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The Business of Data Centers

Open with a winning hand



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February 2015 VOL 04 ISSUE 01

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Security
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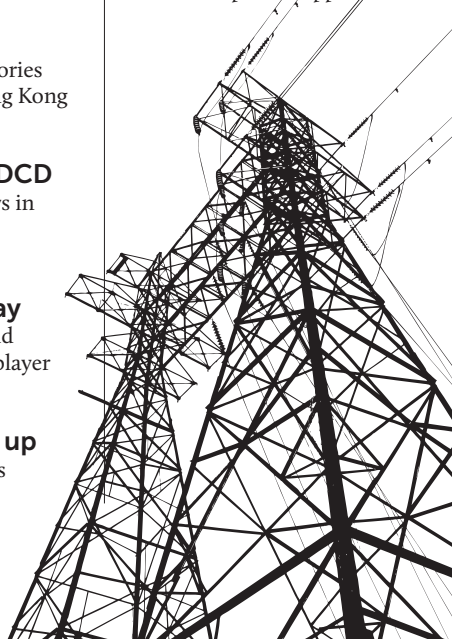
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Our new mission: understanding IT capacity

Our cover says it all. If you're building and operating data centers, open standards are a winning hand, and that's the play we suggest you open with.

But there's more to this issue.

We have a new design, and we're about to reboot our website. We are also about to refine our mission. Read between the lines and you'll see our new direction.

We've been meeting with the people who are creating the open source hardware and software that will fill your facilities and support your services, and we're convinced that open source and open standards will enable choice and drive out costs (p18).

But which standards? Markets make standards, rather than the reverse, so the ones to watch are the ones that get used. By that token, Amazon is a standard for cloud platforms, albeit one that could be improved on - by giving users more power and control.

By contrast, OpenStack is defined by the community that use it, and is rapidly gaining ground as a cloud platform. Meanwhile, in the hardware space, Open Compute has got large and small users redesigning data center kit - so that all players can benefit. And on that platform, projects providing coherent structures include Hadoop for Big Data and Docker for containers.

If all that is too virtual, our Power Supplement is down-to-earth (p33), taking on issues like rack power density. Our international team bring news of deployments round the world (pp 16, 49, 51 and 59). And the most impressive data centers of 2014 are honored in 2014's DCD Awards (pp58-59).

This year you also get a new chance to meet DCD. In March, we open our own hall in Germany's mega-show, CeBIT (p14).

That's all very practical, But let's not get lost in the details. It's time for a Big Idea.

With data centers extending from cables to containerized software, how do we know when what you have achieved? From heat sensors and computational fluid dynamics (CFD) all the way up to financial planning (p22), you can't manage what you can't measure, model and understand.

This year, at *DatacenterDynamics*, our mission is to understand **the true nature of IT capacity**. To track the costs and the performance of every part of your data center - and its revenue and profits.

You may open with a winning hand, but you aren't a winner till you've closed the deal.

• **Peter Judge** - global editor

🐦 @PeterJudgeDCD



This year, at Datacenter Dynamics, our mission is to understand the true nature of IT capacity

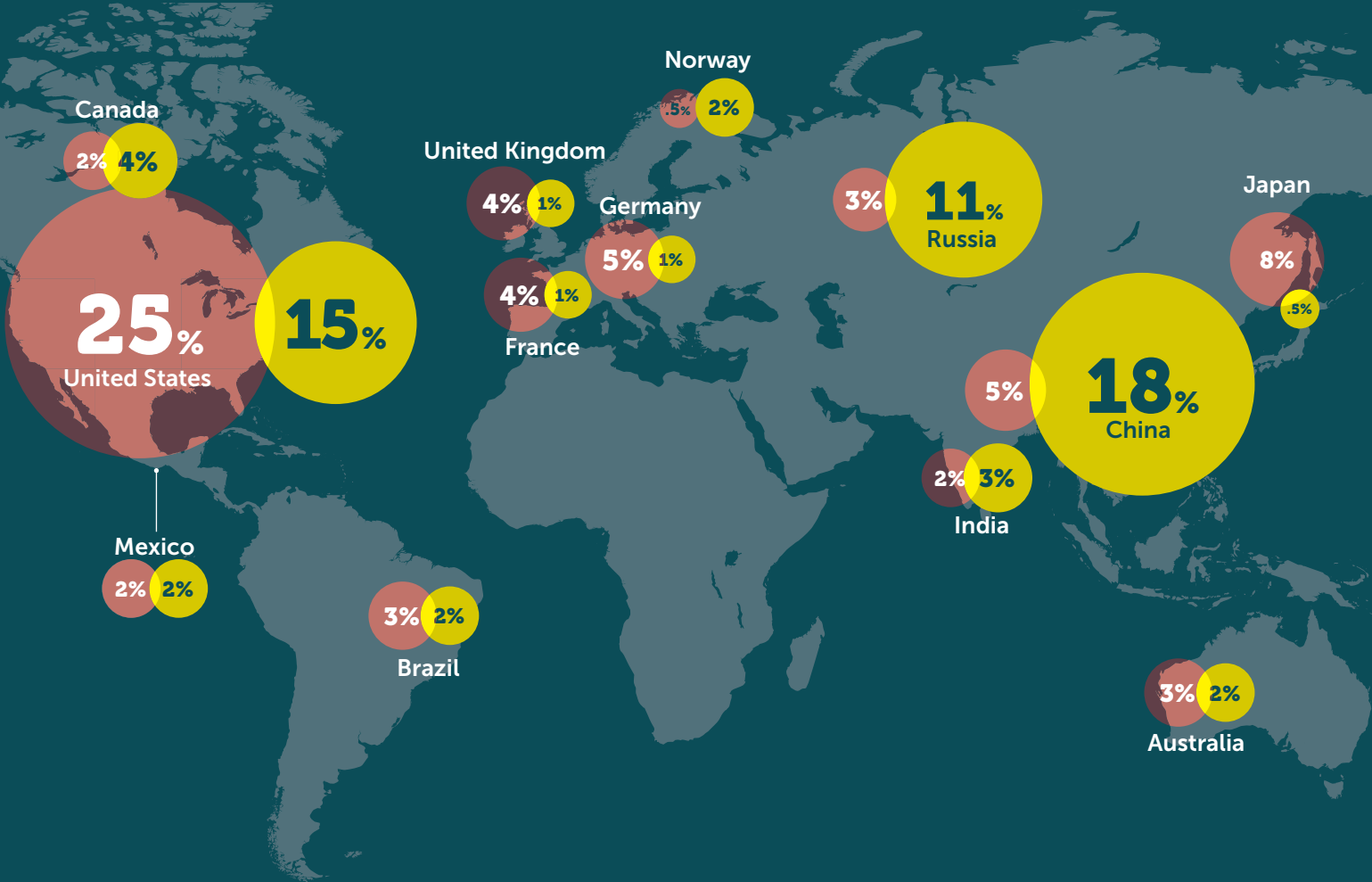
9.4%

Increase in global data center infrastructure spend for 2015 (DCDi predicts an increase to \$129 billion)

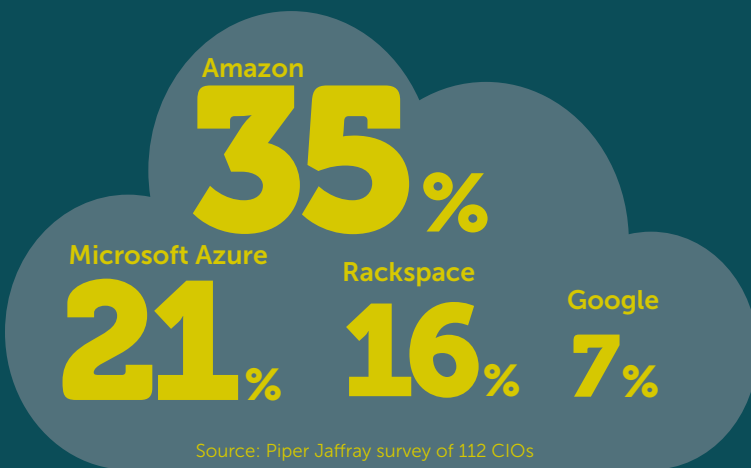
Who has energy for IT?

GLOBAL SHARE FIGURES (IT CANDOR)

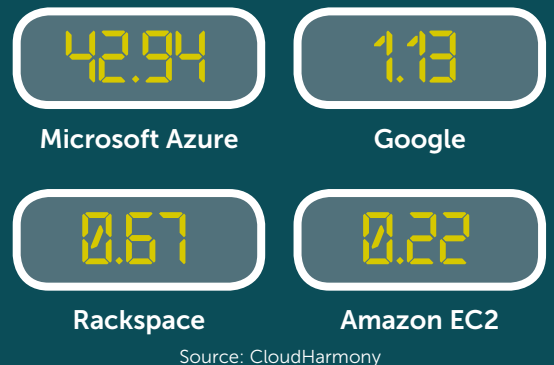
IT SPENDING ENERGY PRODUCTION



CLOUD PROVIDER POPULARITY

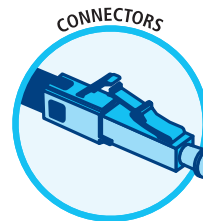
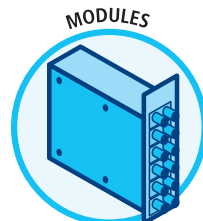
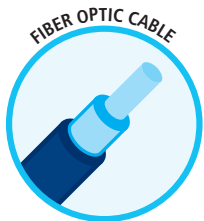


HOURS OF DOWNTIME IN 2014 OF CLOUD COMPUTE SERVICES





SMART Network Results

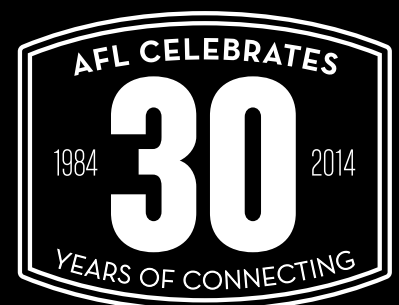


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Verizon downtime

Cloud provider Verizon took its service out for planned maintenance for 40 hours one weekend in January. The company says it won't happen again, because the pause allowed it to institute changes to the platform, "seamless upgrade functionality".

SoftLayer boss quits IBM

Founder of SoftLayer Lance Crosby has resigned, 19 months after IBM bought his firm. SoftLayer is the central plank of IBM's move to the cloud, which will now be led by IBM veterans.

China CDNs expand

Chinese content delivery network ChinaNetCenter has launched a subsidiary making green data centers. It also expanded into Malaysia, while a rival Chinese CDN, ChinaCache opened a European office.

Zayo buys Latisys

Telecom provider Zayo continued a \$5.3 billion spending spree, buying colocation and IaaS provider Latisys for \$675 million.



\$1bn SuperNAP planned for Reno Nevada

Data center provider Switch has announced plans for another of its giant SuperNAP data centers - this time a \$1 billion, 1,000 acre facility near Reno in Nevada. Switch also announced a plan to invest a further \$1 billion in its Las Vegas data centers.

Switch has more than a million square feet (100,000 sq m) of data center space in its home town of Las Vegas, with two SuperNAPs running and another two buildings under construction, and plans to

expand into Europe and the rest of the world. The new project is its biggest yet, with three million square feet (around 300k sq m) planned for the new facility. Reno is 450 miles (750 km) from the existing Las Vegas SuperNAPs, but Switch plans to add a dedicated fiber loop to allow for connectivity and reliability.

The new project was announced by Nevada Governor Brian Sandoval in a "State of the State" speech: "Switch is scheduled to expand to

Northern Nevada, bringing \$1 billion of investment with it," he said, adding the claim that the associated fiber would make Nevada the most digitally connected state in the US.

Switch's plans would put Las Vegas and Reno on a new fiber "superloop" which will also connect to Los Angeles and San Francisco in California.

The facility will be designed to meet the Uptime Tier IV Gold rating, something which Switch's SuperNAP 8 in Las Vegas has already achieved.

In Las Vegas, Switch is adding another 200 acres, with up to a million square feet (100k sq m)

Nevada has become a popular destination for data centers. Apple was lured into Reno with a tax break in 2012, and has since expanded its data center there, with plans for a further expansion.

<http://bit.ly/1C7SxDt>

5 DATA CENTER BEST PRACTICES

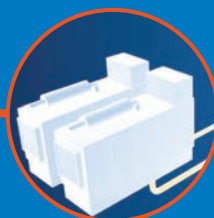
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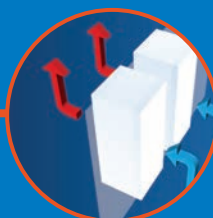
RISK MANAGEMENT



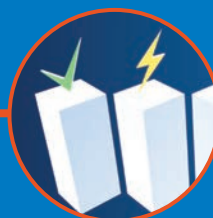
NETWORK MIGRATION



POWER OPTIMIZATION



THERMAL EFFICIENCY



DCIM ENABLEMENT

Learn how you can benefit on page 30

25G and 50G Ethernet breakthrough



With 10Gigabit Ethernet well established in the data center, the market is ready to move to 25Gigabit and even 50Gigabit switches, which can be built in new configurations for giant cloud providers, according research.

The market for data center Ethernet network switches jumped five percent in the third quarter of 2014, according to an Infonetics Research report which looks at data center Ethernet switches, Ethernet switches sold in bundles, application delivery controllers (ADCs) and WAN optimization products.

As is usual, the shift will be driven by more capable silicon - combined with a demand for faster connectivity from service providers and data center owners.

"The data center switching market is poised for another transformation with 25GE and 50GE enabling new data center network architectures targeting large cloud service providers looking to migrate from 10GE switching and server connectivity to 100GE switching and 25GE server connectivity," said Cliff Grossner, directing analyst for data center, cloud, and SDN at Infonetics.

The global data center Ethernet switch market was up five percent in 3Q14 to \$2.2 billion thanks to demand from cloud providers. Meanwhile, covered in the same report, application delivery controller (ADC) revenue dropped two percent from the previous quarter, but continues to grow on a year-over-year basis. The newer and smaller sector of virtual ADCs is still expanding fast, with a surge of 20 percent over the last quarter. WAN optimization was down one percent on the previous year.

<http://bit.ly/1thcF3h>

Grand Ming completes 15-floor Hong Kong data center

Hong Kong based construction company Grand Ming Group has topped out a newly-built 15-storey data center tower in Kwai Chung, Hong Kong.

The iTech Tower 2 is the first purpose-built data centre building in Hong Kong riding on a government policy favoring data center development. It is the Group's first purpose built data center, but is actually its second high-rise facility, following the conversion of an existing building to create iTech Tower 1 nearby.

The new building cost an estimated US\$88m (or HK\$682 million), and was built under the government's Policy of Lease Modification for Development of an Industrial Lot for High-tier Data Center Use. It is expected to accommodate 1,400 racks in its gross floor area of 108,000 square feet (around 10,000 sq m) when it is scheduled to be online in the fourth quarter of 2015.

iTech Tower 2 is designed to a Tier IV ready specification with a reliability of 99.999 percent. Engineering consulting firm WSP produced the design and oversaw the project.

Once online, iTech Tower 2 will provide colocation services to multi-national data center operators, telecommunication companies and financial institutions. However, the group told Datacenter Dynamics, iTech Tower 2 will have a different business approach compared with typical colocation service providers. "It will allow customers to have dedicated resources from CRAC, UPS up to the generator or even the transformer," said Herbert Chan, general manager of the group's data center business.

<http://bit.ly/1CIPCAO>



IBM's most powerful mainframe ever

IBM reckons its z13 mainframe is the most sophisticated computer system ever built, and the first major refresh for the System z mainframes since 2012.

The new machine can handle 2.5 billion transactions/day, which is the equivalent of the holiday Cyber Monday shopping spree, 100 times over. By 2025, IBM expects to reach 40 trillion transactions per day.

Today's z13 has up to 141 CPU units - each of which is a custom 8-core CPU with 10TB of memory and up to 8000 virtual servers. The system has real-time encryption and analytics, and improved I/O.

The z13 cost IBM \$1bn to produce and, five years to develop. It supports Linux and OpenStack, as well as IBM's proprietary z/OS. It has 300 percent more memory than previous systems, 100 percent more bandwidth, and vector processing analytics to speed mobile transactions.

That level of power allows the system to handle real-time encryption of all mobile transactions, and to offer real-time embedded analytics, with a promise that this might provide real-time fraud detection.

"Every time a consumer makes a purchase or hits refresh on a smartphone, it can create a cascade of events on the back end of the computing environment," said Tom Rosamilia, senior vice president, IBM Systems. "The z13 is designed to handle billions of actions for the mobile economy."

It's not before time. IBM's hardware division sales fell 15 percent over the previous year, as it lost share to HP, Dell, EMC, and others. With customers waiting for this machine, System z sales fell 35 percent.

<http://bit.ly/1C7SZCi>





Have you seen the latest
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Telx refits two iconic New York buildings

Cloud and colocation provider Telx has expanded in two historic Lower Manhattan, New York, buildings, called the 'Urban Giants'.

The NYC1 site at 60 Hudson Street has 40,000 square feet of additional space, while the NYC3 located at 32 Avenue of the Americas now has 50,000 more square feet. The latter has an unnamed global telecoms company as anchor tenant.

Both buildings have a long history of hosting critical telecommunications infrastructure,

going back to the telegraph. 60 Hudson was built in the 1930s as a company headquarters by Western Union. It's now a 'carrier hotel' offering one of the densest connectivity environments on the planet.

NYC3 occupies multiple floors inside the impressive Art Deco tower which was built by AT&T and was designed by the same architectural firm as the first site - Voorhees, Gmelin and Walker.

The expansion of NYC1 not only provides new data center

space, but also new office space and an executive meeting center. Meanwhile NYC3 has added a whole extra floor to its space, bringing Telx's footprint within the building to over 120,000 square feet.

"Expansions in NYC1 and NYC3 allow us to increase our connectivity-dense colocation capacity while securing and accelerating additional footprint in North America's most strategic data center market," said Chris Downie, who is CEO at Telx.

"Combining these expansions with our NYC2 facilities at 111 8th Avenue and our three New Jersey facilities across the river, Telx offers the largest critically enabled data center solution in the New York City metropolitan area."

Telx had already expanded NYC3 by 70,000 square feet in 2014. In total, the company now manages 1.3 million square feet of data center estate and more than 50,000 network connections.



<http://bit.ly/1Db7KRJ>

Amazon faces power-line protest in Virginia

An Amazon proposal to build a new data center in Virginia has hit opposition - because of the new power lines that would have to be built to feed it.

Amazon wants to build a new 500,000 square foot (46,000 sq m) facility, called Midwood Center, in Haymarket, Prince William County, Northern Virginia. Although the site is only about 25 miles from Amazon's existing data center in Ashburn, Loudoun County, the proposal would require new power transmission lines to the proposed site - which has sparked protests from residents.

The utility, Dominion Power, has suggested a 230kV transmission line which would use 100ft (30m) poles to go six miles across country on the way to Haymarket.

A residents' group, Protect Prince William County, has objected to the route.

Two local Republican politicians, Delegate Richard Marshall and Senator Richard Black, have written a letter to Amazon CEO Jeff Bezos to complain, and a law has been proposed which would make it mandatory to bury power lines.

The protesters have been branded NIMBYs ("not in my back yard") but they deny this, saying that Prince William County is a rural area not suited for industrial use.

Nearby Loudoun County is a major communications hub carrying an estimated 70 percent of the world's Internet traffic. Dominion Power and Amazon want to develop Prince William County as an alternative hub.

The Protect PWC group wants to force the transmission lines to follow the main I-66 road and be buried underground for the final stretch, a move which would apparently make the data center project's costs prohibitive.

<http://bit.ly/1BulKWN>

Calxeda's ARM chips saved?

Calxeda, the start-up making ARM-based servers which closed a year ago, is back - sort of. A Taiwanese games company has bought its intellectual property (IP) and will use it to build low-power compute and storage servers manufactured by FoxConn.

AtGames Digital Media of Taipei has set up a new company, Silver Lining Systems (SLS), which will sell compute and storage servers designed for data centers, big data applications and cloud businesses. AtGames, a Calxeda customer, bought the IP to keep the server technology going, after Calxeda abruptly ran out of money in December 2013.

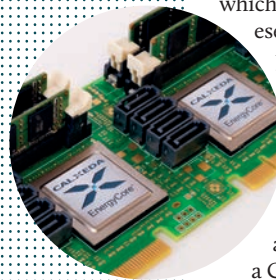
Although Calxeda failed, there is a still a growing opportunity for low-power servers in scale-out data centers, AtGames believes, and has teamed with partners including Taiwan's manufacturing giant FoxConn to offer a Calxeda-based line.

Silver Lining gives few product details, but promises a full rack of its A300 series servers will operate on less than 10kW. The servers will fit in a 2U chassis which will hold 48 modules, connected in a micro-cluster using a 10G low-latency fabric, so a 42U rack should hold more than 1000 servers (low power system-on-a-chip based servers use around 6W, so that checks out).

SLS says its servers will offer "high density, scalability, distributed cluster-computing, fault-tolerance/redundancy, graceful degradation, and low power". The company doesn't give any details of its planned storage servers.

The products are aimed at "data centers, CDNs [content delivery networks], media & entertainment, Internet, academic, and big data analytic environments".

<http://bit.ly/1xZpbkF>



160k
Telx's total 2014 expansion in square feet at NYC1 and NYC3



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CeBIT pairs up with DCD for mighty IT event

DatacenterDynamics magazine looks ahead to CeBIT 2015 – a global event that promises to be big in scale – and even bigger in content

CeBIT, the world's largest IT event – this year taking place from 16-20 March in Hannover, Germany – has joined forces with *DatacenterDynamics*, your very own data center magazine and a global provider of specialist data center conferences, to create the world's largest, truly international, data center event.

The three day conference program – themed *The Business of Data Centers* – will feature a host of internationally renowned experts focusing on helping IT professionals better understand the role of the modern data center as the ultimate business enabler and home to the cloud. It will explore not only how modern data centers are designed, built and operated, but also how organizations should select their data center and cloud infrastructure partners for their ever-increasing international growth requirements.

Program: four distinct tracks

Design + Strategy – Examines issues facing decision makers responsible for the organizational strategy and the design of on-premise data centers.



CeBIT 2015
16-20 March
Hannover Exhibition Ground, Germany
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www.cebit.de

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center Expo
in Hall 12



IT + Networks – Centres on helping senior strategists understand the implications of IT and network transformation on data center design and architecture.

Critical Environment – Looks at the issues facing the professionals who manage the performance, efficiency and resilience of the data center's critical environment.

Sourcing + Delivery – A focus on helping senior IT professionals make effective global IT infrastructure sourcing decisions.

In partnership with CeBIT, the content of this redesigned, timely edition of *DatacenterDynamics* magazine is built around similar industry tracks and shares the CeBIT ethos.

Our five day exhibition, housed in more than 12,000 square metres of exhibition space – the largest of its kind organized to date – reflects the diversity of the conference content, hosting the entire eco-system of product and solution vendors to the market. The organizer is pleased to have already received significant commitment from some of the largest brands in the data center industry. ●

Barak Regev
Head of EMEA cloud platform
Google



What are you covering at CeBIT?
I will share details about Google's cloud infrastructure, our data centers'

security and sustainability, and explain how Google is making it available.

Is there anything new you can bring to the conference, from a knowledge, learning and management viewpoint?
I will bring some unique details and images of our data centers and security infrastructure to tell attendees how we build our cloud.

What are you looking to get out of the event, from the perspective of knowledge and learning?
We want to share our knowledge and help educate the market.

Kushagra Vaid
General manager, server
engineering, cloud and enterprise
Microsoft



What are you covering at CeBIT?
This talk will cover the innovations that are driving public cloud

infrastructure designs, and how these can be implemented in an IT environment to gain efficiencies.

Is there anything new you can bring to the conference, from a knowledge, learning and management viewpoint?
Learnings from designing infrastructure for large public clouds is something unique that I bring to the conference.

What are you looking to get out of the event, from the perspective of knowledge and learning?
I would like to know about the challenges enterprises face in moving to the public cloud or deploying private clouds, and where technology fails in making the transition seamless.

Jens Struckmeier
CTO,
Cloud & Heat Technologies



What are you covering at CeBIT?
How we utilize waste energy in our green cloud data centers. I will talk about the challenges

of implementing a highly distributed public cloud and its advantages.

Is there anything new you can bring to the conference, from a knowledge, learning and management viewpoint?
I will talk about how we overcome challenges utilizing a highly decentralized cloud, consisting of multiple green micro data centers placed in residential buildings, where the waste heat is utilized locally.

What are you looking to get out of the event, from the perspective of knowledge and learning?
We are interested in exchanging experiences, and finding partners and further use cases that could benefit from our solution.

Cole Crawford
Executive director
Open Compute Foundation



What are you covering at CeBIT?
I will be speaking about the next chapter in data center design.

Is there anything new you can bring to the conference, from a knowledge, learning and management viewpoint?
There are many new technologies that have major implications on the cost per megawatt and PUE of data center infrastructure. I will share insights on how to best approach these innovations.

What are you looking to get out of the event, from the perspective of knowledge and learning?
I want to hear from the delegates and exhibitors what I can do to help guide innovation in this industry for the next few years.



Why Telstra paid \$700m for Pacnet

The Australian telco giant is getting its hands on a giant subsea cable network and some prime data centers, explains *Paul Mah*



Paul Mah
South East Asia
Correspondent
@PaulMah

At the end of 2014, Australia's largest telco Telstra confirmed it would buy Singapore and Hong Kong-based Pacnet for \$697 million (AUD \$856.5 m). Subject to regulatory approval, the deal should complete by mid-2015, and will double the size of Telstra's presence in Asia. The deal is noteworthy given Pacnet's extensive reach in Asia, and its ownership of the world's largest private submarine cable network.

So will Telstra benefit from its acquisition of Pacnet? And why would Pacnet, which is owned by a private investor group without the pressures faced by a publicly traded company, be interested in courting a buyer in the first place?

Formed from the operational merger of

Asia Netcom and Pacific Internet, Pacnet's crown jewel is EAC-C2C, a subsea cable network that spans 36,800 km between Hong Kong, China, Korea, Japan, Taiwan, the Philippines and Singapore. EAC-C2C has a design capacity of between 17.92 terabits per second (Tbps) and 30.72 Tbps to and from each of the landing countries.

Cable systems are hugely expensive projects that are typically financed by a consortium of telecommunication operators, though large IT companies are increasingly also getting into the game. For example, the FASTER trans-pacific subsea cable announced last August has Google as an investor. On its part, Pacnet says that having sole ownership of EAC-C2C sets it free of competing interest.

Elsewhere, Pacnet independently operates

Above: Cloudspace II, a Pacnet site in Singapore

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a significant amount of the capacity in the 9,620 km Unity cable system that connects Japan to Los Angeles on the West Coast of the United States. Unity has a design capacity of 7.68 Tbps, and unlike a typical cable system, offers ownership and management of individual fiber pairs.

Pacnet calls its two dedicated fiber pairs "EAC Pacific".

Its subsea network assets aside, Pacnet also operate 19 data centers spread over 15 cities in 10 Asia-Pacific countries. These are not legacy data centers inherited from previous acquisitions either; many are state-of-the-art facilities built as part of a long-term plan.

Pacnet opened two brand new data centers in 2014: The 226,000 square foot TJCS1 data center in Tianjin, China, and a standalone SGCS2 data center at Paya Lebar in land-scarce Singapore.

Pacnet is also the first foreign-owned company licensed to provide data center network services in China, operating through a joint venture called Pacnet Business Solutions (PBS).

Pacnet can claim to have a culture of innovation. A year ago Jon Vestal, vice president of product architecture at Pacnet was given a mandate to "shake up the services market". His team created Pacnet Enabled Network (PEN), from scratch in months

A Network-as-a-Service (NaaS) platform, PEN allows customers to provision bandwidth in granularity as fine as one hour intervals, to dial networking services and bandwidth up and down on the fly, and to pay for what they use via an on-demand model. In October Pacnet added support

for Network Functions Virtualization (NFV), creation of VLANs (virtual local area networks) and better security.

PEN is based on OpenStack, and Pacnet's willingness to talk about this shows a mature attitude towards innovation.

Pacnet also went off the beaten track by converting part of its landing stations into data centers in 2010, exploiting its existing facilities by putting server racks right next to its subsea fiber optic cable network.

"We were the first in Asia to convert cable landing stations into data centers, including facilities in Hong Kong and Singapore," said Pacnet spokesperson Annie Ho. "The strategic move of building a network of CloudSpace data centers next to our subsea fiber infrastructure has enabled us to offer the fastest data and content transmission available in the region."

On the flip side, detractors will point out that the valuation of Pacnet appears to have dipped somewhat from figures mentioned in previous takeover bids. In 2012 Indonesia's PT Telekomunikasi Indonesia (Telkom) expressed its interest in acquiring Pacnet at a speculated price of \$1 billion, while in 2008 Australia's NT News put Pacnet's equity value at \$2 billion.

Pacnet faces competition from regional phone companies, according to Bloomberg, which also noted that Moody's Investors Service cut Pacnet's debt rating to B3 in August last year, with \$20 million interest payments due in December. The company is profitable, but it has just \$30 million in cash reserves with no back-up bank facilities.

Viewed in this context, Telstra's \$5 billion cash reserves could give Pacnet the needed impetus to keep expanding.

Ultimately, there is no question that Telstra could benefit from the culture and people at Pacnet, as it looks to expand. ●

Pacnet Data

36,800

kilometers of subsea fiber

19

data centers

10

countries

30.72

tbps

\$697m

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Illustration: Tracie Ching @ debut art

Open with a winning hand

Containerization will support applications flexibly, providing the final component of the software-defined data center.

Simon Bisson says Docker has a very strong hand

The future of the data center is one of software-defined everything: compute will run on virtual machines in scale-out clusters, and storage and networking will become flexible fabrics. The movement is being defined by open source standards makers (see *Box*, p 21). But ironically, one aspect of tomorrow's data center is still to be defined: the software that runs on those software-defined platforms.

As the DevOps movement brings applications and operations closer together, a series of trends is emerging. One is the concept of continuous delivery, where rapid and agile development methodologies result in much faster update cadences. You might not be Amazon, pushing code every few seconds, but you might well find yourself in the position of having to roll out updated code monthly, or even weekly. Another is the shift to a componentized architecture composed of microservices, themselves updated and improved regularly.

Those two trends mean that you're going to need a new way of delivering and deploying software, one that's independent of the underlying operating system – and one that allows you to take advantage of all the benefits of the next

generation of data center technologies. And that's a good fit for the operating system-level virtualization technologies that have come to be known as containerization.

Containers may not be as flexible, or as powerful, as the hypervisor virtualization techniques used to deliver the compute fabrics in modern data centers, but they have one advantage that makes them an ideal tool for handling application virtualization: they don't rely on hardware-based hypervisors. That means you can run containers in existing virtual machines, letting them work as a tool for abstracting applications from the OS, while hypervisors handle abstracting the OS from the underlying hardware.

So containers are the point at which the software-defined data center finally takes on software itself. They're how we can deliver software rapidly to virtual machines, making software deployment part of the VM deployment, so our applications are ready to run as soon as the VMs are powered up. You can think of it as a model similar to that used by Microsoft's Azure Management Agent, injecting software into a VM on deployment.

Processes running in containers are isolated from

Cover Story

each other, with separate namespaces and resources. Applications in one container are unable to interact with another (except via network connections). You can run many different containers on one host OS, using resource constraints to manage just how much CPU, memory and I/O are allocated. But containers go one step further: it's possible to swap out one instance of a container for another, using familiar VM management techniques. Migrating VMs from one host to another means shutting down an instance (leaving the rest of a scale-out cluster running) and then restarting on a new server. To install a new container, all you need to do is swap out the current instance before restarting the server – either in place or on a new hypervisor.

Managing VMs and applications is only part of the story: the real advantage of containers is the ability to make them part of your build process. With a modern automated build, system apps can be compiled, tested and deployed into containers, ready for delivery to virtual machines in a private or public cloud. As a container isolates the application and its associated services from the underlying OS, it's possible to quickly roll out new containers across compute fabrics, updating the app without affecting the underlying OS – or the associated data.

Of course this approach assumes a certain level of architectural purity in your applications: with well-defined APIs that don't change between releases (or at least support versioning) and with separation of working caches from application storage and data. These aren't new ideas; they're the heart of the service-oriented application development model we've been using for the past decade or so, and won't be a problem for any organization that's building and deploying SOA applications today.

While it's impossible to completely abstract applications from the host OS, containers go a long way to simplifying deployment issues, letting you bundle required services and libraries in a single container.

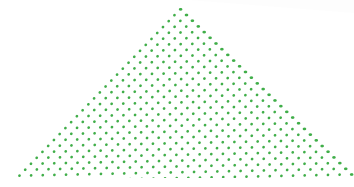
You will still need a Windows container for Windows apps, and a Linux container for Linux code, but at least the process of deploying apps is easier – and all your containers are deployed in a known state, making it easier for operations teams to manage applications and roll back to a previously known state in the event of problems. The question then is not whether to use containers, but which container technology to use.

Docker has been one of the enterprise stars of 2014, and is by far the most popular container technology currently in use. It is supported by all the major Linux distributions,

and available as a cloud service on many of the major infrastructure platforms. Microsoft has also announced that the next release of Windows Server will support containers, and is working with Docker to add Docker support for Windows binaries.

One of Docker's key features is the ability to create differential containers that can be stacked to deliver different services, or support different platforms. You might have a container with a NoSQL analytics service, with differential containers for deployments on Ubuntu, Red Hat or Core OS – and for Azure, Google Compute or AWS. Mixing and matching containers is key to working with Docker, and you're going to need additional tools to manage how containers are deployed in your data center.

Google's Kubernetes is an interesting example of a deployment and management tool that works with Docker. Best thought of as an orchestration tool, it allows you to schedule deployment to compute nodes – ensuring that the containers maintain the state their users desire. That means support for restarting containers and nodes, and for managing groups of services running across several



\$66m

Total venture capital funding for Docker up to January 2015

containers. Kubernetes also automatically deploys containers to hosts, taking advantage of the available resources.

Orchestration tools like Kubernetes are an important feature of any containerization platform. The underlying services, like Docker, are focused on working with the containers, and, like any software-defined service, you're going to need a higher-level tool to handle its interactions with your data center or cloud. That's still an issue as, like Kubernetes, the tooling is still in its infancy, and isn't ready for integration with commonly used system management tools.

With Microsoft adding container support to Azure and to its next Windows Server release, it's likely there will be support for containers (and possibly even Docker) in the next System Center release.

Similarly, we should see tooling in Cloud Foundry's private cloud platforms, and open source tooling like Kubernetes will quickly add features to meet user demand.

Docker isn't the only container platform on the market. As well as Windows adding support, there's built-in container support in Linux, in Solaris, in Parallels' hosting platform, and in other commercial UNIX OSes. While the underlying technologies have been around for some time, recent developments mean they're evolving fast – and with competition coming from new container platforms, things are likely to move even faster in 2015.

The team behind the container-friendly CoreOS Linux distribution has begun to develop its own containerization software, Rocket, with an open standard for container definitions. It's an interesting decision, as until recently CoreOS was closely linked to Docker, with members of the CoreOS team part of the Docker community – and contributors to its code base. Rocket isn't a fork of Docker, it's a whole new set of tools being developed from the ground up.

As data centers evolve, the operating systems we use on our servers are changing too. One interesting research model is the Library operating system, which builds on the current hypervisor model. Instead of just one operating system, with various applications running on top of often redundant services and APIs, a Library OS only offers the services and features its applications require, making it smaller and more secure. Containers are an ideal way of delivering apps to such an operating system, as their manifests can be used to construct an appropriate operating system image for the apps in the container – bringing OS and container together at last. ●



NASA launched Open Stack in 2010

OPEN DATA CENTERS - WATCH THIS SPACE

Docker

An open source project that deploys applications inside software containers, Docker provides portable resources for applications, without the overhead of virtual machines. This is a great framework for finally realizing the promise of DevOps, as these containers can move unchanged from development machines to operational systems. Docker uses features of the Linux kernel, but has bigger ambitions – Microsoft is introducing Docker containers in the next version of Windows.

OpenStack

A free and open source cloud computing platform, OpenStack was initiated by NASA and Rackspace, and has gathered huge momentum amongst cloud providers, with more than 200 companies contributing to the project. OpenStack delivers six-monthly revisions to a code base that provides all the basic services of a cloud platform service – essentially the nuts and bolts of a software-defined data center. The OpenStack platform includes compute (Nova), object storage (Swift), block storage (Cinder), software defined networking (Neutron), a dashboard (Horizon) and identity services (Keystone). Other modules handle images database, orchestration and bare metal provisioning.

Hadoop

A cluster of open source initiatives, Hadoop originated at Yahoo! as a way to use distributed computing and storage to work with very big data sets. It is managed by the Apache Software Foundation, and supported by all the large industry players. Work around Hadoop mostly focuses on increasing its ability to handle different kinds of data, and making the Big Data systems that use it more easy to handle.

Open Compute

Announced by Facebook in 2011, and now led by Corey Bell (below), Open Compute shares designs of data center products, bringing the open source model to data center hardware, so designs created for big players can be made available to all. OpenCompute has redesigned racks, switches and (with its Group Hug scheme) motherboard slot architecture. A sign of its success is the willingness of brandname hardware vendors, such as HP, to endorse Open Compute ideas.



Make your data center grow up and understand finance

When data centers manage their own financial performance, the industry might finally be reaching maturity, *Peter Judge* hears



Peter Judge
Global Editor
@peterjudgeDCD

For all the talk of increasing data center efficiency and bringing down costs, for most people there is a gap between these two concepts. Most data centers are like a child who gets pocket money, but has no idea of the family's actual costs.

The organisation's financials are carefully maintained in purpose-built applications, while IT resources are managed and orchestrated through automation and control software, that understands efficiency, but usually has no concept of cash.

The physical data center infrastructure is designed to deliver the most efficient service possible, and the business has machinery to bill resources to departments or customers.

But how do you decide what to bill your clients? Can your finance software see where any expense is actually incurred?

Now users aren't locked into any service, these answers are essential.

"The emergence of increasingly low cost cloud services, coupled with the ever more competitive market for commercial datacenters, means that those investing in data centers need to have a clear understanding of their costs and be able see and model the implications of their business and technical decisions," says Andy Lawrence, VP of research for data center technologies at 451 Research.

The fact that they don't could simply be because the IT industry is not yet mature. Data center infrastructure management (DCIM) vendors promise cost savings, but those promises often have to be taken on trust, and (hopefully) demonstrated somewhere down the line.

The cloud makes this more urgent. It's the ultimate maturation of the IT market and changes everything by commoditization, according to Zahl Limbuwala of Romonet: "In a commoditized world, it's critical to see costs, to control them and use them as a tool within your business."

Data center services are now less differentiated than mid-sized Fords, Citroens and Renaults, he says. "People will say IT and computing and software have been around for 50 years, but in economic terms the market is still extremely immature."

Large IT firms can't differentiate around hardware, so the margins moved to service and consultancy. But now IT is bought as a service, and those margins are disappearing. With ease-of-use, even the consulting gravy train is hitting the buffers..

"Many people simply don't understand cost as well as they must, to survive in a truly commoditized data center market," says Limbuwala. "The data center is an asset, but they don't understand the costs - either as a total or at a granular level - of

Who is Romonet?

Romonet was founded in 2006 by Zahl Limbuwala and Liam Newcombe - initially just to answer the question of how much data centers cost to operate. Through the British Computer Society's Data Centre Specialist Group Newcombe and Limbuwala have been involved with the European Code of Conduct for Data Centres. In 2009, Romonet helped produce an open source engine to predict cost and power usage. Limbuwala has given keynotes at DCD events, and at Google's data center efficiency event. As well as energy and finance, Romonet products also track CO2 emissions of data centers.

88%
of spreadsheets
contain errors.
*Don't do finance
by hand*



delivering services from that huge energy-intensive building.”

Supermarkets know how much profit they make on every tin of beans. Data centers need the same level of visibility.

A tiny software firm based in South London, Romonet has created a surprising amount of noise - and resolutely refused to be lumped in with the DCIM crowd.

451 Research's Lawrence sees prediction and cost analysis as crucial, and seems taken by Romonet's approach, saying "its introduction is timely and addresses a clear need."

Romonet uses an energy model - and has a patent granted in Japan and pending elsewhere. Energy is the main operating cost of a data center, so Limbuwala's idea is to follow the electrical and mechanical supply chain all the way up from the utility feed to the application software.

It's basically a data center version of "activity based costing" the approach factories and supermarkets have used for many years to understand exactly the cost of producing and delivering each of those tins of beans.

"It's important because cost is not one dimensional," says Limbuwala. Fixed capital costs are written off over time, and operating expenditure is treated differently.

By understanding every component of the the cost of a cloud service, a service provider can compute exactly how much each user should be charged.

Limbuwala compares colocation services to rented office space: "If I have two equal size rooms, I can rent them for the same price to two different companies. But if one fills the room with ten people 24-by-seven, while the other has one person in it for one hour per month, the revenue is identical, but the cost and margin is different."

The office rental firm needs to account for consumption of electricity and coffee, as well as cleaning and toilets. In the data center, the provider will need to address rack density, usage and other factors.

If 5kW racks are rented for a fixed cost, some customers may use all of the power allocation, while others might just put in a switch and use 100W for three years.

Consumption based billing is almost unknown in the US, and still rare in Europe, but without it, the provider has no idea what margin he or she is getting for each customer.

"Whether you are an internal data center or Equinix, you need that knowledge, because you are faced with competition from everyone who can sell the same product," says Limbuwala. "There is nothing special about your data center."

What is needed is to treat capital cost and variable costs separately. That way, the amortized capital, and the operation costs, can be allocated by customer in proportion to who is using the resources.

To work properly, the energy costs have to be measured and apportioned on an hourly basis, automatically, says Limbuwala: "The difficult bit is not doing it once, but doing it continuously."

Put that way, it sounds simple, but data centers contain interdependencies: "In the data center flow chart, there are loops, things cross over, and multiple paths. Complexity is inevitable when electrical and mechanical systems are put together."

It's worth getting right, because other things "fall out" of the energy model, including operational figures, Limbuwala continues, allowing efficiency measurement, and a lot of the things that DCIM has been promising.

For instance, a data center may have a PUE of 1.2, but what if one of the chillers is using more power than it should? To understand that, needs a knowledge of what is happening in the part of the data center served by that chiller. "Unless you have an energy model, you don't know," says Limbuwala.

It's difficult for humans to spot anomalies, but a predictive approach to an energy model will highlight them "Like a highlighter pen", and prompt activities such as cleaning the filters in a laboring chiller: "If you can't see this, it can go unnoticed for six months."

Romonet's strategy is to manage data centers by partnering with leaders in DCIM and building management, says the CEO.

Beyond this, Limbuwala wants to step beyond the data center field to other energy intensive sectors, and help organisations like hospitals take a more efficient approach. If he can pull that off, it might just be a sign that the IT industry is finally maturing. ●

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Stick it where the sun don't shine

The high density and low price of flash are pushing storage into your RAM slots, says *Max Smolaks*



Is there an empty DIMM socket in your server? Research suggests there might be several. Empty spaces that serve no purpose. But with flash memory becoming cheaper, we can now place storage in increasingly exotic locations - for example, in that empty DIMM socket.

Some representatives of this new flash-based storage device class are SATADIMM by Viking Technologies - a product division of American electronics manufacturer Sanmina - and ULLtraDIMM by SanDisk.

The former draws power from any available DDR3 socket but sends data via a familiar SATA cable, which means it can be plugged into a RAID card, as well as directly into the motherboard.

The latter takes full control of the socket's 240 DDR3 pins, meaning less cabling, but also radically different performance characteristics.

Most SSDs (solid state drives) follow the traditional hard drive form factors and are connected via SATA or SAS. More recently, startups like Fusion-io (recently acquired by SanDisk for US\$1.1 billion) have put larger chunks of flash on PCIe cards, for higher throughput, but at a higher cost.

Now, Non-Volatile Dual In-line Memory Modules (NVDIMMs) put NAND chips where RAM normally lives. This allows higher storage density, and can be used as a boot drive or a cache.

The idea is not new, but the capacity and lifespan of SSDs is only now making it a viable option for the data center.

Viking's patented SATADIMM puts up to 480GB on a stick that's a quarter the size of a standard 2.5-inch SSD. Eight of these can be

plugged into a single RAID-enabled Host Bus Adapter for up to 480,000 additional IOPS, without ever touching the existing drive bays.

The server won't notice the difference and treats SATADIMM as just another drive - no drivers required.

Viking estimates that a typical rU storage server will have at least two unoccupied DIMM sockets. Across a data center, this presents considerable potential. Viking plans a 2TB version by March 2015, Hamid Shokrgozar, president of Viking Technologies told DatacenterDynamics.

SanDisk's ULtraDIMM (Ultra Low Latency DIMM) takes a different approach: it places flash on the memory bus to achieve write latency as low as five microseconds: "It allows you to declare the persistent memory either as a block device or memory extension," says Henri Richard, SVP of worldwide OEM

and enterprise sales at SanDisk.

Huawei, Lenovo and Supermicro all expressed interest in the project but in January, American memory specialist Netlist accused SanDisk partner Diablo Technologies of stealing its proprietary memory controller for use in ULLtraDIMM. Now SanDisk can't sell them until the final verdict in March.

Meanwhile Netlist will sell its similar flash-based NVvault module, available in capacities of up to 8GB. And there are other NVDIMM varieties on the way, including Micron and AgigA Tech.

As the demand for storage grows, we could see stacks of NAND chips piled into every corner of the server. Intense competition in the NVDIMM space suggests that at least some vendors believe this is a great idea.

We could see stacks of NAND chips piled into every corner of the server



Equinix, (EQIX) the colocation data center company, declared at the end of 2014 that its board of directors had voted to convert

the company into a real estate investment trust (REIT) as Wall Street had long anticipated.

The board of directors announced that Equinix would start trading as a REIT on January 1st 2015. CEO Steve Smith said the company was: "Pleased with its current business momentum, and the REIT structure positions us well to continue to deliver profitable global growth, while providing world-class facilities and services to our customers through Platform Equinix."

The idea was mooted as long ago as September 2012, and Equinix's stock was hit by uncertainties over the following 18 months, as the US Internal Revenue Service (IRS) looked into the proposal. However, two other data center providers had already set a precedent by turning themselves into REITs: Digital Realty Trust (DLR) and DuPont Fabros Technology (DFT).

The idea has met with approval, with Forbes saying: "Equinix is a natural business to convert to a REIT, because its revenue/rental structure appears naturally like a real estate operation."

Equinix has a PE ratio of 81.0. On the date of the announcement, nine analysts rated Equinix a buy, no analysts rated it a sell, and 5 rated it a hold.

The view of many US



Bill Boyle
Global
Managing Editor
@BillBoyleDCD

All REIT now?

Equinix's long-awaited transformation into a real estate investment trust (REIT) gets *Bill Boyle's* vote



commentators is that interest rates will remain low for the foreseeable future. That means more challenging times ahead for investors. High-yield bonds are always an option for income, as are high dividend-yield stocks so the market is looking at stocks with the potential to raise their dividends higher with little risk.

“There are other options available that may provide a sudden, fat dividend payment, as well as stock price appreciation: companies that are currently in the process of converting to real estate investment trusts,” said investment advisor Peter Anderson on Forbes. “REITs can be appealing for their income features (the company must pay out at least 90 percent of its earnings to shareholders – one of the many requirements for a company to be a REIT) but it’s tough to identify those REITs that have potential capital appreciation, too.”

However, there are problems with REITs. There is always a possibility that conversions to REITs will not go through. This is especially true this year, because the IRS stepped up its scrutiny

and due diligence for conversions, viewing some REIT requests in the same negative category as Merger & Acquisition inversion deals, which divert corporate tax revenues away from the federal government.

As Forbes said: “Equinix builds and operates data centers that house servers for the cloud. This business doubles every two years. In short, we have the endless need to store data of all types. And yes, for some this even includes naked selfies! Equinix is a natural business to convert to a REIT, because its revenue/ rental structure appears naturally like a real estate operation.”

For the past year, the stock traded as if the board believed there was great uncertainty about the conversion prospect, despite the fact that the IRS had already set a precedent by granting conversion to Digital Realty Trust (DLR) and DuPont Fabros Technology (DFT). Good public relations or just caution? No one knows.

To comply with Internal Revenue Service (IRS) rules concerning a REIT conversion in January, the company announced it will pay a special distribution of about \$420

million to shareholders — about \$7.60 per share — not the actions of a company worried about its transformation.

The upsides to the conversion to stock prices are twofold. It will become a member of the REIT indices, which will increase technical demand similar to when a new stock enters the Standard & Poor 500. Secondly, the valuation protocol for REITs is different from traditional stocks, but as I said earlier, Equinix’s structure is perfect for a REIT.

Investors backed down from IT security company Iron Mountain’s (IRM) stock because a long IRS review process caused uncertainty about whether the process would go ahead. In the end the IRS approved IRM’s REIT structure, but it was not easy. Lamar Advertising (LAMR) and CBS Outdoor (CBSO) also converted last year. This suggests that the IRS has become looser in interpreting eligibility for conversion.

Some have argued that data center operators are making a mistake by classifying themselves as real estate operations, when their business model is actually more about the IT kit inside the building - which is essentially a consumable commodity - and the power it uses.

But initial reaction to Equinix’s move suggests we can expect that more organisations in future will step up and test whether they are made of the REIT stuff. ●

We have the endless need to store data of all types... including naked selfies



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Reduce oxygen to save your site

Ian Bitterlin urges data center owners to consider a little-used fire-suppression system with massive benefits – ‘oxy-reduct’

I was recently asked if I have any opinions regarding fire suppression. I do! And in the words of Karl Marx, “If you don’t like them, I have others.” There is no single answer to fire suppression, and any ‘one-size-fits-all’ solution will always be a compromise.

In North America, there is still a high incidence of wet sprinklers, but I believe this is related more to building insurance than protecting the IT load. I can’t recall the last time I saw a wet system in Europe, and the system of choice appears to be one of the high-pressure gaseous types, with a minor sprinkling of water-mist/fog.

The problems with gas are noise on discharge (raised hard-disk failure by the physical shockwave); structural damage such as burst panels; and gas extraction after the discharge. These techniques are not ideal for direct air-cooling systems, or air-side economization.

False discharge, caused by human error, is a common cause of IT interruption, and the cost of gas replenishment is considerable.

There are also fresh-air make-up/pressurization systems that must interface with the fire-suppression being applied.

So where is this leading? Well, one established fire-suppression system that is not widely applied in data centers is ‘oxygen-reduction’, sometimes shortened to ‘oxy-reduct’ or ‘hypoxic’. Fragile and historical documents such as the *Magna Carta* have been stored in oxygen-depleted environments for years.

The theory is that if you reduce the oxygen content in the air from 21 percent to below 16 percent, volume and combustion cannot be sustained. It appears to be a perfect

solution for continuous computing, with no environmental impact, hardware contamination, or risk of false activation. There are several issues, though:

- The room must be air-tight to levels above normal
- The internal pressure should be higher than the external pressure, and the fresh-air make-up must be a source of nitrogen to displace the oxygen
- Some form of air-lock is best for entry/exit
- In a hypoxic environment, staff with respiratory conditions such as asthma may have trouble with activities that require exertion
- If it fails, there should be redundancy, as it will take time to reduce the oxygen level
- Health and safety will require low oxygen alarms

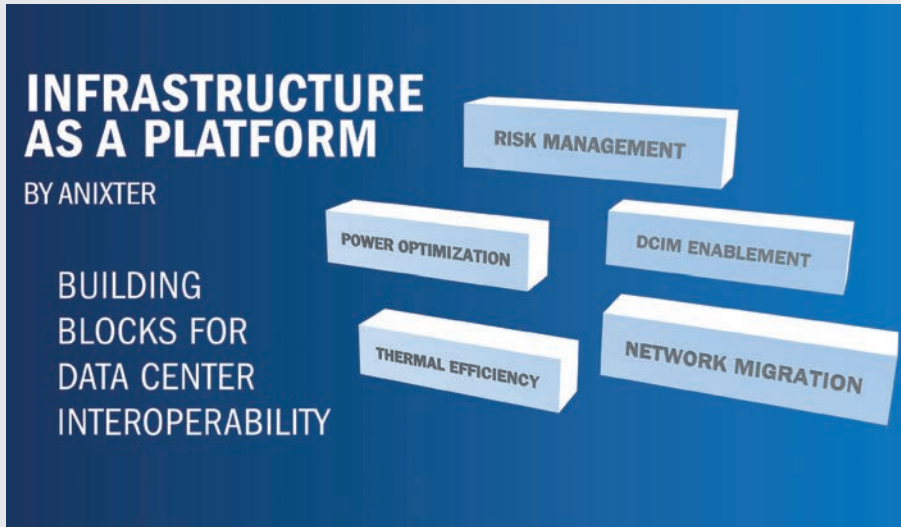
Also, air is made up of 21 percent O₂ and 78 percent N₂, and diatomic molecular masses are 32 and 28, respectively. If you change the ratio to 16 percent O₂, the resultant mass per cubic metre reduces by approximately 25 percent. This changes the thermal capacity of the oxy-reduct air, so heat exchanger coils in CRACs or CRAHs have to be de-rated by 25 percent, or increased in surface area by 25 percent to maintain the same heat-transfer capacity.

There is another issue, which in part remedies itself: the server fans will be running 25 percent faster to control the internal temperature, but they won’t draw any more power as the air will be thinner by the same factor.

I think oxy-reduct offers huge operational and availability advantages, but the application has to be engineered carefully – as with everything in data centers.



Oxy-reduct offers huge operational advantages, but it has to be engineered carefully



Infrastructure as a Platform by Anixter

How do you define best practices in your data center?

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Anixter will review best practices for each of the building blocks that make up the Infrastructure as a Platform model in a series of Data Center Dynamics articles, technology reports and webinars throughout 2015.

Data centers are continually evolving to keep up with the growing needs for capacity, performance and uptime. At the same time, managers of data centers are also anticipating future needs and the impact those needs have on budgets. An agile data center allows you to plan and build with interoperable technologies that fulfill current demands, as well as scale as needed to meet future requirements.

Infrastructure as a Platform addresses the key building blocks for data center interoperability that can provide agility for budgets, scalability for demand and flexibility for technology choices.

Anixter will review best practices for each of the building blocks that make up the Infrastructure as a Platform model in a series of Data Center Dynamics articles, technology reports and webinars throughout 2015.

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- NETWORK MIGRATION
- POWER OPTIMIZATION
- THERMAL EFFICIENCY
- DATA CENTER INFRASTRUCTURE MANAGEMENT (DCIM) ENABLEMENT

Risk management

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- Outsider versus insider threats

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Learn More

- Visit anixter.com/datacenterdcd
- Read article in March, April issue of DCD
- Attend technology webinar - April 27
- Review Risk Management Report - April 13

Network migration

Interoperability is the foundation of a converged infrastructure platform that allows for better return on IT investments with upgrade flexibility and enhanced system longevity. In order to maximize interoperability, proper cabling architecture design and topology are critical to support a migration path for 10/40/100 gigabit network demands.

Learn More

- Visit anixter.com/datacenterdcd
- Read article in May, June issue of DCD
- Attend technology webinar - June 23
- Review Network Migration Report - June 8

Power optimization

When evaluating power distribution configurations, multiple factors such as efficiency, reliability, equipment availability, safety and cost must be considered. By developing an intelligent power chain that starts at the grid and flows through the IT cabinet, you can make sure those considerations are met.

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- Visit anixter.com/datacenterdcd
- Read article in July, August issue of DCD
- Attend technology webinar - July 28
- Review Power Optimization Report - July 13

Thermal efficiency

Selecting the appropriate cooling system for your environment it is essential to manage airflow to and from the IT equipment. Additionally, proactive monitoring will help to balance cooling with the demands of the IT load, improving efficiency, reducing costs and moving your data center towards a state of conditional environmental control.

Learn More

- Visit anixter.com/datacenterdcd
- Read article in September issue of DCD
- Attend technology webinar - October 27
- Review Thermal Efficiency Report - October 12

DCIM enablement

Intelligence gathered from data center infrastructure management (DCIM), along with a process to act on that knowledge, is vital to understanding:

- WHO is responsible for equipment
- WHAT the data center's operational status is
- WHERE equipment is physically located
- WHEN potential issues might arise
- HOW equipment is interconnected.

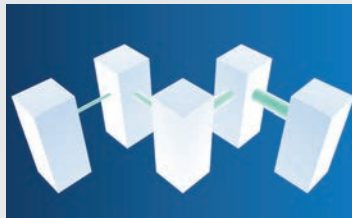
This enables you to plan, budget and respond faster in the event of an outage, improve ROI, and maximize the impact that a DCIM solution has on your environment.

Learn More

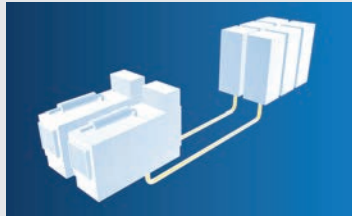
- Visit anixter.com/datacenterdcd
- Read article in November issue of DCD
- Attend technology webinar - November 24
- Review DCIM Enablement Report - November 9



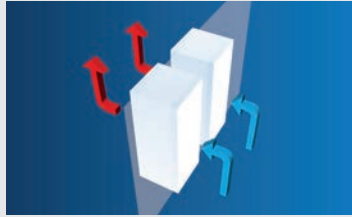
Risk Management



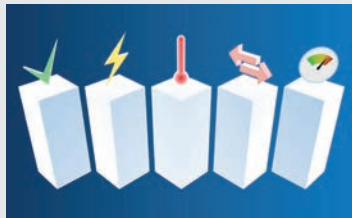
Network Migration



Power Optimization



Thermal Efficiency



DCIM Enablement

Bringing it together

Infrastructure as a Platform by Anixter not only addresses these five key technology areas, but it also integrates innovative solutions to meet your assessment and deployment needs.

Anixter's Data Center HealthCheckSM is designed to address common challenges that can reduce performance by examining energy consumption, convergence, integrated building systems, virtualized environments and increased bandwidth usage.

Anixter's site-specific deployment solutions allow you to more accurately plan projects and improve scheduling, reducing non-productive labor and on-site assembly challenges. Additionally, this can offer better operational and maintenance productivity, resulting in improving your data center's power consumption and meeting your company's sustainability commitments.

About Anixter

Anixter is a leading global supplier of communications and security products that helps its customers specify solutions and make informed purchasing decisions around technologies, applications and relevant standards. Throughout the world, Anixter provides innovative supply chain management solutions to reduce customers' total cost of production and implementation.

Follow Anixter's educational series this year as it covers the various building blocks of an agile, scalable and flexible data center. Contact your local Anixter representative or visit anixter.com/datacenter for more information.



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Watts Up?



Great power Great responsibility



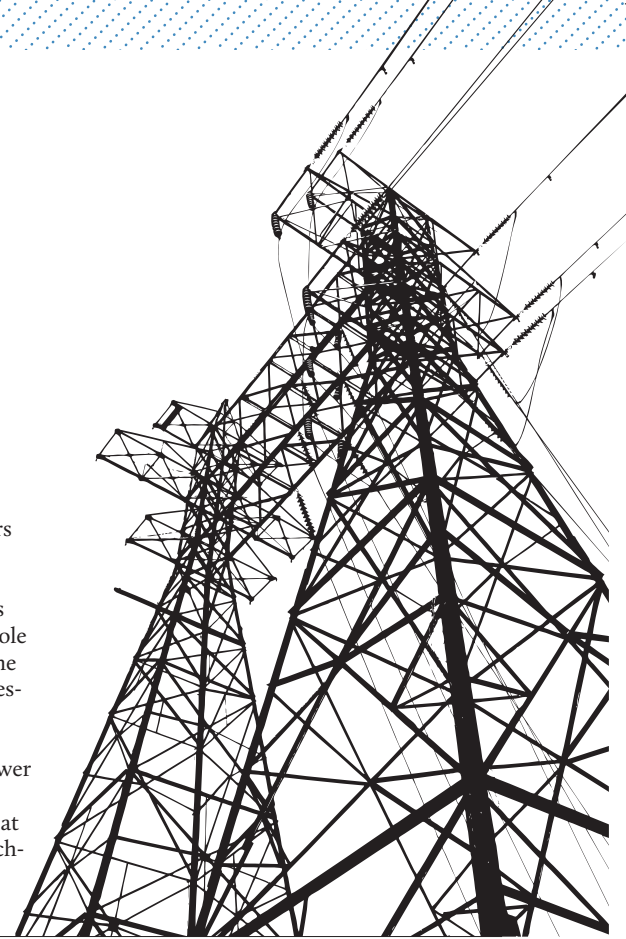
Bill Boyle
Global
Managing Editor
@BillBoyleDCD

Welcome to the first of our 2015 supplements. It is fitting that the subject is power because power, the continuous availability of which the advanced world takes for granted, is becoming problematic. In the UK we warn in these pages of imminent outages. In North America, energy worries are receding. In other parts of the world just attempting to run power to your data center can have the local community in revolt. We recently wrote about the protests which erupted in Northern Virginia,

USA where Amazon wants to build a data center, and protesters are objecting to the power lines it will need.

The cost of burying the cables would be enough to bury the whole project. That seems to be what the protesters actually want. The question is – can they afford it?

In conjunction with some industry experts we track the power trends that are going to affect us soon and Wendy Shuchart looks at the problems of data centers reaching their capacity ceilings. ●



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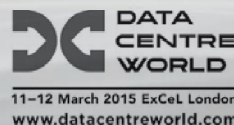
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Cash from your UPS

UK data center owners could earn money from their power management systems, under a scheme powered by an invention from startup Upside Energy.

The scheme helps companies take advantage of incentives offered by the UK National Grid, which pays companies not to use power at peak times. The UK's version of the Demand Response system has not been able to accommodate any but the largest power consumers, for logistical reasons, but Upside says its new management system could accommodate smaller companies and even home owners.

Under the scheme, companies would use the battery power of their UPS (uninterruptible power

supply) systems to power their entire business – including their IT and lighting. The switchover would be handled automatically by software supplied by Upside, which would also manage the metering of power and the claiming of rebates from the National Grid. By going off grid entirely for 15 minutes a day,

€75,000
EU funding
for Upside

even a small company with a few servers could earn a £150 rebate, according to Oakes.

Even data centers could join the scheme, claimed Oakes.

“Most data centers could go off grid for 15 mins at peak times every day right now,” said Oakes. Though for practical reasons this is unlikely – given the need for backup diesel and



questions over battery capacity – a smaller scale off grid session is definitely feasible, he argued.

“What could be done right now is take several data centers off grid for a couple of minutes apiece, on a rolling schedule, with data center A handing over to data center B, which in turn hands over to data center C, until between them all they get to the end of the 15 minutes,” said Oakes.

Upside is seeking to work with major UPS vendors and power management companies to roll out the service. Among the clients Upside is currently helping to be more green is

Greenpeace's London office. In April 2014, Greenpeace organized a series of demonstrations outside Twitter's HQ in San Francisco in protest at the social media company's consumption of power in its data centers. Now Greenpeace has admitted its own servers could be more power efficient, according to Oakes.

In 2014 Upside received a €75,000 from the EU funded Climate and Innovation Community and a further £180,000 from Innovate UK (the former UK government funded technology Strategies Board).

<http://bit.ly/1EMQjYK>

Ukrainian data center secures power supply

With Ukraine's power industry under threat, a data center in the industrial heartlands has moved to secure its electricity feed.

Parkovaya Data Centre in central Ukraine has bolstered the security of its power supply, by signing a deal with Ukraine-based UPS dealer Madek. The power management dealer has supplied a standby power solution consisting of two F G Wilson P1375E3 and four P1700P1 generator sets to the data center operator.

According to a report by analyst The Differ Group, Ukraine's electricity system is at high risk. While electricity demand is expected to double by 2030, outdated thermal production facilities and

higher fuel costs make the Ukrainian electricity system vulnerable.

The investors needed, meanwhile, are being put off by corruption, powerful oligarchs and political instability. With Ukraine's generation facilities only running at 38 per cent capacity (as a result of old, inefficient plants and poor transmission lines) a power management regime is vital to the survival of any data center in the region, according to Madek, which has supplied a backup power station with a total capacity of 9550 kVA.

Six synchronised generation sets were fitted in the data centre's engine room, in order to provide power in the increasing likelihood of a mains failure. Four P1700P1 units will provide emergency power for the data centre while the two P1375E3 units will supply power for common data centre infrastructure.

<http://bit.ly/1wy1H4C>



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Geist launches cloud-friendly PDU

Geist has a new set of power distribution units (PDUs) - suitable for cloud data centers operating a DevOps regime.

The R-series "next generation" PDUs integrate with software through Active Directory integration.

This should help the power strips support enterprise or other cloud environments where virtual machine loads are being moved within the data center.

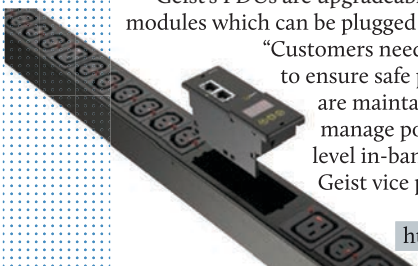
DevOps removes barriers between the development and operations parts of an organisation, with applications created in a virtual machine or container. Resources in the data center need to be powered up and down under software control.

Geist's product is managed through a RESTful (REpresentational State Transfer) Web API, using JSON (JavaScript Object Notation). Communications can be over IPv6, and use Secure Shell (SSH).

Geist's PDUs are upgradeable, featuring monitoring modules which can be plugged in and replaced.

"Customers need reporting and alerting to ensure safe power usage thresholds are maintained, and the ability to manage power outlets at the port level in-band and out-of-band," said Geist vice president Brad Wilson.

<http://bit.ly/1zPlu6M>



Cummins ships grid code compliant gensets

Cummins Power Generation has shipped generator sets compliant with the European grid codes. These codes are being introduced across Europe to help improve the stability of today's power grids, which have become reliant on renewable energy sources.

The code-compliant gensets are the result of 18 months of design and development by the Cummins plant in Manston, Kent, UK.

Compliance for generators that connect to the grid is a legal requirement in Germany where the first units were shipped, and other countries will follow suit. Independent test house DNV GL validated the Cummins' 60-litre and 91-litre lean-burn gas genset range as compliant with the requirements of Germany, France and Italy.

Transmission and distribution system operators in Europe are defining sets of rules that specify how grid-connected power sources must perform, including generator sets and their associated components. These rules, known as grid codes, require embedded generation schemes to stay connected to the grid during certain grid faults, unlike the traditional approach where generator sets could come off the grid.

In order to define the requirements, Cummins studied variations in the grid code requirements across various network operators and countries.

Its generator sets then underwent testing in parallel with the live UK National Grid, using a grid fault simulation device to create a localised fault. Results of the physical tests were then used to validate a mathematical model, which could predict the performance of any Cummins lean-burn gas-powered generator set in the event of a low-voltage grid fault.

<http://bit.ly/1JPQBis>

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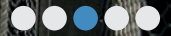


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Wire walking with power

Leo Craig, general manager at Riello UPS Ltd, explores the balancing act between dwindling power availability and higher data center power demand

There is no doubt that power supplies in the UK are dwindling year by year, but demand on the National Grid continues to grow. During the past three years alone, 15 power stations have been decommissioned but, worryingly, energy regulator Ofgem predicts that electricity demand will double by 2050. Clear pleas from industry state that billions of pounds worth of investment will be required to bolster the energy network infrastructure in the next five years to deal with these increases. Here, I explore the challenging energy landscape and the role of data centers in all of this, and examine new ways of integrating into the power grid and other technologies to help support this growing problem. ▶



► **Three years ago**, the UK's National Grid had 17 percent spare capacity. Last winter, it reduced to five percent, and this year it is down to four percent. This decline in energy reserves creates an increased risk of blackouts and further strain on the stability of the National Grid as it looks to switch between the grid and renewables. The UK's target of 15 percent of final energy consumption from renewable sources by 2020 may prove to be ambitious. With the closure of power stations, additional power generation is needed, and although an extension to Hinkley Point Power Station in Somerset is likely to go ahead, it won't be operational for at least 10 years. So, before this, we have 10 years of declining energy reserves, and the impact is bound to affect businesses across the UK.



The date when European energy management directives will come into force is approaching faster than we think

Recent reports found that data center/IT professionals see the reliability of power in the UK as

a 'major concern'. Now is the time for them to take responsibility and work with the National Grid: first, by ensuring the data center is running as efficiently as possible and not drawing as much energy from the National Grid; and second, data centers can actually help at times of peak demand by using their standby generators and going off grid.

More data centers will take up 'triad' or 'smart' contracts with Distribution Network Operators (DNOs). When demand from the grid is high, instead of cutting power from a facility without warning, the DNO asks the data center to remove itself from the grid and use generators instead.

The only problem with this is that the stand-by generators are run using fossil fuels, thereby increasing carbon emissions, which is the very reason so many power stations have closed.

With Lithium Ion (Li-Ion) batteries the UPS can become an energy accumulator, so the data center can use stored power during

times of peak demand. Li-ion batteries last longer (10,000 cycles compared with valve-regulated lead acid batteries at 500 cycles) and are 50 percent smaller than VRLA batteries. They also recharge faster, so they are better for energy storage applications.

Traditionally, the UPS has only been used on critical loads within the data center, with other services such as air-handling relying on a generator for emergency power.

The UPS must continue to use 'online operation' mode to support the critical loads against micro breaks and spikes. These will increase as renewable energy sources such as wind and solar cause more grid switching.

But a UPS and Li-ion batteries could support other services, in 'offline' or emergency

standby mode. This means the UPS is running at 99.5 percent efficiency and acting as an energy accumulator and can be used in power outages. If the data center is working on a smart grid contract, it can take itself offline without using its standby generators. Li-ion batteries can store enough energy for 30 to 60 minutes without having to run the generator.

Greater consideration around data center design will go some way in future-proofing facilities from any changes to the aging power distribution network. There is a growing trend in modular design, which offers the maximum in availability, scalability, reliability and serviceability while also offering high efficiency, low cost of ownership and a high power density, as space is always at a premium. Modular topology allows for flexibility and ease for expansion in data centers of all sizes.

European directives on energy management are coming into force sooner than we think, with 2016

the year when key legislation is expected. This will force businesses to undergo an energy audit to ensure they are doing their part to reduce power consumption. The European Commission has created a code of conduct for energy efficiency in a data center, which details measures for data centers to consider the environmental impact of their operations. These are voluntary at the moment, but are expected to form the basis of more stringent legislation in future.

With a continued reliance on the internet and vast amounts of data out there, it is clear there will be more demand placed on data centers. This reliance on data centers means the UPS will continue to play a vital role in the power chain, but the role will go beyond simply backup power and focus on the additional benefits to businesses. With no significant new generating capacity for the National Grid over the next 10 years, businesses need to consider how they can manage and protect the power to data centers in the future, while also helping the UK meet its carbon-reduction targets. ●

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The Big Issue



Energy efficiency gains are harder to achieve with the move towards hyperscale data centers. Bill Boyle discusses the 'bigger is better' trend with Perry Field, general manager

Data center designers are increasingly adopting the maxim that bigger is better. Driven to a large extent by the shift towards colocation, hyperscale data centers are becoming more common. As data centers have grown larger, they have also grown more generic and their product has become more of a commodity.

Today, data-buying decisions—once the required availability level is defined—basically come down to price, and the prime target in driving that price as low as possible is energy. Considering the amount of power consumed, and the fact that energy is typically the largest controllable cost, data center managers are eager to squeeze every possible percent out of their electricity costs.

In the quest to reduce energy consumption, uninterruptible power supply (UPS) systems are an area of intense interest, and new technology and operating procedures are showing promise.

Eco-mode is a UPS energy-saving feature, whereby the load is supplied via a static bypass line. In the past, this solution has mostly gone unused because the cost-benefit equation has not been sufficient to warrant the increased

risk. A normal double-conversion UPS converts the input AC to DC. The batteries are connected to the DC source to provide continuous charging, and then the DC is inverted back to AC to power the servers. Power loss occurs during those conversions. In eco-mode, the bypass path connects the input AC directly to the output AC.

"There are several reasons operators are more likely to use eco-mode today," says Perry Field, general manager for ABB Power Conditioning. "First is improved technology, both in the UPS and in the servers they power. UPS technology has improved to a level where operators are more confident that, during a power event, the UPS will transparently compensate. On the server side, the built-in ride through capability is well proven, reducing operator concerns about protecting power-related events." Another factor is that power outages are less frequent in the typical hypercenter than in smaller facilities. Larger facilities tend to be connected to transmission-level mains, where long outages are infrequent.

In the past, the one or two percent energy savings delivered by eco-mode were not worth the risk. But technology improvements have improved the risk profile and, in the ultra-competitive hyperscale market, saving one percent in energy costs provides a desirable advantage. ▶

► **Often there is more** talk than action in the area of reusable and renewable energy, but there is little doubt that both will become increasingly important sources of efficiency and reliability in the years ahead. Here, the mantra of “reduce, reuse, recycle” may be appropriate.

There are various strategies being considered to reduce the heat generated in a data center. One is the use of DC voltage to power servers. The AC-to-DC transformer in each server is a major heat generator, but by eliminating the transformer, you can greatly reduce the heat.

Widespread adoption of this approach is unlikely in the short term; in the meantime, operators are looking for ways to reuse and recycle that heat.

While some data center construction occurs in relatively remote areas in order to take advantage of low land/space costs, other projects take the opposite approach, locating their centers in urban areas. In this scenario, the heat generated from the servers can be used to warm adjacent buildings. These centers also have the benefit of proximity to major data trunks.

Many data center operators are closely investigating renewable energy. This offers the potential for lower-cost energy and provides an alternative to the grid in areas where reliability is an issue. Of course, renewables have their own reliability issues. The wind may not blow and the sun may not shine, or they may do so at times when power is not really needed.

“To realize the benefits of renewables while overcoming their limitations,” Field explains, “data centers can rely on a microgrid approach that combines multiple resources such as the grid, diesel generation and renewables. It is no simple task, but it is being done successfully, mainly in remote communities or industrial facilities, where grid-delivered power is particularly expensive or unreliable.”

Technology is available today to successfully address issues related to the shifting power flows that occur in microgrids. Energy storage converters can deliver power when needed and absorb power when the renewables produce more than is currently required.

“Because of the complexity of microgrids, most data centers are better off simply identifying a low-cost power source from the local utility,” Field observes. “However, in places where there are constraints on power sources, or that do not have access to reliable electricity, people are investigating these alternatives. As technology evolves to further simplify microgrid management, you will see data centers increasingly embrace the concept.”

Technology does not always scale up well. The low voltage (<480 V) systems used in data centers provide a good example. Enterprise-scale centers are well-suited to utilizing low voltage power. As centers grow, though, the drawbacks of low voltage begin to add inefficiency, and increase both capital and operations costs.

The capital costs of a low voltage system are higher because they require large conductors, big switchboards and multiple circuit breakers. Maintaining all these devices increases ongoing maintenance costs. Medium voltage systems, on the other hand, provide a more centralized approach. While a low voltage system may have 10 UPS units at a lower power rating, a medium voltage system may have only two or three.

“As the current in a medium voltage system is lower, the efficiency of the whole system is extremely high. Our medium voltage UPS products provide 99.5 percent efficiency compared with the very best double-conversion, low voltage UPS systems that are in the 96 to 97 percent range. The comfort level that operators have with traditional, low voltage systems means that adoption of medium voltage topology is likely to be slow. However, as industry leaders begin to make the transition, the move to medium voltage is a trend we expect will accelerate,” says Field.

Medium voltage systems will provide benefits in very large data centers, but the benefits can extend down to smaller installations in the 5 to 10 MW region as well.

In many industries, trying to predict trends is difficult. But in the data center market, some trends are easily identified. One such trend is that, for the foreseeable future, more processing will be done in hypercenters, and these massive warehouses of computing power will seek solutions that reduce costs and give price advantages. Increased energy efficiency through new technology, including more advanced UPS systems and medium voltage topology, provides a promising path to greater efficiency.

“Manufacturers will continue to respond to customer demand for further technology improvements, leading to even greater enhancements in energy efficiency and power quality,” Field predicts. “Technology advancements, combined with the willingness of data center operators to explore new approaches to energy management, will drive continued operational innovation and efficiency.”

As data centers grow, the drawbacks of low voltage begin to add inefficiency



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Watts up?

Will rack power density keep increasing?
Wendy Schuchart thinks most data center operators have other priorities



5 Kw
per rack
power density
for ever?

If you were to peek inside the average data center, most enterprises have one thing in common - the infrastructure manager probably maintains about 5kW per rack capacity in 2015. So, how is that going to change?

Most data centers will hit a capacity ceiling in the next five years, and approximately a third (36 percent) will hit that high mark in less than two years, according to the Fall 2014 Data Center User's Group Survey conducted by Emerson Network Power. A lot of that computational projection comes from the current rack capacity, so how many kilowatts per rack will data centers be using in the next five years?

"As is often the case, there isn't a simple answer," says Richard Villars, vice president of data center and cloud at Cambridge, Massachusetts-based International Data Corporation (IDC).

Villars isn't being evasive. It turns out, experts can't really agree, not even on the kind of operations running averages of more than 5kW per rack in their data center today, much less in five years. In short, it depends on whether you're grounded in a tight budget or have the robust infrastructure demands akin to that of a cloud provider.

"The power density of new and existing data centers varies widely depending on location, size, workload, operational styles of the owners, and the experience and skills of the designers, but there are some common factors and general patterns that are useful," says Richard Fichera, vice president and principal analyst of infrastructure and operations at Framingham, Massachusetts-based Forrester Research.

"When we speak to most enterprises, as well as hosting/collocation companies targeting them, the standard for average power consumption remains in the 4 to 6kW range. This is partly because few are engaging in wholesale IT swap outs. They have a mix of old and new, and appear to want consistency," Villars says.

Others take a slightly more conservative approach. "For enterprise data centers, the average power per rack in the white space will remain in the 3 to 5kW range for the next 10 years at least," says John R Laban, a London-based data center technology consultant.

Lest you take that solid 5kW as gospel, Laban may be simplifying the zeitgeist of data centers a wee bit. "Enterprise data centers (in-house or colo) are running at 3 to 5kW per rack on average. For racks containing only blades or converged infrastructure, you will see higher densities up to 10 to 12kW per rack, but that tends to be a small portion of the environment (for the average enterprise)," says Sophia Vargas, Forrester data center infrastructure analyst.

We kept hearing that colo providers and cloud providers were stacking heavy, so we decided to check in with one to find out (see Box).

Assuming we wanted to build the perfectly optimized data center, what would we need to do? "With the high-density systems available today, it's quite easy to exceed 15kW, or even 20kW, in a 42-rack unit (ru) rack," says Steven G Hill, senior analyst in data center solutions at Current Analysis in Sterling, Virginia. Hill looked at the base numbers and pushed converged infrastructure projections even further.

"For example, a 6-ru blade system can consume 6kW alone, which averages to 1kW/ru. Even a rack filled with standard density 1-ru servers that average about 500w/ru would run over 20kW per rack, so imagining a data center that averages between 12-15kW/rack isn't out of the realm of possibility," says Hill.

Ultimately, imagining the realm of possibility and realizing the realities is a wide delta. It all comes down to the situation.

"If you took the average of all existing data centers in the world, 5kW per rack is probably reasonable - there are a lot of older data



The sexy new data centers of Amazon and Google won't align with the data center down the street

Wendy Schuchart

centers under 5kW and a lot of newer ones that exceed that number by large margins. As far as new data center space, from what I have seen it is commonly built in the region of 8 to 10kW per rack, because one of the most common wiring schemes delivers approximately 9kW per rack. However, the density of the data center is heavily influenced by the intended use and loads, and by the fact that there is a 'sweet spot' in costs, with costs rising rapidly as density starts to go beyond 10kW per rack," says Fichera.

Vargas cited diminishing returns of cooling efficiency as racks exceed 10kW, and Parks has real-world experience to draw from at Datapipe's data centers. "We have found that going above 8.5kW tends to create a challenge in supplying enough cooling air to justify that type of density. In other words, we would simply lead the client to take another rack to spread out the heat load instead of increasing a rack's density above 8.5kW. Above this number requires in-rack or in-row cooling techniques. Those tend to make the cost analysis not work favorably for the client versus just spreading the heat load out a bit."

It's not just the cooling problems that data center operators must contend with, there's also the more science-fiction elements of converging that much raw power into a single geographical area.

"One of the key reasons why the mega cloud folks are resisting is that when one starts concentrating power in large complexes (as opposed to more limited HPC sites), there is an electrical effect that is the bane of the electric utility industry," says IDC's Villars. "Think of it as spontaneous, random static discharge, supersized. If you want a good visual, review the scene from [the perspective of the film] *The Matrix*, where Neo looks over the edge of his 'pod' and sees lightning arcing up and down all the towers. Unlike utilities, most DC operators don't really want to 'train' for such phenomena."

When it comes down to improvements, the sexy new data centers of the Amazons and

Googles of the world just aren't going to align with what we see in the data center down the street. Most CIOs simply don't have the budget to make the kind of agile jumps that would increase rack capacity significantly. And while it works on paper, it's unlikely we'll see significant improvements in overall rack capacity greater than 5kW on average in the next five years.

"You must remember that working on electrical systems often means shutting off power and/or incurring major risk around power failover between phases. For most organisations this is untenable," says Greg Ferro, London-based network engineer and architect. "Data centers today have their existing electrical systems built around 5 to 7.5kW per rack, and unless a major refit or data center migration occurs there is insufficient reason to go through the pain of upgrading and modification."

Data center operators agree that

we no longer need to put on a sweater before venturing into the cold aisle.

Industry standards are raising the thermostat on cold aisles, while still preserving fragile hardware.

"Many of our clients still believe the data center should feel like a meat locker when we take them on tours. That is old school and does not match the proven trends that dictate running the data center into the 80F+ [26C+] degree band that allows servers to run just fine and saves the data center operator large amounts of OpEx. And it's naturally green to boot," says Parks.

Whether optimization drives the average kW higher per rack, or whether the temperature experts can agree on any one thing, there's never a dull moment in the data center arena.

But the interesting thing is that while market forecasters may be getting hot under the collar, the efforts of actual operators on the ground are keeping things in line. We'd bet that in future operating and management skills will keep the data center's power needs under control ●

Checking with the real world

How heavy are the colocation players stacking, and how solid is the demand for 5kW power?

The only way to know for sure is to talk to an actual player. We went to cloud solutions provider Datapipe.

"Our rack standard provides for 5kW a rack. The vast majority of our white space

is set up in this manner," says Mike Parks, chief data center officer at Datapipe. This is a pretty good guess at the actual requirements, since Datapipe has operations spanning the globe. "A small portion of our racks use three-phase 208VAC power providing 8.5kW per rack. These racks support our four-

blade chassis, very dense type clients."

Of course, that doesn't rule out change in the future. As Parks explains, modern equipment is more forgiving of high temperatures, allowing the temperature to go up.

This could also allow higher power densities in the aisles.

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Keeping the chocolates cool

Celia Villarrubia takes a look at Nestlé's consolidated data center in Mexico City



Celia Villarrubia
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With some 15 factories, 16 distribution centers and more than 80 brands in Mexico, Nestlé has a tough job managing energy efficiency across all its activities. Even the job of improving IT operations is a tough one. To make its IT more efficient, the company opened a new data center in 2014, which will absorb all its local facilities.

This facility has two key requirements: high availability and high energy efficiency. Nestlé says that by using efficient cooling and power systems, monitoring and high scalability and modularity, it is saving between 30 percent and 50 percent of the energy used by a traditional system.

For the new data center, Nestlé worked with Schneider Electric through its channel partner Crevi Communications. Alberto Llavot, a Mexico-based Schneider systems engineer, estimates its design PUE at 1.64.

In February last year, Nestlé opened its new HQ in Mexico City, in a building that contains a 640 sq ft data center that now holds pretty much all the company's local IT facilities. The project started in late 2013 and was completed within six months. After half a year's operation, data center managers are now getting the first infrastructure performance reports from the center's monitoring systems, based around Schneider's StruxureWare software.

The facility has 16 cabinets with a density of between 3.5kW and 4kW

per rack. As best practice demands, 65 percent of the front and rear rack surfaces are open to allow optimum cooling.

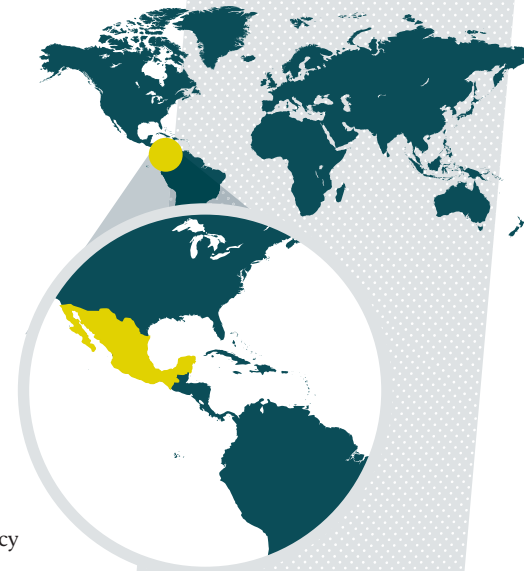
The company has increased efficiency by using in-row water cooling, with direct expansion using eight systems each providing up to 10kW cooling capacity. This is arranged in an N+1 scheme and optimized with a system of hot-aisle containment.

The in-row systems have sensors that measure the temperature of air entering the cabinet, so cooling capacity can be adjusted to the level needed by the racks. There is a generator to support the data center power architecture, along with a system of modular and scalable UPS devices. Initial installation can supply 60kW, but this may be increased in 10kW modules if Nestlé grows.

The data center also includes modular PDUs with isolation transformers, which can identify the energy consumption of each individual cabinet. "To pursue efficiency, Nestlé requires a centralized system to have control of the infrastructure monitoring," Llavot explains. It uses a DCIM solution with three levels of coverage.

The basic level monitors devices across the network cards in each machine, while the second level monitors temperature, humidity, dew point, opening doors and spilled liquids using sensors distributed throughout the data center. Nestlé opted for the third level, in which the two previous levels report to a single platform for centralized monitoring from a screen so the data center can be operated in real time. In this way, Nestlé can detect if all systems are operating within established ranges.

Using virtualization and server consolidation, Nestlé should be able to support an increased load level to meet its technology needs for the next 10 years, without having to grow its infrastructure. ●



Nestlé's new data center

- 16 cabinets
- 3.5kW to 4kW density per rack
- 65% open-rack surface
- In-row water cooling
- 10kW cooling capacity
- N+1 scheme

To pursue efficiency, Nestlé requires a centralized system to have complete control of the infrastructure monitoring

GLOBAL DATA CENTER MARKET TRENDS REPORT 2014–2015

DCD Intelligence's Global Data Center Market Trends report for 2014–2015 provides a comprehensive overview of the current state and future development of the global data center industry. The report is based on the findings of DatacenterDynamics' Industry Census survey.

WHAT'S IN IT?

The report provides a wealth of information on industry trends and market statistics such as data center white space, power demand, outsourcing and investment in new technologies. The data is presented on a regional, country and industry vertical level.

The report includes:

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- Market by market analysis
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Novartis Mexico consolidates its server pharm

Modular data center allows pharmaceutical firm to grow



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Swiss pharmaceutical group Novartis is consolidating all its IT in Latin America into a new Tier III data center in Mexico, capable of hosting applications for customers across the region. “Prior to the development of the new data center in Mexico, we had a Tier III data center that prevented the growth of the company,” says Ivan Breton, physical data center administrator for Novartis in Mexico. The old site had insufficient features to support the compliance Novartis needed.

Novartis is a \$57bn pharmaceutical giant, formed in 1996 after the merger of Ciba-Geigy and Sandoz. In Latin America, it decided on Mexico as the best strategic location to consolidate its IT business, including the Sandoz and Novartis Animal Health divisions, and central functions such as human resources.

The effort won Novartis’s IT team a prize in the 2014 LATAM IT Awards, and it was also a finalist in the *DatacenterDynamics* LATAM Awards 2014 for Innovation in the Medium Data Center.

The new Novartis data center is modular, flexible and expandable, with a total planning capacity of five rows of racks that can be redeployed to make the best use of resources.

After consolidating services and servers, the server farm was reduced by 30 percent. The servers currently

occupy only two rows, containing more than 60 active servers, which is about 35 percent of the total capacity, says Breton, adding: “Obviously, the idea is to grow.”

The new data center is in a former storehouse on a Novartis campus in Churubusco, Mexico City. There is restricted access through a controlled entrance hall, and the data center itself

also has a network operations center, as well as storage and staging areas.

The total area of 572 square metres includes 120 sq m of white space. The power capacity of 228kVA / 230kW represents about 60 percent of the power consumed by the old data center.

Novartis used a partner to design and install the new center and transfer IT equipment from the old sites. “An external provider manages the total operation of the servers,” Breton confirmed, including managing backups. Novartis hasn’t named this provider.

The data center uses advanced technologies for environmental protection. These include controlled lighting with movement detection, in-row cooling and fire-detection and suppression systems. The fire-detection system is an important innovation; it monitors and analyzes the circulating air in the whole site and has controls installed in every area of the data center. “This allows us to identify the type of alarm,” says Breton.

The suppression system uses Ecaro-25 (pentafluoroethane), which can inhibit fire without harming humans or damaging the ozone layer. There is a separate tank of the agent for each area of the data center.

The racks are arranged with hot and cold aisles confined by screens, so cooling can be concentrated row by row.

“Previously, there was no confinement. The cooling equipment worked at full capacity, and the whole room felt cold,” says Breton. “With the screens in place, we have reduced consumption and obtained great savings.”

For the next year, Novartis plans to concentrate more services from its local divisions, build a virtualized environment, and move to new cooling technologies, including complete aisle confinement. Alternatively, Novartis could duplicate its existing scheme and add two new chillers and more equipment in-row. ●



Novartis Mexico in numbers

- 572 square metres
- 120 square metres of white space
- 228kVA
- 5 rows
- 60% energy savings

We had a Tier III data center that prevented the growth of the company



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Orchestral Manoeuvres in the cloud

The software defined data center will offer the capabilities enterprises need in the cloud. *Hawkins Hua*, DCDi analyst, investigates the new conductor

As IT infrastructure and operations have become more complex, technologies such as cloud and virtualization have been implemented to adapt to various business needs. Over the past decade, server virtualization has redefined the deployment, management and optimization of computing resources, transforming the data center into a more adaptable and efficient platform for business applications. Application loads that once ran on static, dedicated servers are now hosted in dynamic, virtualized server environments that can be scaled and shaped on demand.

While virtualization reshapes data center operations, enabling enterprises to deploy affordable, rack-based servers that can be pooled and allocated to shifting application demands, the transformation is incomplete. Network and storage assets in data centers remain tightly siloed and statically configured. Few facilities are capable of automating and orchestrating the management of pooled network and storage hardware.

The software defined data center (SDDC) claims to change that. It is described by VMware as “a unified data center platform that provides unprecedented automation, flexibility and efficiency to transform the way IT is delivered. Compute, storage, networking, security and availability services are pooled, aggregated and delivered as software, and managed by intelligent, policy-driven software.”

Building on what virtualization has applied for servers, SDDC will be able to virtualize network and storage resources to enable an abstracted data center infrastructure that can be managed and

accessed by software and applications. The goal of SDDC is to deliver benefits in many facets of data center operations: more efficient use of resources; easier provisioning and reallocation; and faster deployment of new applications.

Ultimately, SDDC will eliminate the need for IT technicians to manipulate siloed server, network and storage hardware in response to a provisioning request. Rather, provisioning takes place automatically within the framework of defined rules, policies and service-level agreements (SLAs), passed via application programming interface (API) calls to the automation and orchestration engine that configures the appropriate resources from a pooled environment.

Because of the increase in dynamic resource allocation, enhanced power and cooling infrastructure are required to support the scalable demands of data centers. Power and cooling play an important role in making the SDDC vision real. While IT resources have been virtualized with a layer of abstraction, very little such abstraction exists in the data center facility itself. Even in facilities with a building management system (BMS) or data center infrastructure management (DCIM) system, the extent to which power and cooling have been abstracted is often insufficient to achieve the full benefits possible with SDDC.

For data centers, facilities equipment plays a critical role in ▶

Compute, storage, networking, security and services are pooled and managed

► ensuring that SLAs are aligned and met. Data center operators, therefore, have to develop integrated and adaptable power and cooling solutions that are in line with planned and provisioned infrastructure capacity.

Theoretically, numerous VMs can be deployed with the virtual layer of abstraction, but the amount of power and cooling available in any data center is finite. Therefore, data centers have to optimize power usage, and operators must redefine key integration touch points of data centers, and build management systems, infrastructure management and monitoring systems.

To fulfill the future promise of SDDC, the addition of software-defined power is needed. The potential of software-defined power can be reached if the industry arrives at a consensus on a solution with reference architecture and common standards.

This will help provide power to data centers based on demand consumption, rather than planning and provisioning the power and cooling requirements based on pre-existing knowledge of peak systems usage.

More than half of all application downtime today is caused by power problems. Including power and cooling as software-defined elements in the application environment therefore makes it possible to improve availability by fully abstracting applications from all physical resources within the data center.

SDDC would start with a pool of complex, industry-standard hardware that can be portioned out dynamically and defined by software rules and limits. It brings together the cloud infrastructure characteristics that are critical for success:

- 1 Standardization:** Standardized hardware creates efficiencies with the resource pools. Creating an environment based on standardized hardware removes unnecessary complexity within the data center dynamic.
- 2 Holistic:** Cloud infrastructure is designed to support any and all workloads, and to do so in the most optimized way possible across the entire data center.
- 3 Adaptive:** Cloud infrastructure must be dynamic in its ability to adapt to changes in the resource workload. This adaptability should be automated and built on defined configurations and according to the demands of the applications it runs.
- 4 Automated:** Automation is the hallmark of quality cloud infrastructure. When using software to define the data center space, the framework must have built-in intelligences to eliminate complexity and create elastic computing without needing direct human guidance.
- 5 Resilient:** SDDC must be able to compensate for hardware and software failure. Coupled with automation and adaptability, the network should be automated in its approach to adapt to possible problems and continue with the highest level of availability.

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by a plethora of management tools and infrastructure software. But, rather than by adopting a complex new architecture, it is probably better to address such a situation by consolidating to a smaller number of packages and suppliers.

There are also movements away from the need to have all systems built with virtualized x86 machines, such as the docker and container-based approaches, IBM's Watson and little-endian Power servers for Linux, HP's The Machine, etc. The industry should also look at the development of application program interface (API)-defined and catalog-defined approaches.

The cloud can be viewed as a marketing term for application, platform or infrastructure services that internal or external customers procure on demand through web forms. By contrast, the software-defined data center is the mechanism through which cloud services can be delivered most efficiently.

The long-term vision is to transform IT into a service that can be provided to end-users/consumers. Currently, the best way to achieve that vision is through cloud computing models such as Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). Technologies like SDDC strengthen the ability to achieve that long-term vision by enabling IT models like cloud computing. ●

In recent years, IT systems in data centers have gone through a series of dynamic shifts. There has always been competition between the hardware, software and services suppliers in defining systems. For example, network function virtualization (NFV) is being used to target Huawei and Ericsson in the telecoms sector, while SDN and Open Flow are used to challenge Cisco's Enterprise Network dominance. Similarly, SDS is used against EMC and others with a large proprietary storage array business. Cloud services play the same role as the data center outsourcers to take away the need to build systems at all.

It is important to remember that 'standard' does not mean 'open', and that all data center software has to be run on some sort of hardware. VMware and Microsoft virtualization software is proprietary, as are IBM SVC and NetApp OnTap in storage. Also (almost by definition) Open Stack, Open Flow and other Open Source initiatives remain a work-in-progress.

It is wrong to assume that all applications ought to run in virtual machines, that it's always best to separate the control and data planes, or that what everyone wants is a system design that can do anything elastically at any time? IT investments are always spasmodic and form different technology layers in most data centers. In addition, it is not easy to adopt a full transformation

'Standard' does not mean 'Open'. All data center software has to run on some sort of hardware

strategy. For example, a company adopting Cisco's Application Centric Infrastructure (ACI) will have to buy a lot of Nexus switches in order to achieve SDN since it will only run on them.

If 'software defined' approaches are viewed as part of the battle between hardware and software suppliers, then it can be argued that VMware has won in x86 server virtualization and Amazon Web Services has won in IaaS. However, the jury is still out in the storage and networking realms. It is true that most data centers are characterized



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Mentor Graphics Corporation (MGC) consolidate several data centers into a larger data center to improve efficiency and growing demand.

This new, state-of-the-art data center was constructed at the company headquarters located in Wilsonville, Oregon, roughly 18 miles south of downtown Portland.

With their many data centers in operation around the world, MGC facilities engineers had experience with a variety of energy efficient design strategies. The engineers knew they needed to focus on three key aspects of the design to maximize efficiency and minimize cost in relation to the heat rejection aspect of the design: fan energy, hot-aisle containment and minimization of refrigeration cooling.

“In the past, the airflow and temperature requirements of data center cooling equipment were similar to air-conditioning equipment, so air-conditioning was the discipline chosen to fill the need. Today the needs of servers are very different from the needs of people, so air-conditioning equipment struggles to operate correctly in a data center environment.” said John Wozniak, MGC’s Critical Infrastructure Technician. “While the temperature requirement of the ‘intake’ of servers is currently similar to the ‘intake’ of humans, the exhaust temperatures from servers is radically different (much hotter). The approach we took was to implement a design tailored around servers, but also comfortable for humans. Since we could not find precedent for this approach, we relied heavily on Mentor Graphics’ FloVENT® computational fluid dynamics (CFD) modeling software to validate the design.”

Munters’ Oasis™ air-handlers selected for the project operate using the principle of Indirect Air-Side Economization (IASE), where outdoor air is used to reject heat from a recirculating data center airstream by way of an air-to-air heat exchanger. With this approach there are two completely separate airstreams. With IASE systems, only a small amount of make-up air, as required for



proper ventilation and space pressurization, is introduced into the data hall. Since the cooling units simply extract heat from a recirculating airstream, they do not impact room humidity levels and risk of ambient pollutants impacting the servers is greatly mitigated compared to direct air-side economizer designs.

The Oasis units were customized to provide optimal efficiency of fans and heat rejection components. For the recirculating (supply) airstream, a fan array using direct drive plenum fans was selected with EC motors (variable speed), each with an inlet back-draft damper. The fan array was configured to provide N+1 redundancy at the fan level.

The air-handlers were delivered on site in July 2012 and commissioned shortly after. Designed to meet a seismic importance factor of $I_p=1.5$, they are anchored to concrete roof curbs. During the first year of operation the system maintained server inlet temperatures throughout the room within $\pm 1^\circ\text{F}$. The operating efficiencies have exceeded Mentor Graphics expectations, especially

in the early stages of operation when data centers are typically least efficient. At the outset the team’s initial target was for 5,000 hours per year (57%) of economizer cooling using no compressors but actually achieved nearly 8,000 hours (>90%) during the first year of operation.

“The result of using this quality equipment and the detailed design process has allowed us to be efficient on day one, and from this point on we are saving money, energy, and everything is working correctly.” said Wozniak.

Download the full case study at:
munters.com/mentorgraphics



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HERE IS THE FULL LIST OF WINNERS:

Future Thinking & Design Concepts -
Equinix Cloud Exchange

Data Center Blueprints -
The UK's academic network Janet/JISC by Infinity SDC

Innovation in the Micro-Data Center -
Summus, Spain

Innovation in the Medium-Data Center
Leicester Council, Workspace Technology

Innovation in the Mega-Data Center -
Infinity's Janet/JISC data center

Leadership in the Public Sector -
Leicester City Council UK / Workspace Technology

Innovations in Outsourcing -
Equinix Cloud Exchange

The 'Green' Data Center -
Portugal Telecom, Covilha

Improved Data Center Energy Efficiency -
Virgin Media, Project Red to Green

Innovation in IT Optimization -
The National Bank of Abu Dhabi

Modular Deployment of the Year -
Green Mountain, Norway

Young Mission Critical Engineer of the Year - James Rowse, Red Engineering

Data Center 'Special Assignment' Team of the Year - Facebook, Lulea

Business Leader of the Year - Simon Segars, ARM Holdings

Outstanding Contribution to the Industry - Paolo Bertoldi European Commission

EMEA Awards Winners party

The brightest and best of the data center industry gather in London to get the recognition they deserve

The winners of the DatacenterDynamics EMEA Awards were announced, at a glittering dinner at London's Lancaster Hotel in December 2014.

From a mightily impressive shortlist DCD's expert judges winnowed a list of the leaders of the datacenter world in EMEA, and the industry showed up to applaud their decision. The task was harder than ever this year, reflecting the pace and competition of a datacenter market which is rapidly growing right across the region.

Portugal Telecom's Covilha facility won the Green data center award, while Infinity SDC won two prizes for the UK's Janet/JISC academic network data center, that mixes densities of 3kW to 30kW in the same hall.

From Spain, Summus won for a 3D rendering facility which recycles waste heat in surrounding offices. And in Leicester UK, Workspace Technology moved council IT

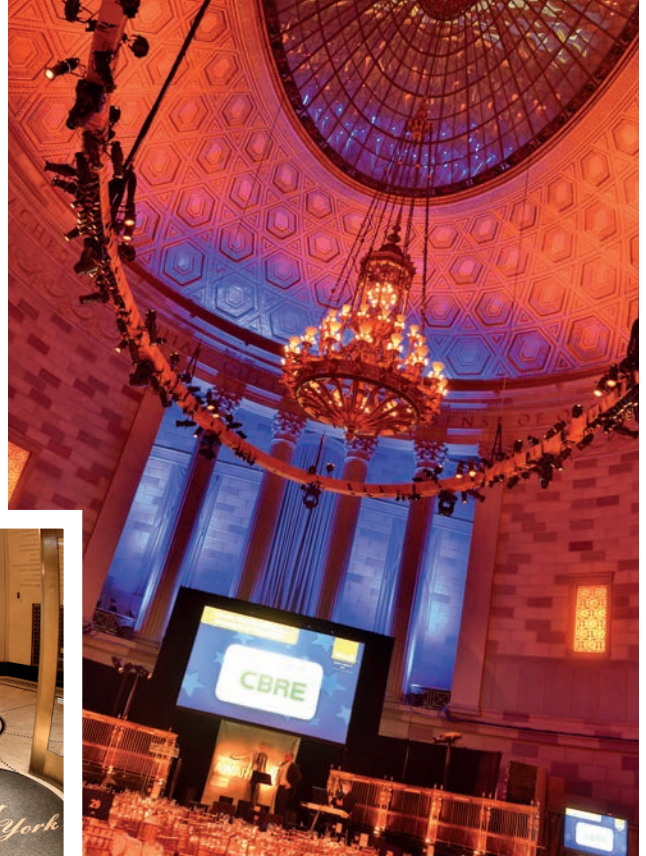
resources from an obsolete building to a new carbon-neutral facility with a PUE of less than 1.1.

Virgin Media's Project Red to Green caught attention by applying best practices, while the National Bank of Abu Dhabi shrank its rack space by 40 percent and switched off CRAC units.

Meanwhile in Norway, Green Mountain built an award-winning modular site despite temperatures as low as -17C. And nearby in Sweden, Facebook's efforts in Lulea earned them a Special Assignment award.

James Rowse of Red Engineering is our Young Mission Critical Engineer, while by contrast, veteran Simon Segars got Business Leader of the Year for his efforts at ARM Holdings.

Finally, Paolo Bertoldi was a popular winner of the Outstanding Contribution award, having steered the European Commission's data center work since 1986. ●



HERE IS THE FULL LIST OF WINNERS:

Future Thinking & Design Concepts -

Siemens, Not all Low Voltage Switchgear is Created Equal: The must-have option for every Switchgear

Data Center Blueprints -

Sabey Data Centers, Intergate Manhattan

Innovation in the Medium Data Center -

Digital Realty, ARM Holdings North American High Performance Center

Innovation in the Mega Data Center -

Oracle, Breakthrough Innovations in Large Data Center in Cold Climate

Innovation in the Outsourced Environment -

CyrusOne, CyrusOne National IX

The Green Data Center -

Digital Realty, ARM Holdings North American High Performance Center

Improved Data Center Energy Efficiency -

Yahoo, Quincy Data Center Air Flow Optimization Project

Innovation in IT Optimization -

Fidelity Investments, Achieving IT scale that passes value onto the customer

Young Mission Critical Engineer of the Year -

Dropbox, David Fiedler

Data Center 'Special Assignment' Team of the Year -

RagingWire Data Centers, Commissioning Task Force

Outstanding Contribution to the Industry -

John Tucillo, VP Schneider Electric, former President and Chairman, The Green Grid

NY welcomes North American award winners

DCD's 2014 North American awards were presented in New York in December

It may have been a chilly, rainy evening, but the atmosphere was warm and festive inside New York's Gotham Hall as the DatacenterDynamics Awards North America honored the region's data center leaders. Awards were handed out in 11 categories - with winners selected from more than 200 submissions.

Begun in Europe seven years ago, the DatacenterDynamics Awards have spread to North America. The first set of prizes were presented in San Francisco in 2013.

"DCD's awards are all about leadership and innovation", said Zahl Limbuwala, founder and ex-chairman of the BCS Data Centre Specialist Group: "Despite

our constraints and our highly risk-averse nature, we have managed to transform our industry over the last ten years in ways that would astonish you."

"We are not just another energy-consuming industry to be shot at by the Greenpeaces of the world", he added, highlighting that many of the awards recognize efforts to improve efficiency and lower energy consumption.

Digital Realty, the colocation and data center services giant, received two awards during the evening, cashing in on the same project in different categories. The firm is a repeat winner, having taken home a prize in 2013's inaugural North America awards, for improved data center energy efficiency. ●

Consumer-colo correlation

Striking regional variations will emerge in the growth of investment in consumer services and colocation provision

The next five years will see a big change in the patterns of data center investments round the world, according to projection by DCD Intelligence (DCDi).

Both consumer services and colocation are growing in all sectors, but the rates of growth are changing, and investment is shifting between the two broad categories: end user services and colocation or outsourcing providers.

In territories where economic development is taking place rapidly, such as China, end user services show a rapid growth, largely driven by the penetration of mobile devices.

In more developed territories, mobile penetration is virtually saturated, so growth is more moderate.

Colocation growth is less affected by these factors.

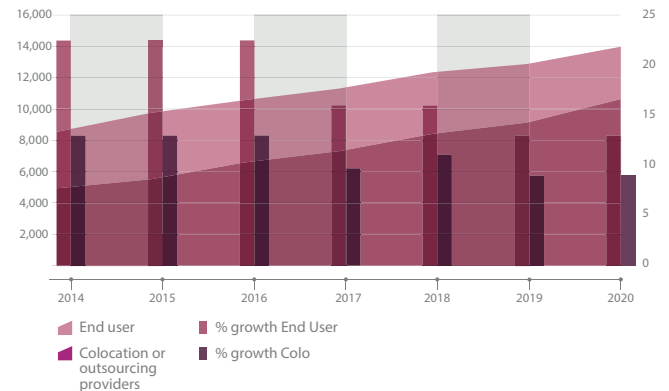
USA Data Center Investment in IT & Infrastructure Solutions

(power, cooling, monitoring, UPS, DCIM, modular systems virtualization, cloud within the firewall, IT upgrades, servers, HP computing)



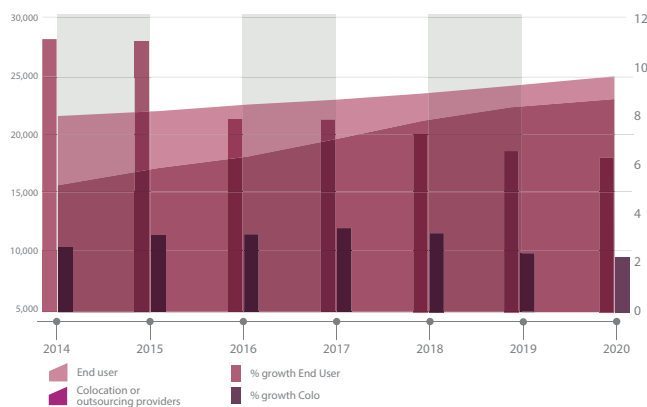
Latin American Data Center Investment in IT & Infrastructure Solutions

(power, cooling, monitoring, UPS, DCIM, modular systems virtualization, cloud within the firewall, IT upgrades, servers, HP computing)



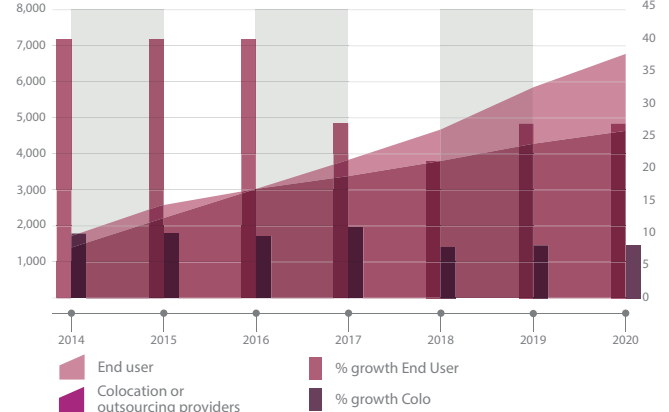
Europe Data Center Investment in IT & Infrastructure Solutions

(power, cooling, monitoring, UPS, DCIM, modular systems virtualization, cloud within the firewall, IT upgrades, servers, HP computing)



China Data Center Investment in IT & Infrastructure Solutions

(power, cooling, monitoring, UPS, DCIM, modular systems virtualization, cloud within the firewall, IT upgrades, servers, HP computing)



The European Union is a strange beast. Different departments cover similar areas, and within those departments, different nationalities and power groups jostle for power.

Given that, it's hardly surprising that when the EU decided to investigate power conservation within data centers, it didn't set up just one initiative. It set up six.

The six projects (see box) are part of the Framework 7 Programme (FP7) set up by the outgoing European Commission, which left office in Autumn 2014. In total, the Framework Programme has considerable resources - its total budget is over € 50 billion, an increase of 41 percent over the previous program, FP6.

But all these are predated by two original projects - All4Green and CoolEmAll - which kicked off the EU's efforts in this area. Both were started early in 2011, and finished early in 2014.

These two projects had straightforward aims. All4Green was set up to develop SLAs between data centers and the users they serve, the idea being that different forms of computing would have individual energy saving policies. CoolEmAll was established to work on tools that would help data center operators make more efficient use of their facilities.

Among the current crop of projects, RenewIT (October 2013 to September 2016) sounds similar. Its goal is to develop a tool that can be used by data centers as a way of measuring energy efficiency. It shares many of the same partners, but those involved say RenewIT is not a continuation of CoolEmAll.

"These are distinct projects. CoolEmAll was about 30 months from October 2010 to March 2013, while RenewIT started in October 2013 for 36 months," says Philip Inglesant, EU analyst at the 451 Group, one of the partners in both CoolEmAll and RenewIT. "There are obvious overlaps between the two; but the focus is different. CoolEmAll was particularly looking at cooling techniques within the data center. RenewIT is looking wider than that, at energy use as a whole, and not only within the data center but also at things like energy reuse for local heating."

What about the other five projects? They cover similar ground but, according to Fabrice Roudet, data center automation product manager with Eaton - one of the leading players in the GreenDataNet consortium - they all have clear goals and their own identity. "There is some overlap, of course," he says, "but the projects are all very different with their own particular areas to work in."

"It is quite unique to have six different

The EU's many data center efforts

Why does the European Union need six projects to improve data center efficiency? *Max Cooter* investigates

projects all covering the same area," says Andrew Donoghue, research manager for 451 Research, one of the partners in the RenewIT group. But this could be part of a plan to increase the chances of success. "By having multiple approaches to the same problem, the Commission is increasing the possibility of a successful outcome," he says.

The other projects tackle different elements of the data center. DOLFIN (Data centers Optimization for energy-efficient and environmentally-Friendly INternet) takes a holistic approach pulling together the management of virtual machines as well as the data centers themselves.

There's an Irish flavour to GENiC (Globally optimised ENergy efficient data Centers), which reflects that country's long-established data center industry. The project is co-ordinated by the Cork Institute of Technology and other partners include University College Cork and United Tech-

nologies Research Centre Ireland. It wants to target and manage cooling better.

The other EU projects all relate to the Smart Cities concept. DC4Cities relates the energy used by the data center to the constraints of the city where it is located. It aims to make data centers adaptive, and will

develop a new set of metrics (such as Software Execution Energy Efficiency and Renewable Energy Utilisation Efficiency) to complement the usual data center ones like PUE, CUE and WUE.

Geyser looks to combine management of the IT infrastructure

with better management of power grids. The project aims to improve AC/DC working practise and to ensure that computing workloads are better matched with energy provision so Smart Cities and their supporting data centers work better together.

The EU has had a reputation for launching grandiose-sounding projects that start with the noblest of intentions but fail to make a commercial splash. The organisation hopes that this time, the projects will have a life beyond the EU research programme.

"The EU is very keen on exploitation," says Donoghue, "that's to say that the projects

If we want make data centers greener, then we have to make them smarter

Fabrice Roudet
Eaton





THE EU'S SIX DATA CENTER EFFORTS

RenewIT

Integrating data centers into the environment with use of waste heat for local heating

GreenDataNet

Aims to optimise energy in data centers at the rack level and includes the use of vehicle batteries to store locally generated renewable energy

DOLFIN

Improving efficiency in data centers by making virtual functions more easily portable amongst servers within a data center

GENic

More efficient targeting of cooling where and when it is needed within a data center

GEYSER

Improved AC/DC power practises, and integration with smart cities

DC4Cities

Energy-adaptive urban data centers

have some commercial value. They grill us on how we're going to make the technology work and how we can exploit commercially."

He says that, as part of the project, all the companies had to have their own exploitation plan. "This doesn't have to be a commercial offering, it could be research."

What's less clear is what's going to happen when the projects come to an end. Donoghue admits that's still a little vague. "It gets complicated at the end of the project. Do we set up a limited company? If so there are intellectual property issues to be discussed. Who owns what?"

Donoghue says that the Commission is very much involved with the RenewIT project. "They behave like a venture capitalist, but one with a very light touch. We have yearly reviews with them and they'll produce a report and that could involve rejecting some of the deliverables."

One of the key features of the overall program is the co-operation between the distinct project partners. According to GreenDataNet's Roudet, this meant drawing on a range of expertise. "Within the project we have Credit Suisse, ICT Room, a Dutch datacenter operator, Nissan who have been discussing with Eaton about using their batteries in data centers, two universities, Lausanne and Trento, who have been working on algorithms to improve data center performance and CEA, an alternative research organisation who have been working on alternative energy sources."

Roudet says GreenDataNet is slightly unusual as it's led by Eaton, a data center company. "We're a data center vendor and we're the only data center vendor leading such a project." He says that the company's expertise will help it develop projects that will have real value for end users.

Much of GreenDataNet's finished product will be freely available to everyone: "We are proposing a solution based on open source, this will be made public - this will be fully available to everyone. The first deliverable will be literature and specifications on what we've been doing. In late 2015/2016, we will publish the pilot. There will be a booklet on how to efficiently run a data center for any environment and we will also offer an open source tool that offers basic features that can be used on a daily basis by data center operators." However, he also envisages more advanced modules that can be sold.

For the European Union, data center projects meet several objectives. They give a commercial gloss to some European companies and complete research in vital areas. Above all, the projects aim to make data centers more efficient. ●



Event horizon

We unveil our new look in this month's issue of *DatacenterDynamics*. It's new, modern and functional. It has taken a lot of time to finalise. You may have noticed that we have changed the name of the magazine – it is now just plain old *DatacenterDynamics*. We've dropped FOCUS because it has become redundant. It has gone into that big virtualization black hole.

We have unified the look and feel between the magazine and web site. Both now boast the same leaner, cleaner look with more short sections, room for industry opinion and clear integration of content between magazine and our converged events.

We have started a new, vibrant set of dialogues with the data center industry which is keeping *DatacenterDynamics* at the heart of all discussions, news, comment and trend-spotting. Our news team is setting the agenda for lesser outfits to follow on a daily basis. We have been at the very heart of this industry for fourteen years and we have invested heavily in our team, magazine and social media outlets and we intend to stay on top for many decades to come. Data centers are our business.

Redesigning something is a series of events. Creation of anything often has a 'Big Bang' moment when a tiny sliver of inspiration becomes an idea, then a series of ideas, then a series of ideas strung together.

That's certainly been the case in our magazine and site redesign. Each new change opened up fresh opportunities to improve other aspects of the whole package, sometimes suggesting new features we wouldn't have considered before.

It goes further than this. We'll be working with our colleagues in other parts of the business to increase the bandwidth of our communications with you. We'll be working with DCD Intelligence, our analytical brethren, to make new connections to our audiences.

And our DCD Converged events will continue to evolve. This year, that brings us to center-stage of the mammoth CeBIT trade show in Hannover, Germany, while on the other side of the world we have our Enterprise USA event in New York, 17-18 March, along with an array of other venues worldwide throughout 2015 - all developed to meet the needs of you and our industry.

•
Bill Boyle - Global Managing Editor
@billboyleDCD

We are working to increase the bandwidth of our communications with you

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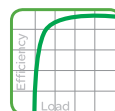
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