want to join any the brunch or lunch briefings contact us at www.zettastructure.com

WORKSHOPS



The Green Grid will be holding an intensive 2 hour workshop on data center management frameworks for non-engineers

► 1 November at 2.45pm
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OCP will be running their European engineering workshop with a focus on the newly unveiled OCP Telco project.

► 2 November 11.00am to 4.00pm
Registration required

Workshop leaders include:



Fred Oliveira
Cloud Architect
Verizon



Mark Shaw
Partner - Hardware Engineering
Microsoft



Jerry Luo
Principal Software Engineer
Ericsson

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Design + Build

Focused on what's new in data center design, value engineering and construction methodologies within the emerging data center segments.



Security + Risk

Focused on assessing risk and managing the security of ever-more distributed mission critical infrastructure and ICT systems.



Core > Edge

Focused on the internal and external data center transit layer from core to edge and the rapidly developing data center interconnect [DCI] eco-system.



Servers + Storage

Focused on 'North of the Rack' on understanding the impact of compute, network and storage transformation on IT capacity requirements, data center design and architecture.



Software-Defined

Focused on understanding the journey towards the true software defined data center that requires automation at every layer of the stack.



Open-Source

Focused on the open-source and data-driven data center movement and the transition from proprietary to non-proprietary software and hardware models.



HISTORY OF OLD BILLINGSGATE

From selling fish to leaking disaster recovery sites, we chart the storied history of the heritage site that's hosting this year's DCD Europe event – Old Billingsgate Market in London

No one is sure how the market got its name, with earlier versions including Blynesgate and Byllynsgate. Perhaps the name comes from a water gate at the south side of the City where goods came in, thought to have been owned by a man named 'Biling,' or perhaps the name came from King Belin, who ruled 400 years before the Common Era.

But Billingsgate, as it became known, grew with London, becoming an integral part of its culture and existence. In 1327, Edward III signed a charter that prohibited the setting up of rival markets within 6.6 miles of the City of London, a distance chosen as the reasonable length a person could be expected to walk to market, sell their produce and return in a single day.

Roughly 80 years later, King Henry IV granted the right for citizens to collect tolls and customs at Billingsgate, Cheap and Smithfield. The market sold everything: Corn, coal, iron, wine, salt, pottery, and whatever else people could trade, before becoming increasingly associated with fish as the 16th century dawned.

An Act of Parliament was passed in 1699 making Billingsgate "a free and open market for all sorts of fish whatsoever," with the sole

exception being the sale of eels, which was restricted to Dutch fishermen moored in the River Thames. They were granted this privilege due to their help feeding the people of London during the Great Fire of 1666.

As the market grew in import, it became clear that the sheds and stalls crammed around the dock at Billingsgate were insufficient to handle the level of demand. In 1850, the first Billingsgate Market building was constructed on Lower Thames Street by the builder John Jay, but it soon proved too small as well.

In 1873, the structure was demolished and replaced by the building that stands today – designed by Sir Horace Jones, an architect perhaps best known for creating Tower Bridge. Business boomed until 1982, when

the fish market moved to the Isle of Dogs.

The architect Richard Rogers was brought in to refurbish the building now known as 'Old' Billingsgate, and turn it into a disaster recovery site for a major bank. Then the trouble started.

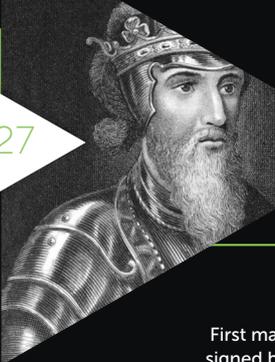
In a time of increasing terrorism from the IRA, banks were eager to set up recovery areas in case of an attack. Billingsgate was chosen as one such site, but it had crucial structural flaws.

The ground floor was converted into a backup trading floor, with the basement set to have UPSs, switch gear and a generator installed for disaster recovery. "But when they came to the basement they saw that it had a big pit in it - the ice pit," said Professor Ian Bitterlin. At the time, Bitterlin worked as a critical facilities engineer at Anton Piller, with the bank as one of his customers.



BILLINGSGATE IN PICTURES

1327



First market charter signed by Edward III

1757



View of bustle in the market and adjacent port

1873



Market demolished and rebuilt as existing structure by Sir Horace Jones

"For over 100 years, that was filled with ice. That's where they dumped the fresh deliveries, that's where they took the ice out to pack all the fish in when it came off the boats."

"What no one had realized was that for a hundred years, the ice had kept the walls at virtually zero, and the Thames, when the tide is in, is much higher than that pit.

"So, literally, the ground that surrounded the pit was in a state of permafrost, and that wouldn't allow the salt water to get into the basement, because the frozen ground actually acted as a barrier for the water, and they had terrible trouble with it at every turn. Every week more water would arrive in the basement as the ground thawed out. So, in the end, they had to pack it - they changed the whole thing."

John Laban, who worked at BT at the time, helping to connect the trading floor, said: "I can remember them talking a lot about this in the planning meetings, about what happens when the permafrost melts. 'Will the building fall down?' It was a really significant problem."

Mike Foskett, who once ran Morgan Stanley's mission-critical data centers, explained that the permafrost issue could have been anticipated, but it wasn't: "That's the major problem. We never learn." Bitterlin agreed: "Disaster recovery is more a disaster than a recovery."

And so, Laban said, the recovery site "just sat there for years, until eventually it was purchased for a conference center and they took out all the infrastructure. Now it's just a big empty space upstairs and downstairs."

2016

DCD finds a new home for its flagship event



1937



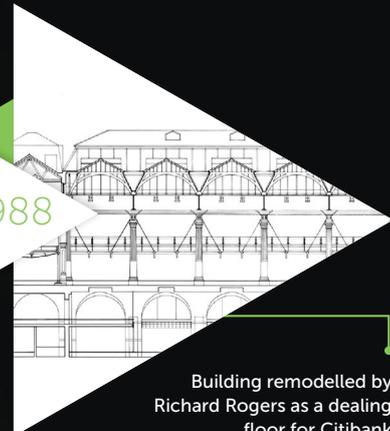
The building's heyday as the largest fish market in the world at the time

1982



Market moves to new Isle of Dogs location (New Billingsgate)

1988



Building remodelled by Richard Rogers as a dealing floor for Citibank

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TIME FOR A REVOLUTION

As telecommunications providers begin to deploy commodity servers, we will see a massive shift in the way data center hardware is built and sold

We often talk about 'revolutionary' technologies when we actually mean ideas that offer incremental improvements. We seem to forget that revolutions are a messy business, involving pain, suffering and the complete destruction of the established order.

This coming revolution is one of those: quick, brutal and inevitable. It will see decades-old businesses dying in a ditch.

We are talking about the transition of the telecommunications industry from specialized, proprietary equipment to open hardware, originally pioneered in hyperscale data centers run by the likes of Facebook and Google.

Telecommunications service providers are facing an existential crisis: their traditional business models are being eroded by a new breed of online companies that offer the same services at a much lower cost.

Applications like WhatsApp, Skype or the recently launched Google Allo (the name itself seemingly designed to taunt telecoms providers) can innovate faster, scale quicker and, when the going gets tough, they can use the virtually unlimited resources available from

public cloud providers. At the same time the infrastructure these challengers are running is actually cheaper and easier to manage.

For a few years now, the telcos have been working on a solution to their problems called network functions virtualization (NFV), which aims to replace expensive, specialized hardware with commodity servers that can serve the same functions through software, building on a simplification of the underlying infrastructure, delivered by software-defined networking (SDN).

NFV infrastructure should be cheaper and easier to configure. It could increase speed-to-market for new services and enable operators to locate their network infrastructure at the data center of their choice.

The software component is being taken care of by traditional telecoms suppliers like Ericsson and Nokia, the open source community – in large part focused around the OpenNFV project – and even by IT vendors like VMware, with its vCloud NFV platform.

But the telco industry will also need servers, routers and switches – built to industry-standard blueprints by ODMs in China and Taiwan. This approach to infrastructure has been exemplified by the Open Compute Project, an organization that has helped separate hardware and software, and taught us that a failed server is not really a problem. The OCP is gaining increasing popularity with engineers who don't believe the way we build data centers today is sustainable, or indeed rational.

"These products are out there, they have been out there for about five years. It's a relatively mature technology now, this approach. And they want keep everything open, because if they keep everything open, they don't feel screwed by the manufacturers that have locked them in for years," John Laban, European representative for the Open Compute Project Foundation, told *DatacenterDynamics*.

"I'm ex-telecom, and the straightjacket nature of proprietary hardware was a nightmare. It would take you three months to plan something,

and then it would take you another three months to install it in a telephone exchange."

According to Laban, today the same operation can take you a few days – as long as you use open hardware.

In January 2016, a number of the world's largest telecommunications service providers – including AT&T, Deutsche Telekom, EE, SK Telecom, and Verizon – became members of the OCP. And thus, the OCP Telco Project was born.

"They've got to rush," Laban said. "If they don't rush, they are going to lose the industry to the hyperscalers. They've lost most of the international business already. As 5G starts to roll out and we get all of these data-intensive IoT apps in just about three years' time, if they are not ready for that it is going to kill their networks."

The evolution of the telco has the potential to remake the data center industry because of the sheer scale of the change.

We will need hundreds of thousands of servers, many of them located in 'edge' locations, closer to the end-user, where power and cooling presents particular challenges.

If the telco industry indeed adopts OpenStack as the foundation for NFV, it will immediately take the open source cloud platform to the next level, with more developers and more investment.

The model has already started to change among the telco suppliers – for example, the mighty Nokia has started selling the AirFrame, a cheap and cheerful server range designed to run on OpenStack and certified by the OpenNFV project.



OCP will be running their European engineering workshop with a focus on the newly unveiled OCP Telco project.

**► 2 November 11.00am to 4.00pm
Registration required**

FIVE
global telecoms providers have joined OCP in 2016



WHO'S ATTENDING DCD ZETTASTRUCTURE?

DATA CENTER END-USER/OPERATOR DEMOGRAPHICS

Based on self-reported data from the first 1,250 pre-registered and qualified end-users as of 30th September 2016

About their organizations



Sphere of influence by track

COLO + CLOUD	37%
DESIGN + BUILD	67%
POWER + COOLING	61%
OPEN-SOURCE	16%
CORE > EDGE	18%
SOFTWARE DEFINED	17%
SERVERS + STORAGE	27%
SECURITY + RISK	30%

What they are working on



What their job roles are



End-user operator ecosystem

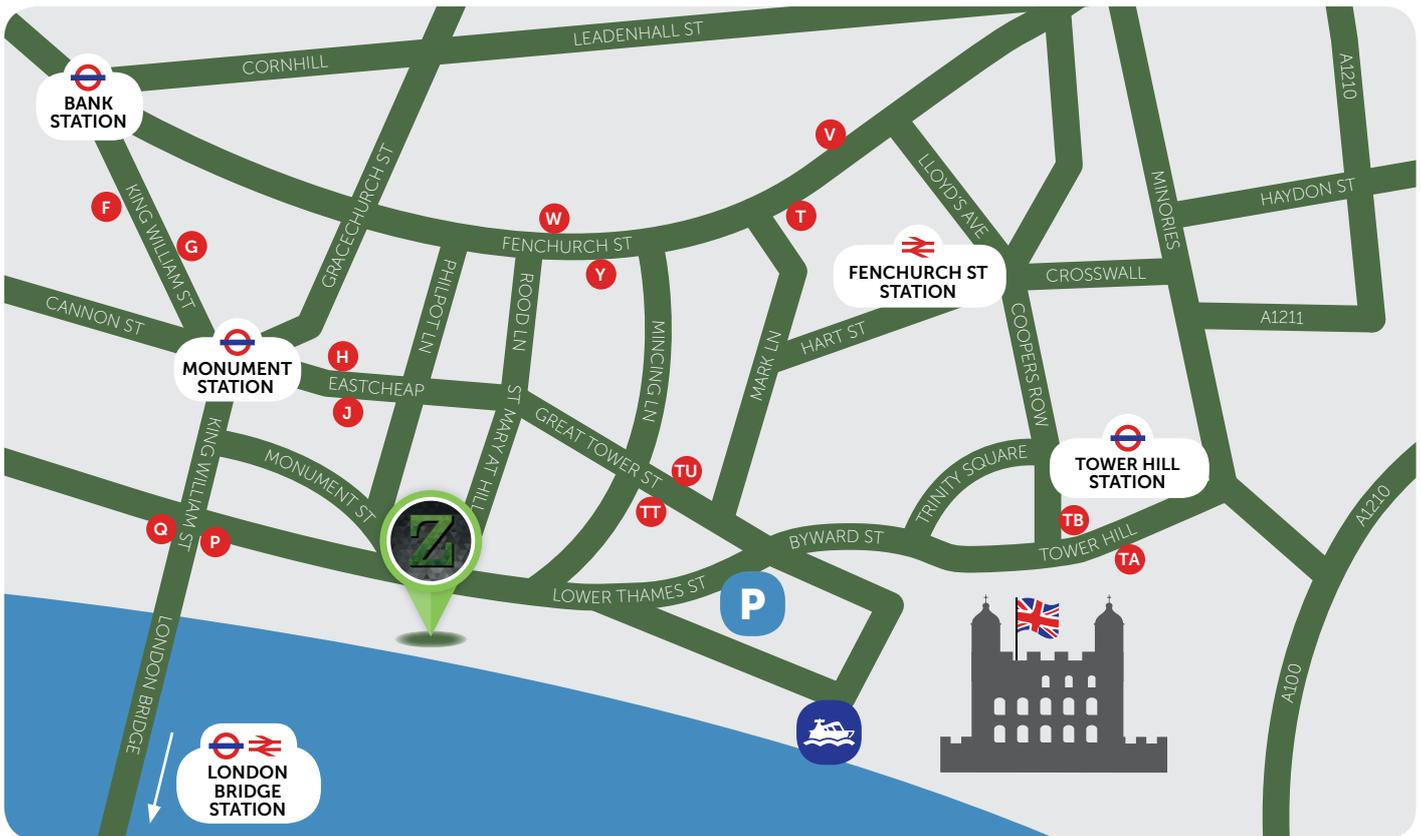


Organizations participating include

ABN AMRO | Accenture | AECOM | Aegis Data Ltd | African Development Bank | Ageas Insurance Ltd | YAHSAT | **Alibaba** | Alinma Bank | Arcadis | Argos | Ark Data Centres | ARM | Arup | AT&T | Atea Sverige AB | ATOS | Aviva | AWE | AXA | Axis Communications | B-Barcelona Consulting | Bailey Consulting | Bank Leumi (UK) plc | **Bank of America** | Bank of America Merrill Lynch | Bank of England | Bank of New York Mellon | **Barclays Bank** | Barclays Capital | BBC | Bilfinger GVA | Bloomberg | BMW | BNP Paribas | Booking.com | Borealis Data Center | BP | British Telecommunications Plc | Brunel University London | BT | BT Security | Cambridge Assessment | Camelot UK | Camro Data Campus | Capgemini | Capita PLC | cbr | **Centrica plc** | CenturyLink | Charles Russell Speechlys LLP | Chevron | CITI | Claranet | **Clifford Chance** | CloudOrigin | Co-op | Colt | Commerzbank | Compass Datacenters | Computacenter | Coromatic | Credit Suisse | CSC | Cundall | DACC Europe | Danskebank | DataCentred | Dataplex Data Centres | **Decathlon** | Defra | Deloitte | Department for International Trade | **Department for Work and Pensions** | Department of International Trade | Digital Realty | Discovery Communications | DLA Piper | Downing LLP | Dunwoody Iip | Dyson | E Hosting Data Fort | eBay | EE | Eli Lilly | Emc | Equinix | Ericsson | Ernst and Young | EUMETSAT | European Data Hub | **Experian** | Facebook | Faithful+Gould | **Fidelity International** | Ford Motor Company | G-Research | **G4S** | Gardiner & Theobald | GCHQ | GE | **GlaxoSmithKline** | Global Aerospace | Global Switch | Goldman Sachs | Google | GoToNetworks Inc | Gratte Brothers Ltd | Great Lakes International | Great-West Lifeco | Green IT Amsterdam | Gridoog inc | Guy's & St Thomas | Haringey Council | **Heathrow Airport** | Hewlett Packard Enterprise | Hoare Lea | **HSBC** | Huawei | Hydro66 | IBM | IBM Global Technology Services | IHS Markit | Imperial College London | IMS Health | Infinity SDC | Internap Network Service | International Financial Data Services | Interoute | Interxion | Invesco | ION Trading | Iron Mountain | ISG | ISS | ISS World Services A/S | Jacobs UK | Jefferies International | **John Lewis Partnership** | JOHNSON & JOHNSON | **JP Morgan Chase** | KAO Data | KCOM | **Keppel Datacentres** | Keysource Ltd | KPMG | KPN | Laing O'Rourke | Land Registry | LCH Clearnet LTD | Lenovo | Level 3 | LinkedIn | LINX | Lloyds Bank | Logicalis UK | London Borough of Camden | London Internet Exchange | London Stock Exchange | M+W Group | Marks & Spencer | Marsh & McLennan | Martello Ltd | Mauritius Telecom | MaxFordham LLP | MDBA | Medhurst IT | Memset | Merseyside Police | Met Office | **Metropolitan Police** | Micron | Microsoft | Mirapath | mitie | MoD | **Morgan Stanley** | Morrison Utility Connections | Motability Operations | National Grid | **Natural History Museum** | NBC Universal | NEC Corporation | Network Rail | NHS | Nomura Asset Management | Nomura International | Nottingham County Council | NRI - Nomura Research Institute | NTT Communications | **Ocado** | on365 | Onyx Group | Optimum Data Centres | Oracle | Orange | Orange Business Services | **Paddy Power Betfair** | Pico Global | Pitney Bowes | PLUSNET | PricewaterhouseCoopers | Prudential | Prime DCS | Produban | PTS Consulting | **Public Health England** | Publications Office CE | pwc | QA Ltd | Qatar Airways | Queen Mary University | Rabobank | Raiffeisen Informatik GmbH | Rambøll Danmark A/S | RBS | Red Engineering | Redcentric | Redstone | Ridge & Partners LLP | Rolls Royce | **Royal Bank of Scotland** | Sainsburys | Salesforce.com | Saudi Telecom | Schlumberger | **Scottish Power** | Select Data Centres | Server Farm | ServiceNow | **Shell IT** | Six Degrees Group | Sky | Sony Pictures Entertainment | South Wales Police | Spie UK | SSCS Global IT Services | State Street | Sudlows | Sungard Availability Services | SuperNap | Surrey County Council | SWIFT | T Clarke | **T-Systems Ltd** | Tata Communications UK Ltd | TCL Data Ltd | Telety | Telefonica | Telehouse Europe | Telent | Telia | **Telstra** | Tengiz Chevron Oil | Tengizchevroil | Tesco | The Bunker | LINX | The Shipowners Protection | **Thomson Reuters** | Transport for London | Travelers | **Travellex** | Turkcell | TÜVIT | UBS | UCL | UK Hydrographic Office | UK Trade & Investment | **Unilever** | Unisys | United Biscuits | United Nations | University College London | University of Cambridge | University of East London | University of Hertfordshire | University of Leeds | University of Southampton | University of Leicester | **Verizon** | Vertex Pharmaceuticals | **Viacom** | Virgin Media | Virtus Data Centres | **VISA** | Vodafone | Volta | Warwickshire County Council | Waterman Group | Wates Construction | Wells Fargo | White & Case LLP | **Worldpay** | WSP | Yahoo! | Yandex Oy | Zenu



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DCD Europe opens at 08.00am on November 1-2. For more information on how to find Old Billingsgate and to register visit www.zettastructure.com.



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LONDON BRIDGE (11 MINUTE WALK)



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P Q 17, 21, 35, 40, 43, 47, 48, 133, 141, 149, 521
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The return of the green agenda

The recession stopped the green data center movement in its tracks. *Zahl Limbuwala* says it's coming back, older and wiser, and without any new metrics

There has been a pretty big resurgence in the world of sustainability, especially in the data center sector. Initially, I was a little surprised, but there's more substance to the movement compared with the pre-2009 economic crash that pretty much killed sustainability and green initiatives as a board-level issue.

Before the last recession, the green movement in the data center sector had gathered quite some pace. There was a lot of good work done by the BCS, Green Grid, EPA, LBNL, METI and others around metrics and tracking of how green a data center was.

Indeed, it was this very movement that gave birth to power usage effectiveness (PUE), which has become "one metric to rule them all," making it the J.R.R. Tolkien of the sector.

Back then, I was chairman of the BCS Data Center Specialist Group, and raising awareness of energy efficiency (or the lack of it) in data centers was best done by talking to environmental lobbyists.

Greenpeace started its *Click Green Report* in 2010, naming and shaming companies for how green their data centers "were not." The Click Green program initially examined energy efficiency in the data center but has evolved to encompass a much broader scope since then.

When the global economic downturn descended upon us, most of the less publicly visible corporations put green on the back burner and focused on saving money instead. In those days, data centers had a low public profile and fell into this group.

I have to say that this always seemed an unwise move to me. Any green initiative worth its salt, especially in the energy efficiency arena, should have a good financial return on investment (RoI)

and not just "green brownie points" RoI. The issue was that many didn't have the tools, context or knowledge to assess and build strong green and financial business cases that could stand up to scrutiny or any sort of third-party validation.

Thus I was very happy this year when my conversations with customers and other industry pundits once again started to include discussions about the green agenda – now referred to more often as sustainability, a term I prefer, as it encompasses broader issues beyond energy efficiency, such as water consumption, embodied carbon and sustainable construction practices.

Before everyone jumps back on the "we need more metrics" bandwagon, let me say, no we don't! Stop. Put down the white paper draft on the new "super all-encompassing one sustainable metric to rule them all!"

Please just keep it simple and collect, track and analyze data indicating your energy efficiency, carbon emissions (this is a calculation from energy) and water consumption, and you'll be well on your way to improving your data center's sustainability.

And remember, simply believing raw data from sensors and instrumentation points is not an accurate representation of what's going on (trust me, Romonet cleans and validates data for a living). But better data also helps service providers to allocate carbon emissions to their customers.

Sustainability is a board-level issue again, and claiming your IT is zero-carbon because it's all in the cloud is not going to cut it in the public's eyes. ●

Zahl Limbuwala is CEO of Romonet

Keep it simple. We don't need more metrics!



Illustration: studionippoldt.com

DCD Com

Highlights from Singapore Data Center Week



Conference



Yuval Bachar
LinkedIn

"Singapore, as with the rest of Asia, is positioned attractively to grow as a successful bed for Data Center projects. We see strong numbers of new users and a large increase in activity in the region over the last few years"



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October 24-25, London



Data Center Design Awareness
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Energy and Cost Management
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São Paulo

US & Canada

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New York

Asia Pacific

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Hong Kong Convention
& Exhibition Center

EMEA

December 7
Hilton on Park Lane,
London





community

Upcoming Events: DCD Converged

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THE BUSINESS OF DATA CENTERS.
Canada | October 12, 2016

DatacenterDynamics
CONVERGED
THE BUSINESS OF DATA CENTERS.
London | November 1-2, 2016

DatacenterDynamics
CONVERGED
THE BUSINESS OF DATA CENTERS.
Hong Kong | November 9, 2016

DatacenterDynamics
ENTERPRISE
THE BUSINESS OF DATA CENTERS.
New York | March 14-15, 2017

DatacenterDynamics
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THE BUSINESS OF DATA CENTERS.
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The data hall is going to change, but you can be damn sure we'll still have mainframes

What is dead may never die

This month, we look at the future of the parts that make up the data center, as the industry is getting ready to store and process zettabytes of information. We'll need elastic storage pools that manage themselves, optical networking that pushes against the physical limits of speed, and architectures that abandon the notion of servers as individual machines with their own storage, memory and compute.

The data hall is going to change, and fast. But you can be damn sure we'll still have mainframes, and considering their ridiculously long lifespan, they'll probably be the exact same mainframes we are using today. These beasts pre-date client/server architecture, they can run code that was written 50 years ago, and they keep coming back from the dead.

Mainstream technology publications don't talk about mainframe computing. There's a shortage of people qualified to run mainframes, teenagers don't want to learn the intricacies of building a sysplex, and they definitely don't want to learn an obscure language like COBOL. Mainframes cost millions, they require care and attention, and specialized software. And license pricing, well... it will bring a tear to a grown man's eye. In theory, these relics should have been replaced by distributed commodity systems as soon as cloud computing arrived. They should be dead.

And yet according to IBM, the vast majority of corporate data still resides on mainframes. Following the sale of traditional servers to Lenovo, Big Iron has emerged as the company's most profitable hardware business. Salaries for mainframe programmers and administrators are some of the highest in the IT industry. And the dead keep marching on. Last year, IBM donated 250,000 lines of mainframe code to the Open Mainframe Project, kickstarting the effort to improve compatibility with ubiquitous Linux, instead of the trusty old OS/2. The company also launched LinuxONE Emperor – “the world's most advanced Linux system” – which can power up to 8,000 virtual machines from a single chassis.

IBM is pitching the modern mainframe as the ultimate server – a dense, powerful system with guaranteed uptime that feels at home on the network and loves to share its resources. And even if Big Blue decides to sell its mainframe business – yep, that's the rumor – someone else will carry the torch.

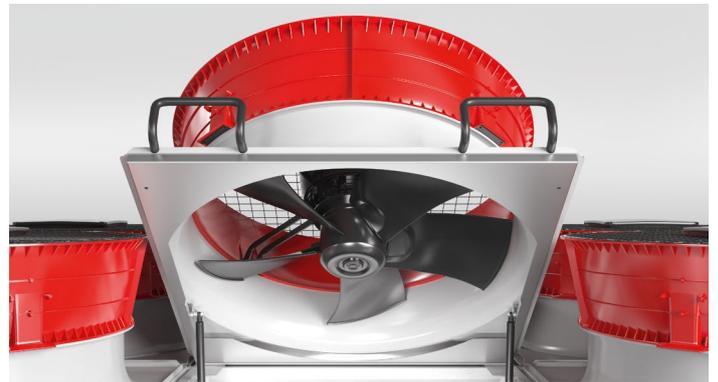
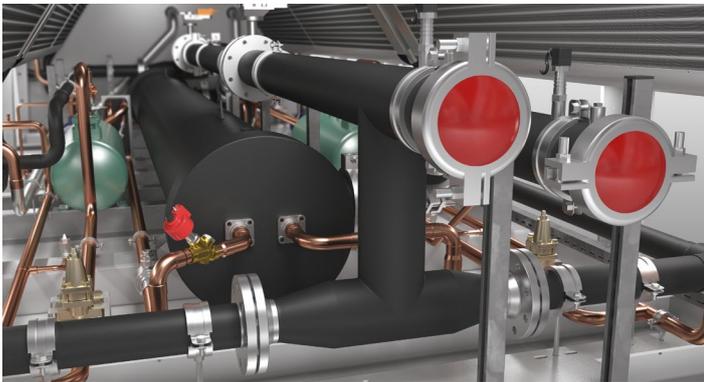
Attempts to kill off the mainframe will continue. For example, Swiss startup LZLabs is currently offering a platform that can run fully featured mainframe code on any computer. While this will make certain use cases a reality, it is unlikely to offer the same levels of RAS: Reliability, Availability and Serviceability – three words that have shaped mainframe computing.

For some reason, I keep thinking about the religious chant of the denizens of the Iron Isles, a fictional realm in *Game of Thrones*: “What is dead may never die. But rises again, harder and stronger.”

•
Max Smolaks – News Editor
@MaxSmolax

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