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September 2015 VOL 04 ISSUE 07

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IT + Networks

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App > Cloud

Managing blended infrastructures and delivering critical ICT applications through the cloud.



Design + Strategy

The big picture: organisational strategy and design issues for on-premise data centers.



Security

Ensuring reliability and protecting online data and services from the data center.



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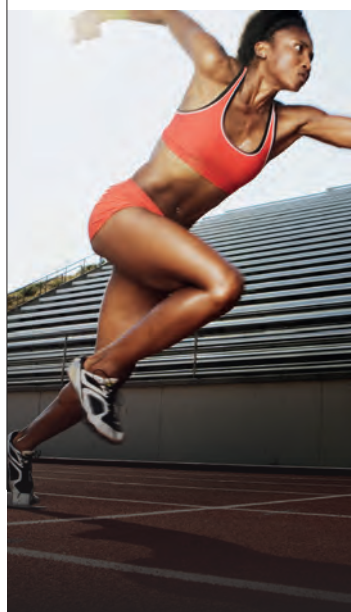
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Can cloud really work while we allow so many outages to occur?

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Fresh views on water

Water is a basic need, for people and data centers, but one that can be so obvious it gets overlooked. It's also an environmental concern as parts of the world suffer droughts. Should data centers worry?

Michael Kassner thinks so (p32), but Professor Ian Bitterlin points out that our usage of water is small in comparison with, say, Coca-Cola bottling or the urinals in McDonald's restaurants (p28).

Data center people have been considering water usage for some while, but with no real sense of urgency. There's a trickle of interest in the subject now that might grow. A proposal has emerged to include evaporative energy in the warhorse PUE measure (p30), and this has been vigorously opposed by people, including Bitterlin.

Water and power are interlinked – you can use water to reduce your electricity consumption, and in the process (says Bitterlin) reduce overall water use.

Efficiency levels are shocking, Jonathan Koomey reminds us (p21), and only a consideration of the entire system can improve this.

One way to get at the entire system will be to instrument everything and use analysis to find where things can be improved. This is part of the promise of the Internet of Things (IoT), that by measuring everything we can improve everything.

When the IoT hype machine gets going, data center people will have a sense of déjà vu: our industry pioneered a lot of IoT concepts (p36) with the fabled approach to DCIM (data center infrastructure management).

All this instrumentation, applied to water distribution systems, will increase efficiency, both within the data center and in the world at large.

One of the benefits of the IoT could be that it makes sure we don't overlook the obvious.

•
Peter Judge – Global Editor
@PeterJudgeDCD



Water can be so obvious we overlook it. Perhaps the IoT will ensure we don't do this

1000m³

Volume of water per year for evaporative cooling a 1MW load

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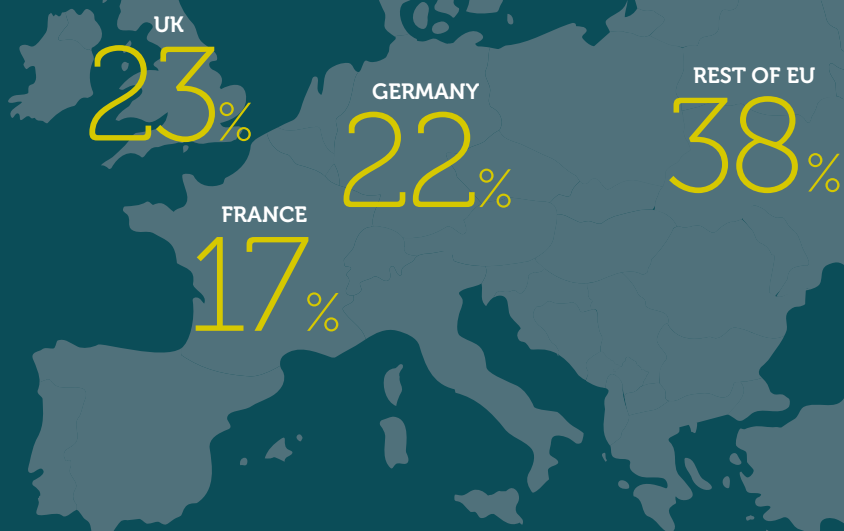
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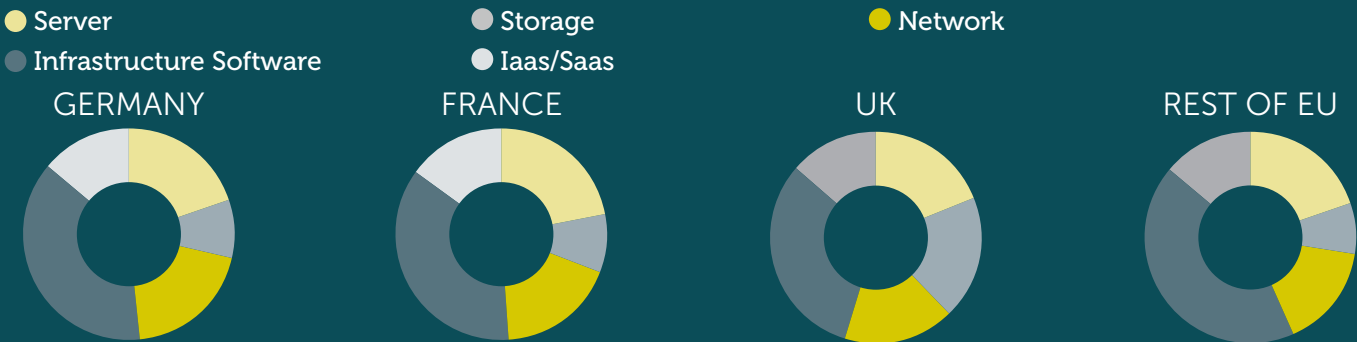
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EU Data Center Spend

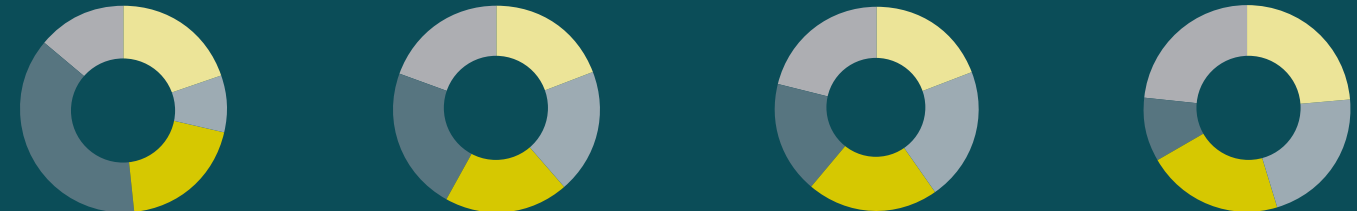
BY OFFERING AND MAJOR COUNTRY, 2014, TOTAL €48.8BN



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Dell launches scalable unit

Dell has created a Datacenter Scalable Solutions (DSS) line selling optimized x86 servers for data centers in heavy-duty processing businesses such as telcos, web tech and hosting companies, and energy and research organizations.

Lightning hits Google data

Lightning strikes affecting a Google data center in Belgium caused some persistent disk storage customers to lose data, as some storage systems were susceptible to power interruptions at Google's St Ghislain data center. Google says permanent data loss occurred in less than one millionth of a percent of the zone's persistent disk space.

Compass eyes southern bells

Compass Datacenters bought rights to build facilities in three new sites, potentially bringing as many as nine of its standard-build data centers to 43.2 acres of land in Georgia, Texas and Ohio. It's the company's first foray into southern states.



Labyrinthine tunnels in Norway to house giant data center

A new data center in Norway will have more than a million square feet of space along a maze of underground "streets."

Built in an old mineral excavation in the Sogn og Fjordane region between the west Norwegian ports of Måløy and Nordfjordeid, the Lefdal Mine, due to open in Måløy in August 2016, could potentially offer 120,00 sq m (1.3m sq ft) of space built into a mountain, and situated within 100 metres of a deep fjord. This

will give free sea-water cooling systems, while CO2-neutral energy comes from a variety of local hydroelectric generators.

One of the streets will house three floors of traditional space, where racks and cabinets can be installed. Each of the six levels of the old mine site will be connected by a central access road providing direct access to vacant chambers.

The project has backing from both IBM and Rittal: IBM, its first partner, will move in when the

facility goes live, offering resiliency and backup services to its customers, according to Lefdal. While Rittal's parent, the German-based Freidhelm Loh Group, has signed a lease agreement where Rittal will supply containers and infrastructure.

A customized container can be fitted-out, shipped to Lefdal, hooked up, and brought online in six to eight weeks, said Lefdal's marketing director, Mats Andersson. Customers wanting to work with other container vendors can do so, though everyone has to take the infrastructure, which will be Tier III certified.

But others poured scorn on the idea. Andrew Jay, head of data centers at CBRE, said: "It's a great location, cheap, it's green and cool. But no one is going to compromise a mission-critical operation to save a few quid on their power bill."

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

5 DATA CENTER BEST PRACTICES

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NETWORK MIGRATION



POWER OPTIMIZATION



THERMAL
EFFICIENCY



DCIM ENABLEMENT

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you can
benefit on
page 14

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Facebook tax deal for third site in Oregon too hard to pass up

Local authorities in Oregon have signed off a multimillion-dollar tax deal that will bring a third Facebook data center to Prineville, a city in Crook County with a population of about 9,200 as of the 2010 Census.

Apple opened a data center there in 2013 with little fanfare.

The 15-year deal was approved unanimously by Prineville and Crook County authorities, according to Oregon Live. Facebook still has not formally announced it is going ahead, as it has been looking at an alternative site, but an announcement is expected by early next week.

Tax sweeteners for data centers have been a controversial issue, but Prineville clearly sees a benefit.

With two large data centers and a "cold storage" archiving facility in Prineville, Facebook has spent nearly \$780m in a town of only 9,000 people – 147 of whom work for Facebook. At 487,700 sq ft (45,000 sq m), the new building will be

bigger than either of the two existing data centers.

Facebook gets property tax exemptions, which have saved it \$30m in three years, according to Oregon Live. In exchange, it pays a flat fee of \$110,000 each year for the existing data centers. The new deal will add a further \$190,000 a year.

Elsewhere in Oregon, The Dalles in Wasco County is offering tax incentives to Google, while other states are honing their offerings. Arizona is wooing further Apple investments with tax offers, and Philadelphia also has a tax regime designed to encourage new data centers.

<http://bit.ly/1NXCv8D> ●



Ireland has high hopes for go-ahead of Facebook €200m facility



Meath County Council has approved Facebook's plan to build a €200m (\$220m) data center in Clonee, County Meath.

The center will be built in two phases over the next 10 years on a 220-acre site about a 30-minute drive from Dublin. News first leaked out when Facebook began recruiting electrical engineers and data center managers in Ireland in May. No start date is set, as the permission could still face objections. "This is the best news story that I have seen in County Meath in relation to industrial development in my 30 years at the council," said Brian Fitzgerald, chairman of Meath County Council, when speaking on Louth Meath FM radio.

The first phase of the build will comprise eight data halls and office space in two buildings, with a gross floor area of 50,800 sq m, designed to consume as much as 72MW of power. There will also be a new 220kV electrical substation on the site.

The entire campus is expected to employ around 100 staff, thanks to a level of automation already displayed in Facebook's facility in Luleå, Sweden. However, Facebook has said the site will bring millions of euros of business to Ireland and support thousands of skilled jobs.

Ireland remains a popular location for data centers, with Microsoft recently asking for permission to build its fifth data center in West Dublin, and Apple spending \$930m (€850m) on a massive data center in a forest in Galloway.

<http://bit.ly/1hidd41> ●

Explosion rocks data centers in California's City of Angels

An explosion shook the basement of 811 Wilshire Boulevard, causing a fire that was put out by 160 firefighters and which injured two people. The blast is believed to have started in the building's generator, and the resulting fire caused network and power outages to the surrounding areas of Downtown Los Angeles, leading to problems with nearby data centers.

The fire took out an on-site power station in the building, which briefly left 12 buildings without electricity.

At least two data centers lost utility power – the Equinix LA1 data center on West 7th Street, and CoreSite's LA1 center in the One Wilshire building. However, both switched over safely to generator power until the utility power returned.

However, some disruption was experienced by network provider Level 3 Communications, located in the Equinix data center, which also affected its local customers.

Those affected at the Equinix site included Internap and its customers, including remote access firm LogMeIn. Customers at One Wilshire seem to have escaped without network troubles.

The blast also caused a few minutes' break to a Shania Twain concert in the nearby Staples Center in Downtown LA.



<http://bit.ly/1ND3ToR> ●

Battling for Thermal Supremacy in the Data Center

When poor airflow literally leaks money from your business, lines are drawn up and sides are chosen. Find out how proper thermal management can help restore harmony.

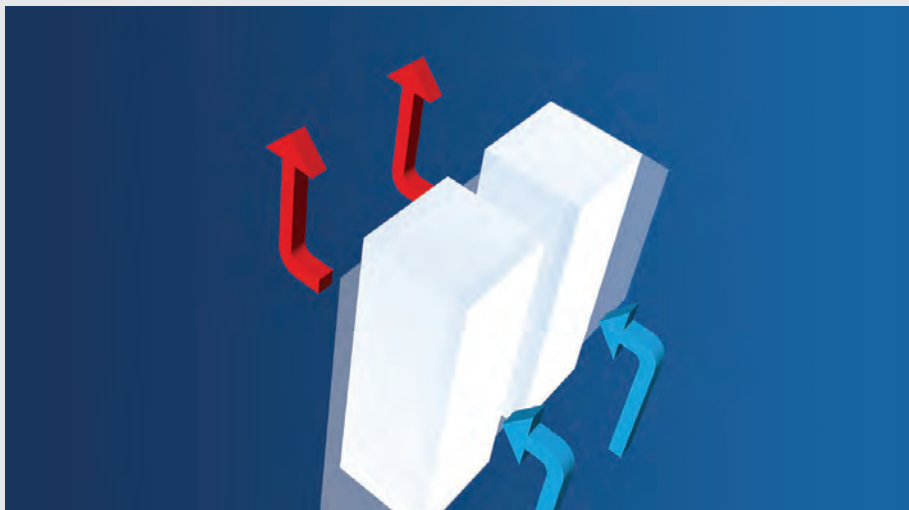
Facilities vs. IT. When it comes to budget, efficiency and uptime, these two groups are usually at loggerheads on the right course of action to take—and usually have different mandates and objectives from executives that have the two working against each other.

A frequent source of friction between the two is a common problem for all data centers: thermal management. Facilities groups are typically tasked with delivering cold air as efficiently as possible to the IT equipment that supports the business. IT wants availability and the means to install equipment quickly—regardless of how it might affect the data center's overall thermal dynamic. This sets the battle: IT is rapidly adding equipment to support business needs and facilities is rationing the cooling supply.

But is there a way to get these two groups on the same side working together? Yes there is, and it's simpler than one thinks. "The conventional thinking is that if there are hot spots in the data center, just throw more cooling at it," said Dave Wilson, Director of Technology for Data Centers at Anixter. "But we need to focus on the delivery of airflow to increase cooling efficiencies, which includes better airflow management practices."

The Cost of Bad Strategies

Data center architectures and designs are rapidly changing, and they can affect overall thermal efficiency. Operators are facing more pressure from the business to be efficient and reduce operating expenses while managing an increase in IT capacity needs.¹ So as IT requires more cooling to support their growing infrastructure, facilities has started to look at how to optimize its delivery. One of the reasons facilities is focused on thermal efficiency is because on average cooling



Thermal management: Aren't we all on the same side?

accounts for 37 percent of a data center's energy consumption² —12 percent of that is just to move the air.

"Part of the problem is bad airflow management strategies, which leaks money," said Tim Hendricks, Director of Advanced Technology Services for Data Centers at Anixter. "The current strategy in many data centers is akin to having the air conditioning on at home but with the windows open. Turning down the AC when you have leaks doesn't make sense for a house and certainly not for a data center."

But there is a way to plug those leaks. By using airflow segregation strategies, taking advantage of free cooling when possible, and adhering to new industry guidelines, it's possible to improve efficiency, save on operating costs and lower overall PUE. And when it comes to facilities and IT, it's possible to keep both sides happy by lowering overall costs

while keeping servers running at the right temperature to ensure uptime.

The next issue will cover the latest passive cooling and containment strategies and how changing industry practices can get these two sides working and being successful together.

¹ DCD Intelligence 2014 Global Census Data

² Source: EYP Mission Critical Facilities Inc., New York

ANIXTER

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Rackspace to support AWS and Azure

Managed cloud provider Rackspace has confirmed it will offer support for customers of the Amazon Web Services (AWS) cloud, following an earlier announcement that it would resell Microsoft's Azure public cloud. Rackspace offers its own public cloud, but this business has not been growing, while AWS dominates the space.

In July Rackspace announced it would resell and support Microsoft's Azure. Support for AWS had been rumored, but was finally confirmed by Rackspace in an earnings call with the CEO, Taylor Rhodes.

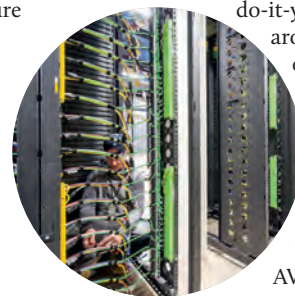
Rackspace is "building an offering for customers who want specialized expertise and Fanatical Support on the AWS cloud," said a company statement. No details were available at press time, but Rhodes said an AWS package would be available before the end of the year, after admitting that growth in Rackspace's own public cloud service in the

second quarter of 2015 had not met the company's hopes.

The AWS service will likely resemble the Azure service, which Rackspace says fills a gap in the Azure market for support and implementation services.

Rackspace is known for its managed cloud and supports customers' private clouds, as well as VMware's vCloud and its own public cloud based on the OpenStack open source

cloud platform. AWS initially had "low-touch" support, but this has led to a strong do-it-yourself ethos around the platform's early users. Since then the sheer scale of the AWS market has called other support options into existence, including official AWS consulting partners such as CapGemini, CSC, Wipro, Accenture and Datapipe.



<http://bit.ly/1NXD8bY>

Vapor and Bloom back low-emission centers

Vapor IO, whose hyper-collapsed data center design is based around cylindrical chambers, has teamed up with fuel-cell provider Bloom Energy to offer low-emission data centers.

Vapor IO offers an open source hardware approach based on wedge-shaped racks built in circular "vapor chambers" that improve density and cooling by convection currents. Bloom provides fuel cells that make "clean" energy from hydrogen or hydrocarbons. Together the companies will build a reference model that couples the two in a modular data center design.

While power distribution is traditionally a separate system from the IT within racks, the two companies will work together on ways to integrate them more closely.

Vapor's hardware is designed around an open source management interface called the open data center runtime environment (OpenDCRE), which is, in effect, an open source DCIM platform, published by the Open Compute Foundation.

Vapor will give Bloom access to CORE, the commercially developed intelligence layer it offers on top of OpenDCRE, so the power generated from the Bloom Energy Servers can be routed more intelligently. Each Vapor chamber has six racks and draws up to 150kW. Bloom Energy Servers are available in various configurations up to 200kW, which is enough to power multiple chambers at more normal densities.

Vapor emerged from stealth in March 2015, while Bloom has been around for 15 years, during which time it has had \$1bn of investment to commercialize fuel cells originally designed for Nasa and intended for space exploration.

<http://bit.ly/1MR5kys>

Robot opens Switch's SuperNap 9 in Vegas

Nevada-based Switch has opened more colocation space in Las Vegas, with local robot star Metal Rebel cutting the ribbon for the SuperNAP 9 site. The new 470,000 sq ft (440,000 sq m) colocation center supports up to 50MVA of power and brings Switch's footprint in Vegas to more than 1.5 million sq ft. It is expected to have a PUE of 1.18.



Metal Rebel was created by the University of Nevada, Las Vegas (UNLV), and can climb stairs, drive a vehicle and use power tools – skills that won it eighth place in the annual US Defense Advanced Research Projects Agency (DARPA) robot challenge in June.

The site has Tier IV design certification and Switch says it will also apply for a Tier IV Constructed Facility Certificate, as well as a Tier IV Gold Operational Sustainability Certificate from the Uptime Institute. Assuming it gets them, that would make it one of only two Tier IV Gold neutral colocation sites in the world, says Switch.

Switch has said its goal is to eventually run all its data centers using 100 percent renewable energy. "Switch was started with the idea that data centers needed to not only be able to handle the scale of the internet but to do so in the most efficient manner possible," said Rob Roy, who invented Switch's cooling system, known as Wattage Density Modular Design (WDMD).

Switch has a long-standing relationship with Metal Rebel's creator, housing the university's Cherry Creek Supercomputer in its Las Vegas 7 facility. Cherry Creek, built with Intel, ranks among the world's fastest and most powerful supercomputers.

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

\$1bn

Investment Bloom has received over 15 years to commercialize fuel cells intended for Nasa



2km
Buildings 2km away
suffered severe damage
and casualties
in the blast

Image credit: Jason Kotteke

Port of Tianjin blast took out supercomputers

A series of blasts at the port of Tianjin, China, damaged a nearby data center and took down Tianhe-1A – once the world's most powerful supercomputer.

According to information on Sina Weibo, the area serves as a hub for technology companies, with Hewlett-Packard, recruitment site Liepin, online classifieds site 58.com

and mobile device manufacturer Ahmed Technology all located in the port's immediate vicinity.

Chinese internet giant Tencent was forced to close its data center temporarily after the blast managed to fling debris as far as the server rooms.

Meanwhile, the National Supercomputing Center in Tianjin had to shut down its machines as a precaution, after

suffering damage to the exterior of the building.

The explosions in Tianjin were so powerful they registered as minor earthquakes, and so bright they were visible from space. Apartment blocks located as far as 2km from the site had their windows shattered, more than 100 people were killed, and several hundred were injured.

The exact cause of the tragedy is not clear, but evidence collected so far points at an industrial accident caused by breaches of regulations and safety procedures.

In the aftermath of the explosion, Tencent had to take its data center offline, causing disruption to video services. The company said the repairs have already been completed, and the facility is now operating

at full strength. No data center employees were injured.

The National Supercomputing Center was also caught in the blast, which shattered its windows, damaged the façade and caused some internal ceilings to collapse.

The center decided to switch off Tianhe-1A, the fastest computer in the world, from October 2010 to June 2011 (now residing at number 24). Its successor, Tianhe-2, is currently the most powerful machine in the world – the position it has kept for more than two years.

State-owned Xinhua News reports that no hardware was damaged, since Tianhe-1A resides in a reinforced computer room – it was shut down manually due to security concerns.

<http://bit.ly/1LyHS7v>

VOX BOX / DCD VIDEO



T J Kniveton
Vice president
Salesforce

What's the deal with SKUs?

Hardware SKUs is a term borrowed from the retail industry to describe unique server configurations. Containerized applications and web-scale computing will reduce the number of SKUs present in the data center, leading to the Holy Grail of hyperscale – a facility running with a single SKU.

<http://bit.ly/1En62lO>



Bryan Cantrill
CTO
Joyent

How will containerized workloads change things?

Linux-based application containers are making virtual machines obsolete. The new approach, pioneered by companies such as Docker, has advantages including application portability, improved resource efficiency and lower I/O latency.

<http://bit.ly/1hicf7S>

Netflix closes data centers and goes to Amazon's public cloud



Netflix will have moved completely to the public cloud this summer, when it shuts its last remaining data center.

The company began moving to Amazon's AWS after a major failure in its data center in 2008, and will now become one of the first major companies to move completely to the public cloud. Netflix's customer-facing streaming business has been 100 percent cloud based for some time, the announcement explains, but the process to move the entire business to the cloud has taken eight years, as Netflix's technology and cloud delivery have matured.

The transition has been gradual, with different components of the operation being completely transitioned to the cloud in a planned exodus from the data center. Along with customer-facing streaming, Netflix moved its Big Data platform in 2013, and 2014 saw billing and payment infrastructures make the move.

Netflix is not, however, giving up on its own content delivery network, which it has been deploying over the same period of time to certain service providers. It will continue to install its own servers at those service providers, and will maintain control of the service delivery network outside of the AWS ecosystem.

This delivery system is more important than the data center in maintaining a high level of performance to Netflix's end-user customers, caching video at the ISP site in order to improve the performance of the streaming service and not requiring the network traffic to move outside of the user's local provider.

Still, with the closure of its final data center, all of Netflix's IT operations will be cloud based, split between AWS and its own CDN.

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

Equinix lands trans-Atlantic cable

Equinix will deploy and sell fast links on a new \$300m cable joining Ireland with New York. The 5,400km America Europe Connect (AeConnect) cable from the West Coast of Ireland to Long Island is being laid by the end of 2015 and will provide more than 52Tbps of connectivity. It is being laid at the same time as the Hibernia Express cable, and both are intended to provide more capacity and lower latency between Europe and America.

The route between New York and London is one of the world's busiest. It is the second largest internet traffic route globally, carrying multiple terabits of peak traffic.

<http://bit.ly/1U8jdJL>

Google and Amazon covet Tata business

Tata Communications – a subsidiary of India's largest conglomerate – is reportedly selling most of its data center business, with Google, Amazon and a number of private equity funds all lining up as potential buyers. On offer is a 74 percent stake in the division that owns and operates 44 cloud and colocation facilities, most located in India.

Tata Communications – primarily known as a network infrastructure provider – established its data center business to take advantage of the Indian boom in colocation and managed hosting, and spun it off as a wholly-owned subsidiary in 2014.

<http://bit.ly/1i557MG>

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Key trends

Growth

– 35 million internet users added in three months

Green data centers

Corporate social responsibility and government support

Public cloud

Traditional data centers transform to the cloud

Connectivity

Direct links using dark fiber are gaining ground



South East Asia's data centers look forward to 2020

Paul Mah talks to the movers and shakers in a region gearing up for several years of growth

Asia's internet recently increased by 35 million users in three months (the equivalent of the entire population of Canada), says Joe Kava, vice president of data centers at Google. That's why he's announced a second data center in Singapore, barely 18 months after Google opened its first center there.

We asked some industry experts to predict what kind of growth this would generate.

Green data centers are growing in the region, says Martin Ciupa of Green Global Solutions. Facebook, Microsoft, Apple and Google are spending billions on energy efficiency, and in Singapore there is a strong

government drive to promote green IT – in new-builds as well as retrofits – as a way to cement the city-state's regional leadership.

Not everyone agrees, though. Simon Piff, associate vice president of enterprise infrastructure research at IDC Asia Pacific, says green data centers have “pretty much stalled” in the Asia Pacific region, apart from in Singapore, Australia and New Zealand.

“In reality, the function of data center management is separate from the department that pays the power bill, in most cases, and so the industry's attempt to market ‘green’ to the IT community has not hit the target market that cares about power costs,” says Piff.

Ciupa admits that mindsets need to change, but has observed that corporate social



responsibility initiatives are becoming more important, and those companies that ignore green initiatives may tarnish their image, or fall foul of government regulations.

Wong Ka Vin, managing director of data center service provider I-Net Singapore, wants to take green IT beyond increasing energy efficiency. He supports initiatives such as the BCA-IDA Green Mark for Data Centres in Singapore, but wants greater adoption of renewable energy strategies. "Energy efficiency does not equate to being green. We have to look at how we can develop reusable renewable sources."



Data centers that are not developing cloud-friendly strategies might be challenged

**Wong Ka Vin,
I-Net Singapore**

The public cloud is growing and maturing quickly in South East Asia, with providers such as Amazon Web Services, GoDaddy, DigitalOcean, Rackspace and Linode establishing a physical presence here. "In Thailand, more and more enterprises are integrating cloud strategy to help grow their business," says Waleeporn Sayasit, a director at TCC Technology, a large carrier-neutral data center operator. "I believe that traditional data centers will soon transform into cloud data centers."

In its own data centers, TCC is one of the largest operators of hosted SAP applications in the region, with more than 10,000 users.

Overall, data center operators do not feel threatened by the cloud, pointing out that it needs to be hosted in some physical data center. But Wong warned that data center operators need to be cloud-ready. "Data centers that are not looking into acquiring cloud infrastructure players, or developing strategies to be cloud-friendly, might be challenged in time," says Wong.

Interconnected data centers is a final trend, in which operators eschew traditional telecom providers and use external points of presence, including rival data centers.

In Malaysia, the high cost of connectivity has already boiled over and prompted Malaysia's Multimedia Development Corporation to build a high-speed backbone. AIMS Cyberjaya Sdn Bhd had been appointed to connect data centers within Cyberjaya, which is located in the Multimedia Super Corridor region of Malaysia.

Meanwhile, Superloop, which runs fiber optic networks between Brisbane, Sydney and Melbourne, expanded outside Australia into Singapore, offering services on dark fiber between Global Switch and Equinix data centers that act as carrier hotels in the country. "Superloop sees the rise in 'cloud' data center traffic as a key feature for its entry into the Asia Pacific region," says Daniel Abrahams, CEO of Superloop. The company also has a Unified Carrier License in Hong Kong.

I-Net has established what it calls a "data center corridor" linking 14 sites operated

by AT&T, BT, Digital Realty, Equinix, Global Switch, KDDI, Pacnet (Now Telstra) and others. It seems clear that a wave of inexorable trends is sweeping across the region. Multi-year IT contracts and the lead-time required to build a new generation

of data centers will give existing players temporary respite. But data center operators must start now or miss an opportunity.

There is a data center boom in the Asia Pacific region fueled by internet devices. The only question is, 'Are you ready?' ●

Hear more about what the next five years will bring at DCD Converged SE Asia, on 15-16 September, in Marina Bay Sands, Singapore. More information on the multi-track conference program and the expo can be found online.

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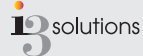
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Facing the efficiency scandal

Enterprise data centers are shockingly wasteful, says
Jonathan Koomey



Twenty-first century data centers are the crown jewels of global business. No modern company can run without them, and they deliver business value vastly exceeding their costs. The big hyperscale computing companies (such as Google, Microsoft, Amazon and Facebook) extract that business value well, but enterprises whose primary business is not computing do not do so well.

If you work in such a company, you know that data centers are often strikingly inefficient, with performance far short of what is possible. And by “far short” I don’t mean by 10 or 20 percent; I mean by a factor of 10 or more.

This waste should be shocking to anyone who cares about financial performance. In a recent study of 4,000 enterprise servers, my colleagues and I found that about 30 percent of these servers were comatose (using electricity but delivering no useful computing) – a result consistent with findings from McKinsey and the Uptime Institute. McKinsey found that typical enterprise server utilization “rarely exceeds” six percent. Many enterprises don’t even know how many servers they have, let alone their utilization figures.

These inefficiencies do not primarily arise from technical issues, but revolve around people, institutions and incentives. They start with fractured management chains that separate budgets for IT and facilities departments. Poor measurement and failure to apply the best technologies led to most data centers underperforming.

What can management do? First, centralize data center operations, with one boss, one team and one

budget. Only then will the team focus on the system costs and benefits of any proposed changes.

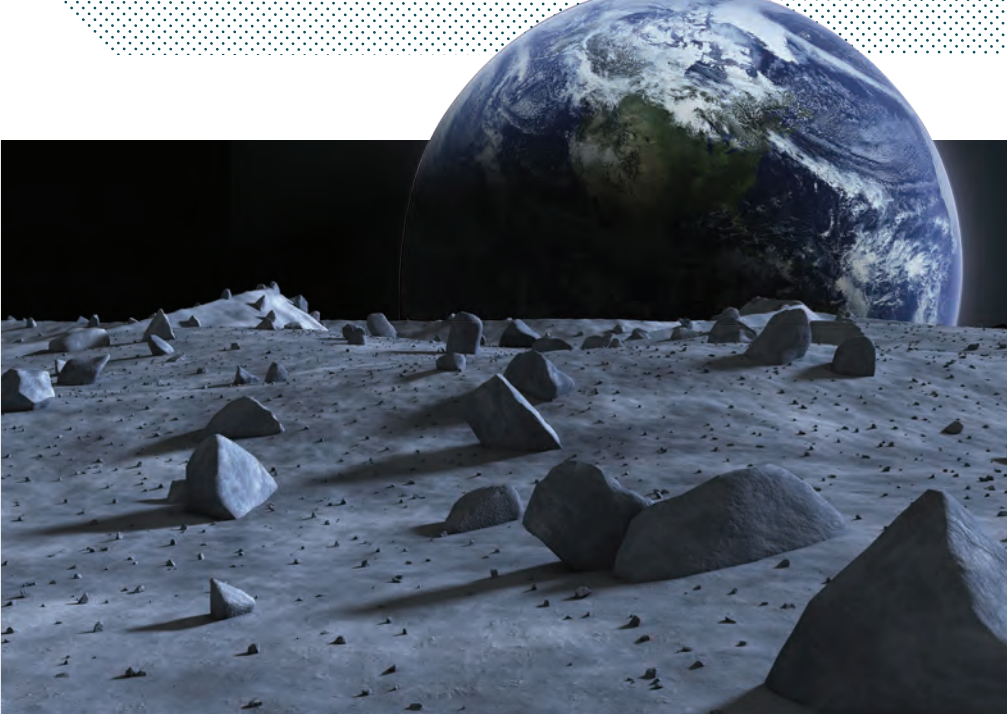
Second, tie data center performance to business performance, map data center infrastructure costs onto business processes, and use metrics that show the business implications of data center choices. Every part of the business should be able to compare total IT costs with benefits at the project level. Most importantly, calculate (or at least estimate) total costs and revenues per computation.

Finally, the most advanced companies use the power of IT to transform IT. Apply measurement and engineering simulation to optimize data center operations. Standardizing on a few server designs instead of dozens or hundreds will reduce deployment times from months to days. Moving smaller computing users to internal clouds will reduce deployment times from days to minutes.

Modern companies require modern data centers, but transforming existing operations requires senior management attention. Those inside the data center can’t make it happen. Only management can begin transforming data centers from cost centers to cost-reducing profit centers – and that’s a result that everyone can cheer. ●

Inefficiencies do not arise primarily from technical issues, but revolve around people and incentives

Jonathan Koomey’s online class about modernizing data center operations will be available to managers, from October 5 through November 13, 2015, in collaboration with Data Center Dynamics and Heatspring.
<http://goo.gl/K4kJG2>



As cybersecurity becomes more important, governments and companies are responding with safety systems to deal with DDoS attacks, persistent threats and identity theft.

Alongside the United States, Mexico is doing its bit. The Mexican Space Agency, together with the national government, has created a technology development center to prevent possible attacks.

"Rather than protecting the country, the aim is to promote the development of technology for such protection, so that both the government and employers can adopt technologies developed in the center," explains Hugo Montoya, director of innovation at Agencia Espacial Mexicana (AEM) – the Mexican Space Agency.

AEM was set up in 2010 to develop entrepreneurship and to capitalize on the space sector (the tradition of astronomy in Mexico dates back to pre-Columbus times), including satellites and related services such as ground antennas and data-processing centers for satellite imagery.

In 2015, AEM announced that it intends to send a payload to the moon, using the Astrobotic lander that has spun out of Carnegie Mellon University in Pennsylvania.

"Although we are the new kids on the block, we want to contribute to the protection of Mexico from cybersecurity issues and natural disasters," says Montoya. The agency will set up its security technology center in Torreon, in the state of Coahuila.

The agency will stand alone in this. It has already begun working with bodies in other countries to share best practices and generate the best possible center for technological development. For this reason, the organization has already visited Spain to start collaborations with various universities, including Complutense

Mexico secures cyber space

The Mexican Space Agency has created a technological development center to foster talent in the country, writes *Patricia Mármol*



Patricia Mármol
Assistant Editor
LATAM



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The project is still taking shape but will develop in three stages. First, a series of events will identify the talents, and needs, of Mexico's existing professionals. Then the size and scope of the center will be decided, along with its exact location. AEM expects the center to be operating in 2018, with projects that can be launched on the market.

AEM says the institution will run profitably, using an open laboratory with open source solutions: "We see good profitability and productivity, with an open collaboration platform," says Montoya.

The Mexican tech market is familiar with computing languages such as Python, Ruby and Perl, all of which are in use within open source software development for satellite systems from various countries.

The security center will need its own data center, though, which Montoya ranks as important as the human talent the center will recruit: "The rest is an architectural shell," he says.

This data center is still on the drawing board, but Montoya expects it to meet or exceed the design standards set by the Uptime Institute to be certified with Tier III reliability. It will be built through a public tender process and will be modular and scalable in design, so by the end of 2016, AEM should have agreed on the dimensions for its power and cooling systems.

The rough draft design is currently about 1,200 sq m (13,000 sq ft), including an auditorium, a training room, an administrative section, and a network and security monitoring center (NOC/SOC). The

agency currently has a small data center, based on servers in office space, since it currently has only administrative data.

The core of the technology development center will be security, but it will also foster the skills of young enthusiasts and enterprises to develop projects, including big data, scientific computation and artificial intelligence, and accelerate economic development through new specializations.

It will also help to boost the country's national standing by ensuring much of the production is carried out in Mexico: "The idea is to have sovereignty over certain critical systems in the country."

And, finally, the center aims to support Mexico's talent: "Our idea in the space agency is to contribute to the benefit of society and put solutions developed by Mexican talent in the service of the government and industry," Montoya adds. The center will also aim to export products to the international market and contribute directly to Mexico's economy.

Despite having definite goals, AEM will have a light touch, not judging but encouraging developments so as "not to hinder the development of disruptive technologies," says Montoya.

The bottom line is to strengthen competition through innovation. "The center will facilitate the maturation and completion of technology projects," he says. ●

Hugo Montoya of AEM will speak at DCD Converged Mexico, 6-7 October

Although we are the new kids on the block, we want to contribute



AEM: Key facts

Founded
2010

Director General
Francisco Javier Mendieta Jiménez (appointed 2012)

Headquarters
Mexico City

Security center
Projected to open in 2018

Data center size
1,200 sq m (expected)

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Flexible switches limber up

The Open Compute Project defined bare metal commodity switches for data centers. *David Chernicoff* looks at the industry response

Facebook calls this open modular switch platform "6-pack"



Love it or hate it, the Open Compute Project (OCP) has been making waves in the data center hardware world. And when Facebook decided to make its own high-performance data center switches, it put network giants such as Cisco and HP on notice. But times they are a changing.

It has been two years since Facebook announced the goal of developing an OS-agnostic top-of-rack switch for data centers, which would be shared through the OCP. And it's been a year since the actual arrival of the TOR switch (codenamed Wedge), along with a Linux-based OS to run it (codenamed FBOSS).

The Wedge TOR uses the same modular microserver architecture that Facebook was already deploying for the standard OCP server in its data centers. This means Wedge switches can slide seamlessly into Facebook's existing software deployment, provisioning and management system.

But just because something works for Facebook doesn't mean it will work for everyone, and there are certainly other open switches in the OCP ecosystem.

A selection of vendors, including Accton, Broadcom, Intel and Mellanox, have also provided reference designs that were accepted as open switches by the OCP.



David Chernicoff
US Correspondent



@DavidChernicoff



On the software side, Big Switch Networks contributed Open Network Linux to the OCP design (formally accepted in March 2015), and Cumulus Networks offered the Open Network Install Environment (ONIE) and ACPI Platform Description (APD) technology to simplify the development of software for these switches.

The basic idea of ONIE and ADP is to enable a bare metal network switch environment. ADP allows the creation of BIOS-accessible information that can be accessed by the operating system to dynamically generate all of the necessary control interfaces.

ONIE defines the installation environment that combines a boot loader with the Linux kernel and Busybox, and provides the environment for the installation of the compatible OS of choice. Because it is Linux-based, it allows the switches to be managed, provisioned and deployed in the same way that users currently manage Linux server hardware.

Broadcom also submitted a specification, currently in the final stages of approval, called the OCP Open Switch, based on the existing StrataXGS Trident switch technology (see panel).

Fast-forward a year, and in 2015, what were once white papers and reference designs are now actual products in the marketplace. Facebook has gone from focusing on just TOR switches to building a switch capable of replacing spine and leaf switches within the data center, using the same basic technology as the Wedge TOR switch. Facebook calls this open modular switch platform “6-pack” and published full details on the device early in 2015.

Additional software specifications have appeared as well, with Big Switch Networks, Dell, Mellanox and Microsoft

submitting their switch abstraction interface (SAI) to the OCP. SAI is complementary to ONIE, with SAI abstracting the FPGA switch silicon to allow developers to write to a single specification instead of needing to tweak the code for different brands of silicon.

In March 2015, a design specification was accepted by OCP for next-generation 100GbE switches and a cost-optimized 40GbE design jointly submitted by Accton Technology Corp and Edge-Core Networks.

Designs and specifications mean little if the IT department can't go out and purchase a product. And while a look at

the OCP networking specs and designs page shows only two accepted hardware products, both from Accton, drilling down will show that other vendors have hardware built to more recent versions of the design specification, which are

already in production.

There are also devices that are not part of the specification process but are simply being built to the model. These are being submitted to certification at the University of Texas San Antonio OCP Certification and Solution Laboratory. Though there has been some controversy about the facility and its procedures, vendors are selling equipment that has been certified by the facility as OCP-compliant.

Edge-Core Networks, for example, has four certified networking products tested by the lab for compliance. In March 2015, Edge-Core was also the first vendor to release a commercial product based directly on Facebook's TOR design, the Wedge-r6X, which is being manufactured by Accton. With the Wedge modular design also being the core concept for Facebook's 6-Pack leaf and spine switch, it is a reasonable

OCP features

Key elements of the OCP switch specification, as presented by Broadcom and Interface Masters

- Open rack and enterprise rack 1U-compliant leaf and spine switch design
- Leaf switch configurations: 48x10GbE + 6x40GbE ports or 48x10GbE + 12x40GbE ports
- Spine switch configurations: 32x40GbE ports or 96x10GbE + 8x40GbE ports
- Supports ONIE and multiple off-the-shelf network OS options
- X86 control plane CPU with server-class Linux OS and tools
- Available options for other MIPS/PPC CPUs
- Support for optional data plane co-processor based on Broadcom XLP432 for L4-L7 network functions acceleration

presumption that Edge-Core will continue down this path of development if the company determines that there is sufficient demand for the product.

Even unexpected vendors have joined up with the OCP networking group. At the beginning of the year Juniper networks began shipping the OCX 11000 switch based on the OCP design, running the Junos operating system and built in partnership with Alpha Networks, one of the early adopters of the OCP networking spec.

Networking giant HP has accepted the reality of OCP networking and is working with its long-time partner Accton to bring HP-branded OCP-compliant switch products to the market. Both Accton and Alpha Networks already have OCP-compliant switch hardware available for purchase, as do Mellanox and Inventec.

Edge-Core has introduced a line of bare-metal switches that come preloaded with ONIE to allow the customer to load the compatible switching operating system of their choice. Original design manufacturers such as Quanta and ODM are also building OCP-compliant hardware for unnamed customers.

While the OCP standard has a lot of flexibility and can fit in as a solution for a significant number of data center situations, it is not suitable for all environments. Few companies have the same type of data center needs as Facebook or Google. Most data centers don't have huge numbers of servers performing the same tasks, but are still suitable for the deployment of OCP-compliant switching.

Cloud support, Hybrid SDN networking and CDNs all seem to be a good match for OCP hardware. Where it doesn't yet fit is in environments that require significant fault-tolerance.

There is a reason why certified fault-tolerant hardware is costly and very specific in terms of what software and OS is supported. The cost of building and guaranteeing the level of availability demanded by users with these requirements is at odds with the basic premise of OCP, where the hardware architecture is a commodity item. ●

Just because something works for Facebook doesn't mean it will work for everyone



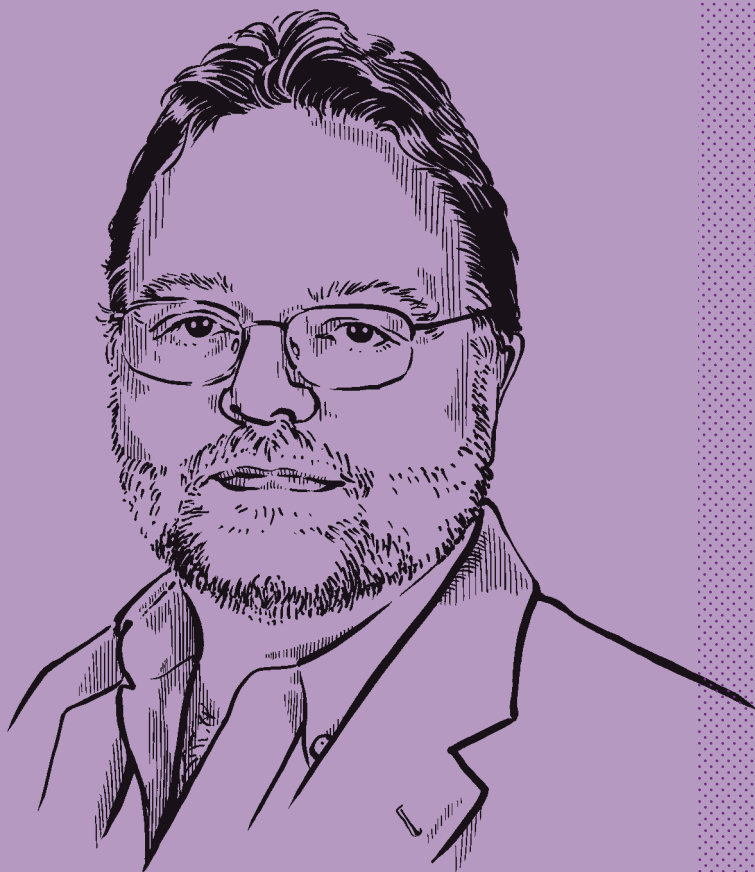


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Why are we even talking about adding water usage to PUE? It's already covered!

Ian Bitterlin explains



I see that Emerson US has proposed a new KPI that “captures the energy used in water consumption.” With power usage effectiveness (PUE) widely abused and little-understood, it is hardly likely a new KPI will find an audience other than in a comedy routine. In fact, all the energy used in water consumption within a data center (including the embedded energy of city water) is already captured within PUE – if only people would take it seriously.

Four years ago, in a white paper, I showed that water efficiency gets worse as PUE improves. I called this WUF (water usage factor) instead of the eventual Green Grid term WUE (water usage effectiveness).

I went on to show that consuming more water locally reduces overall water consumption from power station to data center, as electrical generation in thermal stations uses vast quantities of water. An evaporative system uses 1,000 cubic meters per MW of load per year – equivalent to about 20 domestic houses – and reduces the pPUE from a target 1.4 to 1.08.

If you harvest rainwater, you avoid the embedded energy proxy, equivalent to about 0.008 in pPUE. All of the energy for pumping, spraying and so on is included in the PUE. So, there is no need for a combination metric – just a need to formalize the embryonic WUE.

And there we have an interesting problem. The Green Grid has given up the rights to PUE to the international standards committee

drafting ISO/IEC SC39 KPIs for resource effective data centers, but it has not let go of WUE yet.

As a member of The Green Grid, I chaired a group to develop WUE a bit further, in my mind to prepare for a standard. I (along with my co-chair) published draft documents and expected the 40+ members of the WIG to comment. There was only one response other than from my co-chair. Does anyone care about water consumption? I think the heart of the problem is comparative consumption.

Coca-Cola has a good reputation for minimising water consumption but still uses 2.5 liters of potable water to produce one liter of fizzy pop. If Coca-Cola reduced consumption by less than one percent, the saving would be enough for all the data centers in the world to be indirectly adiabatically cooled (except in humid regions, of course). McDonald's waterless urinals each save about the same water that 1MW of adiabatically cooled data center would consume.

As a society we consume vast quantities of water, but the consumption in data centers is minuscule in comparison with the total and has the added advantage of reducing electrical demand.

We don't need to combine PUE and WUE; we just need both to be used separately, and correctly.

I think there could be a water metric KPI that includes impact on the utility. Let's call it WCF. Because “woof” sounds daft. ●

Consuming more water locally reduces overall water consumption from power station to data center, as electrical generation in thermal stations uses vast quantities of water



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PUE: clouding the waters

Is it really a good idea to add a water factor to the power efficiency metric? *Peter Judge* looks into it



Peter Judge
Global Editor
@peterjudgeDCD

Since the power usage effectiveness (PUE) rating was created in 2006, a number of people have tried to improve on it. But the latest effort has stirred up some controversy by trying to extend it to include water use.

PUE was created to help data centers reduce their carbon footprint by cutting their consumption of electricity, which is normally generated from fossil fuels. To help reduce this, PUE offers an indication of how efficient a data center is at delivering electrical energy to the IT equipment it contains. It has a simple formula: the total energy used by a facility, divided by the energy that is delivered to the IT racks.

Obviously enough, any energy used outside the IT kit will increase the top line of the fraction and increase the PUE, taking it further away from the ideal theoretical figure of 1.0. So achieving a better PUE has become a matter of choosing less energy-hungry

infrastructure for tasks like cooling and power distribution.

But there is more to efficiency than electricity usage, say members of The Green Grid – the non-profit industry group that promotes PUE. The group created a separate metric for water usage effectiveness (WUE), which is simply the ratio of water used to IT power.

WUE has not achieved any real traction in the market, but water usage has become a concern, particularly in parts of the world where water is expensive, or which suffer from droughts (see p32).

Meanwhile, concentrating on PUE could actually be pushing data centers to consume even more water, according to a recent blog post by Jack Pouchet of Emerson Network Power: “Although it was clearly launched as a



tool to be used wholly within the confines of a single facility, PUE has nonetheless become the de facto universal metric for comparison shopping when evaluating data centers. This behavior has led to numerous unintended consequences, not least of which is the staggering increase in the use of water by data centers."

Data centers have been moving away from mechanical cooling systems, which use a lot of electricity and comparatively little water, to outside air cooling systems, which are often boosted by evaporative cooling.

The move is only possible in countries where clean water is readily available, and where the climate allows cooling by evaporation, but the effect on PUE has been remarkable. Data centers that use outside cooling have seen their PUE drop from around 2.0 to 1.2 or less.

The effect on PUE is quite legitimate, because evaporative cooling is a natural process driven by the difference in vapor pressure between the liquid and the air around it. It does not need electricity to drive it, and it is not responsible for carbon emissions. Moving to evaporative cooling cuts the carbon emissions associated with a data center.

What about the water use? Pouchet's suggestion for "PUE revised" (PUER) adds in a factor for water usage, the water equivalent

energy (WEE), and would thus increase the PUE of data centers that use a lot of water.

There is some justification for this, and Pouchet's idea has met with enthusiasm from some who see it "levelling the playing field" for data centers in warm and humid climates, where evaporative cooling won't work, or in areas where water is in short supply and the method is unaffordable. PUE is a metric created by the Northern Hemisphere, for the Northern Hemisphere, say the critics.

But the WEE factor has been controversial. Pouchet uses the energy required to evaporate the water, which is 2,257kJ (0.627kWh) per liter. While it is true that this energy is "used" in evaporating the water, it has come from available low-grade heat and has not incurred any electricity usage or carbon emissions.

Robert Tozer of Operational Intelligence describes this as a "thermodynamic flaw" in PUER, and others have levelled similar criticisms of false energy accounting. Essentially, it takes an item that doesn't feature on the energy balance sheet and adds it to the debit side.

If PUER caught on, it would certainly have a significant effect on efficiency figures. A 1MW data center with evaporative cooling might have a PUE of 1.1, but it would have a PUER of 1.4. If it uses indirect evaporative cooling, its PUER could go up above 2.0.

But will it catch on? It will be put to The Green Grid, where Pouchet has been

a long-term participant, for evaluation: "We are moving forward with this via The Green Grid processes," he says.

But PUE has become well established over nearly 10 years, and has even reached the stage of being published as a draft international standard (DIS 30134-2) by ISO – the International Organization for Standardization. Adding the WEE factor would make the measure more complex and undo the work of creating that international standard.

Moreover, Ian Bitterlin of Critical Facilities Consulting (p28), says that water is already included in PUE. Behind the simple PUE formula, The Green Grid and other bodies such as ASHRAE have published a lot of information on how to calculate all the equivalent energy for parts of the data center, including the water used in an evaporative cooling system. "Read both V2 of TGG and ISO 30134-2 and you will find the proxy kWh/ unit tables," says Bitterlin. "The energy for evaporation or pressurisation for adiabatic spraying has always been a part of the facility overhead power."

The bottom line is that Northern Hemisphere data centers do indeed get a better PUE figure than those in other climates. However, it is an unavoidable fact that they also have a lower carbon footprint.

Water and power are connected in a complex way. Mixing the two runs the risk of clouding the issue. ●

PUE timeline



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The WUE metric

Following the success of its power usage effectiveness (PUE) metric, in 2010 The Green Grid defined a metric to help discuss the amount of water used by data centers. WUE, or water usage effectiveness, is measured in liters/kWh and is defined as the site's annual water usage, divided by its IT equipment energy. The WUE metric should include both water used on site, and water used off site; for instance, in producing the electricity used by the data center. WUE has not been widely used in the industry, and is only rarely quoted, but water use has become a more significant factor for data centers, leading to calls to find a way to incorporate water into the PUE metric (see p28).

Do data centers drink too much?

A typical data center drains an Olympic-size swimming pool every two days. *Michael Kassner* investigates



Michael Kassner
US Correspondent



@MichaelKassner

Gold has increased seven percent in value since the mid-1990s. Real estate jumped nine percent.

Water, not normally considered an investment, beat both, increasing 10 to 12 percent.

Now add shortages to the ever-increasing cost of water, and data centers known for using huge quantities of water are being looked at with a certain amount of disdain. Is this justified?

James Hamilton, vice president and distinguished engineer at Amazon Web Services, saw the problem coming in 2009. In his Data Center Efficiency Summit presentation, Hamilton mentioned that conservation is not just about power. It's about water consumption; in particular, evaporation and blow-down losses.

Evaporation and blow-down losses are by-products of a common method used to cool data centers, where hot exhaust air exiting from electronic equipment is cooled by passing it through an air/liquid heat exchanger. The liquid coolant



Each year, California's 800 data centers consume enough water to fill 158,000 Olympic-size swimming pools

also passing through the exchanger picks up the heat on its way to cooling towers, another form of heat exchanger that uses water evaporation to remove heat from the liquid coolant.

Besides losing water through evaporation, data centers using cooling towers also lose water during blow-down. The liquid portion of the cooling system and cooling towers build up sediment; cooling efficiency suffers if this is not removed.

So, on a regular basis, the system purges a certain amount of water holding the sediment. These two operations are the reasons why data centers use as much water as they do.

The Green Grid, a source of the power usage effectiveness (PUE) metric, launched a measure of water use called WUE (water usage efficiency) in 2010 and, although Facebook reported a WUE figure in 2012 it has not been used widely (see box, The WUE metric).

The issue of water use seemed to go quiet, until Drew Fitzgerald penned *Data Centers and Hidden Water* for the *Wall Street Journal*.

Then things got interesting.

In the article, Fitzgerald focused data on one US state – California – which he obtained from 451 Research. California is home to 800 data centers (more than any other state), and each year they consume enough water to fill 158,000 Olympic-size swimming pools. And, lest we forget, California is in its fourth year of a severe statewide water shortage.

Hamilton recently acknowledged Fitzgerald's *WSJ* article on his Perspectives blog and reiterated his stance, saying: "Water consumption is the next big natural resource issue for data centers after power. I think it's still true today and expect that water consumption will continue to need to be managed carefully by all data center operators."

Using swimming pools as an analogy may be a nice visual, but it does not equate well when trying to determine just what it all means. So, the first step becomes determining how much water is needed to fill 158,000 Olympic-size pools. Thankfully, Marc Andreessen figured that out – 104,280,000,000 gallons.

Rather than just accept Fitzgerald's amount at face value, let's compare his total to what Hamilton mentioned in his presentation – that a typical (15MW) data center uses 360,000 gallons of water per day. If one takes a second and reflects on that number, it is somewhat mind-boggling that 360,000 gallons of water (half the water in an Olympic-size swimming pool) pass through a data center each day.

Time for some simple math: multiply 360,000 gallons by 800 (the number of data centers), then multiply the results by 365 (days in a year). The answer is 105,120,000,000 gallons – close enough (you will see why in a second).

Now let's try to gauge the impact that data centers have on the overall water usage in the state. Information needed to help determine that can be found in the 2014 US Geological Survey's (USGS) *Water Use Estimates for California*. The report states: "In 2010, Californians withdrew an estimate of 38 billion gallons per day." Just to get an idea of how much that is, the USGS's report states: "Water use in the US in 2010 was estimated to be about 355 billion gallons per day."

How much of that is used by data centers? We need to divide 104,280,000,000 gallons by 365 days to get the amount of water used each day by all 800 California data centers. That number is 285,698,630 gallons. Next, let's figure out the percentage: dividing 285,698,630 gallons by 38 billion gallons comes to 0.7 percent – and Hamilton's statistics agree. It seems that California's data centers use 0.7 percent of the water consumed in California.

How does that compare? To understand whether a bit less than one percent is significant or not when it comes to state-wide water usage requires us to find out who else uses the state's water and how much. Referring back to the USGS's California water usage report, we find that irrigation tops the list at 60.7 percent (23,056 million gallons per day), followed by thermo-electric power generation at 17.4 percent (6,601 million gallons per day).

One wonders, looking at those numbers, why Hamilton and others are so alarmed. Combined, all of California's data centers only use one-fourth of one million gallons of water per day.

In the grand scheme of things data centers' water usage is minor, but leaders in the industry are concerned. As well as Hamilton, others have spoken out, including Lisa Jackson (who led the US Environmental Protection Agency until 2013 and is now Apple's environmental director), and Joe Kava, Google's data center operations executive. They view wasted water as inefficient operation, bad for the environment, and ultimately bad for us. I suspect they would feel that way if the daily amount was even less than it is.

"This is an area (water conservation) where the industry will keep innovating," says Hamilton, "and I expect to see results along the line as we have seen with power, where compute usage has gone up dramatically but power consumption has not."

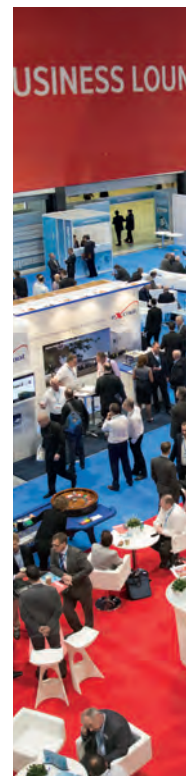
In less than a decade data center operators have addressed the power issue and taken responsibility for how much electricity they use, with most of the major data center operations moving towards using 100 percent renewable power.

In another 10 years, we may see similar changes around water use. ●

360K
gallons of water used
each day by a typical
15MW data center

'Disruption' takes center stage at DCD Converged

This year's DCD Converged Europe will cover the Full IT-Stack. Here's what's in store in London this November...



DCD Converged Europe returns this year with an expanded ecosystem. With new features, topics, speakers and interactive sessions, DCD Europe is set to connect the entire IT stack, debating everything north and south of the rack.

The data center is in a constant state of disruption. In the physical infrastructure, software-defined networking (SDN) is disrupting networking, flash is shaking up storage, and hypervisors have transfigured how we buy servers. For managers, DevOps and lean business models are changing attitudes and application strategies. And, of course, cloud and open source are everywhere.

Against the backdrop of constant disruptions, Europe is emerging as a global tech hub, bringing forward IT infrastructure requirements that create a vast array of opportunities across the region for global industry players.

DCD Converged Europe will tackle these new disruptive technologies, highlight what's on offer from the European market, and connect 3,000-plus senior business, operations and technology representatives from across the entire IT stack.

Major topics 'north of the rack' that will be covered this year range from the rapid proliferation of software-defined

infrastructure and how it will shape enterprise data center strategy, to the changing nature of security threats in ever-more distributed critical environments.

'South of the rack,' we will explore how critical infrastructure requirements are changing, especially given the trend towards more hybrid solutions, and what DevOps add to this equation.

"DCD Converged has transformed over the past four years to become a truly holistic event that covers the whole IT stack, as well as the mission-critical services and engineering element of the industry. We are creating a collaborative environment, where the many professional disciplines that touch the data center within large-scale operators and end users can come together to find cross-stack solutions," says George Rockett, CEO and co-founder of DCD Europe.

This year has so far been the year of the hybrid cloud, and it doesn't look as if it will slow down any time soon, as the adoption rate among enterprises continues to experience a significant boost. However, as the hybrid cloud is on course to becoming a mainstream solution within the next few years, it inevitably leads to complex architectures, emphasizing the need for a cloud-centric data center strategy capable of supporting hybrid IT environments.

One of the world's most recognized brands – Coca-Cola – will be represented at

DCD is a great ideas platform, providing up-to-date information on technology and best practice in cloud environments

TEOMAN BUYAN
Coca-Cola



This year's event will feature some of the industry's leading cloud technologists

the event by its EMEA CIO and global head of infrastructure, Teoman Buyan, who will be discussing the company's ambitious journey to the cloud. "We are aligning our strategy to heavily leverage cloud platforms as much as possible to lower costs and provide flexibility. While security and data concerns prevent us from adopting the public cloud across the board, hybrid cloud models represent the best model," says Buyan.

The event will also feature some of the largest users of cloud services and leading cloud technologists, including executives from Amazon Web Services, Boeing, Deutsche Bank, Deutsche Börse Cloud Exchange, Google, Mergermarket and SAP.

Stacking IT, an all-new knowledge component to our conference tracks, will focus on the open-sourcing of the data center and the potential disruption of moving from proprietary to non-proprietary frameworks for technology development and acquisition. Discussions around cloud, IaaS and other outsourced data center services will feature prominently across the whole conference program, with relevance to different stakeholder communities. ●

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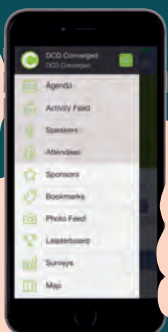
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THE HEART OF IOT

Everyone is talking about the Internet of Things. Data centers are already using it explains
Rupert Goodwins



Regular
or charred?



30^{bn}
Number of IoT
devices by 2020



The next industrial revolution, we're told, is the Internet of Things (IoT). Smartfridges will order smartfood, while your smartwatch will tell you when the next smartbus is due.

The idea is that we add automation and control to the way our machines work together. As this cuts across the normal compartmental barriers, new insight, efficiencies and opportunities will drive new business models and create the magical more-from-less that's the perennial promise of IT to its masters.

Data centers will be at the heart of all this, marshalling and analyzing the huge new data flows that power the IoT – and to do this, they will need a lot of new engineering to balance their own efficiencies, costs and capabilities. A lot of basic engineering awaits, and a lot of people are keen to sell data center companies new hardware and services to help support the transition.

The data center itself is a candidate for IoT techniques. Quite aside from the normal considerations of monitoring and controlling client data flow, storage requirements and access capabilities, the machinery of the data center can be intelligently linked to provide efficiencies that reduce operational expenditure and create new client services.

Data center infrastructure management (DCIM) is a well-known product sector that has been providing an embryonic IoT within the facility for a while, as it learns to mesh information from many different sources within the data center. So far, DCIM has tended to focus on automation and alerts rather than data analysis. This is where work in IoT thinking can feed back into DCIM.

Normalization is very important. One of the challenges for IoT is that while many machines and existing intelligent controllers generate the right operational data, it's in a proprietary or uncommon format. Normalization means translating all of that into a common format before storing it, and that's essential for any long-term analysis. There are a plethora of industrial protocols – Modbus, BACNet, SNMP, WMI being just some of the more common – that ►

Time for
toast yet?



► need a common transport and translating to a common nomenclature before finally turning the actual data into common units.

For example, one power management unit might report data as OUTPUT_CUR, another as DCRAILI, with the first being an integer representing amps and the second a floating point number with tenths of an amp resolution. Within a particular DCIM suite or the manufacturer's own software, this doesn't matter, but to compare the two either in real-time or over an extended operational period, these must be stored with the same name in the same units.

Why bother? Well, there are at least two reasons. Taking an IoT approach will allow you to understand and control your operations through a common set of tools, which should be able to cope with future changes. It will also be useful to your customers, who have an interest in knowing the efficiency of their operations.

Having a common, deep data set, you can easily provide much more information as a service to them, or provide tariffs that reward efficiency while keeping margins. There are already signs of this in the data center market – American colo company RagingWire gives its customers access to a wide range of internal data through its N-Matrix service, with visualization tools to help map their usage of its resources and plan ahead – but IoT will create more opportunities for everyone to develop these ideas.

Once a lot of normalized data is available, new models suggest themselves. You can relate power usage to changes in your workload by combining server reports with electricity meter values or thermal changes, and then use this to drive automated load amalgamation within your data center, or even transfer loads to other sites.

At one extreme this lets entire sections of your equipment be idle, while at the other it can provide early warning of the need for more provisioning. Long-term trend and correlation knowledge is the only way to do this efficiently, and that requires IoT techniques for large data set compilation and analysis.

By bringing more of the machinery of the data center into the overall management system, other savings are possible. Ambient cooling can improve power usage effectiveness (PUE), but it needs filters on the fans that pull in the outside air. And these clog: as regular inspection is expensive, they tend to

be replaced on a regular cycle, whether they need it or not. If the fan units report speed or current draw, dirty filters are easily detected as RPM, or power requirements start to rise – no inspection needed, but much better resource management.

This is also an example of lifetime management, which becomes much simpler with an IoT approach, which not only reduces costs but has significant safety and uptime ramifications. In the same way that hard disk error-monitoring catches not just instances but patterns of failure, more in-depth knowledge of UPS battery conditions and thermal cycling within cabinets can constrain risk and reduce costs.

One of the reasons why IoT is being promoted so heavily is that vendors expect it to provide a single software and hardware integration platform for vertical industries – healthcare, transportation, energy, retail and, yes, IT itself – which have traditionally developed and guarded their own infrastructure fiefdoms. This provides the same economy of scale for industry as the internet has done for information.

Thus, in all areas of industry infrastructure the next generation of smart devices, including those common in the data center, will start to talk IoT protocols, in much the same way that all pre-internet networking standards were subsumed or rendered extinct as the IP-based systems took over.

These standards are already being introduced. Last month, GE and Pivotal announced the development of open-source support for IoT protocols such as MQTT, CoAP and DDS in the Cloud Foundry consortium. Cisco is actively developing MQTT, CoAP and XMPP, and IBM, well, it invented MQTT, while Intel has it at the core of its IoT thrust. On one level, these standards simply do the jobs that older, proprietary protocols did, but this generation of protocols are explicitly designed to work over the internet, to interoperate, to be supported by entire industries, and applicable to the widest range of uses.

The Internet of Things certainly isn't about toothbrushes ordering toothpaste or monitoring your central heating from a beach in Rio de Janeiro. Its first and most abiding impact will be in bringing industry into the internet age.

In many ways, data center management got there first – but there is still a risk that it might miss the next big wave. ●

IoT isn't about toothbrushes ordering toothpaste. It's about bringing industry into the internet age

Standards: a round-up

MODbus – Machine-to-machine industrial control protocol, commonly found in switching or single-variable sensor applications.

BACNet – Building automation standard for access control, heating/cooling, fire and security.

SNMP – Simple Network Management Protocol. Used to control and monitor IP network devices and ancillary equipment such as routers, servers and UPS.

WMI – Windows Management Instrumentation. Microsoft protocol for linking Windows-based management systems together, with very wide adoption in third-party management tools.

MQTT – Message Queue Telemetry Transport. Device data collection protocol aimed at telemetry and remote monitoring of large networks of small devices.

XMPP – Extensible Messaging and Presence Protocol. Originally designed for instant messaging, it's proving popular in the Internet of Things as a way to remotely address devices simply and pass structured messages.

You're the strong silent type?



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Max Smolaks
News Editor



@MaxSmolaksDCD

Upcoming memory at-a-glance

Phase Change Memory

Made by: IBM, Intel, Micron, Samsung.
Expected in 2016.

ReRAM

Made by: Viking Technology, SanDisk, Micron, Sony, Panasonic, Crossbar, HP, SK Hynix.
Expected in 2017.

3D Xpoint

Made by: Intel and Micron.
Expected in 2016.

Racetrack memory

Made by: IBM
Expected - we have no idea, but it will be worth waiting for.

For years, the data center storage landscape has remained fairly simple: you used 7200rpm (7k) hard drives for most of your daily workloads. Demanding tasks asked for high-performance 10k and 15k drives, which were later replaced by flash memory. Barring exotic solutions for especially paranoid organizations, archives were kept on magnetic tape.

Today, the industry has mostly gotten to grips with flash, but the overall growth in storage performance has pushed equipment manufacturers to dedicate more resources to the development of even faster ways to read and write information.

If you thought the transition to flash was messy, complex, full of far-fetched promises and underwhelming delivery, wait until you see what's coming next.

To keep up with the performance of processors – which, as we know, doubles approximately every two years – servers of the future will need fast, non-volatile memory to occupy the position between NAND and DRAM.

DRAM – DDR4 in particular – is really fast, but it's a massive power hog and can't store information once the machine is turned off. Flash can store data without using any electricity, but it is too slow for in-memory databases, and while the latest chips last considerably longer than their ancestors, even enterprise-class flash is only good for about 30,000 read/write cycles before the memory cells wear out.

With this in mind, we list four of the most promising non-volatile memory technologies, two of which are set to appear in enterprise storage devices next year.

PCM (Phase Change Memory) – PCM cells consist of two electrodes on either side of a chalcogenide glass. By applying heat, the glass can be switched easily between an amorphous (low conductivity) and a crystalline (high conductivity) state, changing its optical and electrical properties to record data.

PCM chips last much longer than flash – between 10 and 100 million write cycles. They are also resistant to radiation, unlike flash, which is unsuitable for many space and military applications.

Phase-change memory has been proven to work, but currently does not meet the density and cost requirements for enterprise applications. Intel previously predicted it could become cheaper than NAND memory.

PCM is being developed by IBM, Intel, Micron and Samsung, and enterprise storage devices based on this technology are expected in 2016.

ReRAM – Just like PCM, most types of ReRAM don't feature transistors. Instead, a memory cell consists of three layers: a metallic top electrode, a dielectric

The race for memory

High-performance storage contenders are on the starting blocks. *Max Smolaks* says there will be a shake-up in 2016

switching medium, and a bottom non-metallic electrode.

Rather than trapping electrons like DRAM and NAND, this memory type uses high voltage to either form or break a conduction path through the dielectric medium, thus changing its resistance.

ReRAM consumes less energy than any of its competitors. It also produces less heat than PCM, which means it's easier to build larger-capacity storage devices.

Hamid Shokrgozar, president of Viking Technology, told *DatacenterDynamics* that the manufacturing process for ReRAM is relatively simple and the components are expected to be very cost-effective. He added that microcontroller chips with embedded ReRAM are already on the market, used in consumer products such as home security systems, smoke alarms, and portable blood pressure monitors.

ReRAM is being developed by Viking Technology, SanDisk, Micron, Sony, Panasonic, Crossbar, HP and SK Hynix. It will appear in high-performance enterprise storage devices in 2017.

3D Xpoint – Pronounced 'crosspoint', this is a very recent addition to the alternative storage roster.

According to Intel and Micron, 3D Xpoint relies on layers of switch and memory cell materials that can permanently change their state. The company has denied that the underlying technology is based on PCM or a form of ReRAM, claiming it has invented a completely new type of memory – something that remains the subject of intense speculation online.

What we do know is that 3D Xpoint features no transistors and offers individually addressable memory cells. The technology will be used to produce PCIe SSDs under the Optane brand, followed by a new class of yet-unnamed DIMM storage devices.

3d Xpoint is a proprietary technology owned by Intel and Micron, and the partners



are planning to launch the first Optane devices some time next year.

Racetrack Memory – Racetrack Memory is being developed at IBM by Professor Stuart Parkin, a world-renowned physicist who, in the 1990s, invented spin-valve technology that enabled 1000-fold growth in the capacity of hard drives.

Racetrack Memory writes magnetic information onto nanoscale wires made out of a special alloy, each storing hundreds of bits. The bits are then transported along the wires to the read-write heads using 'spin polarized' electric current, produced by a transistor.

Racetrack memory is still in the research phase and may take longer to reach commercialization than PCM or ReRAM, but the potential performance, endurance and density characteristics here are very impressive.

Earlier this year, Parkin and his team published a paper which confirmed that the project is firmly on track – no pun intended. But exactly when it will produce something that can be put inside a server is anyone's guess.

This is by no means a complete list. It misses such beautiful specimens as Magnetic RAM (MRAM), Spin-transfer Torque RAM (STT-RAM), Ferroelectric RAM (FeRAM), and probably a few others.

The use-cases for faster non-volatile memory already exist, and certain technologies envisioned about 30 or 40 years ago are about to reach maturity. In the next two years, your storage choices are guaranteed to get a lot more diverse. At the same time, we see software-defined equipment helping to unite storage devices into abstract tiers, based solely on their performance characteristics.

Taking this into account, next-generation storage devices will be easy to manage, but that doesn't mean they will be easy to purchase. We are about to enter another 'hype cycle', and considering the number of competing technologies, this one is going to get rough. God help us all. ●

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Michael Mudd
*The Open
Computing Alliance*

There is a lot of concern about the Cloud somehow being less secure than on premise data hosting. If you are describing the dominant full service providers such as AWS, Microsoft or Google, or Cloud DC hosting services such as Equinix, BT or NTT and others, then this is a myth.

DCD Converged upcoming events



DCD Com

We have gone out to the DCD community to find out what you have been doing over the summer and what you are looking forward to taking part in during the next few months

George L Williams
Cummins Power Systems

The show is a great investment, not only from a vendor perspective or as a speaker, but also for networking and peer interaction. The open vendor area and access to meeting areas within the vendor area all promote a more relaxed atmosphere to conduct business, as well as gather information.

Stevan Plote
BTI Systems

DCD provides another view of the key topics in the industry. It is different from the standard set of conferences we normally get emailed and contacted about. I highly recommend this alternative view to the critical topics being addressed in the industry.

Tanja Lewit
Kentix US

You spoke my language – Open Source. Open API IoT... we are a new Open API IoT product, so the future as discussed is now!



TJ Kniveton
Salesforce.com

[Server] consistency and making sure the software can easily control the fleet of servers is the reason why SKUs are important to us.

* SKUs (Stock-Keeping Units) – A term borrowed from the field of inventory management.

Sherrie Brown
Littlejohn
Wells Fargo

My hope is that with cloud computing, infrastructure becomes a less integral part of what it is that we do, and the developer can now concentrate on not worrying about the [infrastructure] environment that the application lives in but what can the application do for customer's businesses.

community

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SPEAKERS:



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Director of Strategic & Solutions
Marketing, CommScope



Ciaran Forde
VP of Global Data Center Business,
CommScope



Henk ten Bos
*Ageas Insurance Company
(Asia) Limited*

The DCD Forum in Hong Kong was very informative. The sessions contained good sharing of vendor solutions and experiences of customers. Four different tracks enabled everyone to prepare a customized program. The DCD app added a nice engaging and interactive element to the conference.



Scott Walker
Jones Lang LaSalle
DCD in Hong Kong for me was a great chance to network with peers, and seeing the new technology and trends in the market was very interesting.

Scott Holgate
Director of Project
Management &
Infrastructure Design,
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Even Margaret Thatcher thought The Chicago Boys allowed the market too much freedom

Planning is a skill

It's all very well planning our future in the cloud but there is one thing worrying me at the moment – our international skills shortage. So while corporate IT spending is still on the up-and-up there is a skills shortage. In the next two years most analysts agree that the burgeoning number of new data center technologies, from the much-anticipated renaissance of data center infrastructure management (DCIM) to the spread of software defined networking (SDN) and network functions virtualization (NFV), will mean that the IT technical workforce in the USA alone needs to expand by 50 per cent by 2016 just to keep pace.

If you look at the skills wars that took place in San Francisco 2006 - 2009 between Google, Apple, Intel Corp, Adobe and others which has just ended in a \$415m settlement, it is obvious that globally we are not producing enough skilled people. You can say it is merely the operation of the market economy but since this particular battle erupted the poaching frenzy amongst these companies has, this year, reached new levels.

Competition for jobs is so intensive that Silicon Valley employers tempt top programmers from rivals with signing bonuses from Apple typically starting at \$250,000 for Tesla staff prepared to jump ship. When I was in the Valley two months ago I was told that Oracle was offering some rival staff signing bonuses of £1m. Severe shortages are bad for employers.

We need to take a leaf out of the German education system which is carefully structured to ensure that people in the system are given the education which they need both as individuals and as members of a bigger society. This means that there is an element of planning which allows educationists to work with government to ensure that German society can avoid major skills shortages.

In the recent Cisco Global Cloud Index Study, 60 per cent of data center operations said that lack of qualified staff was one of the major issues they face.

The free market is fine – but even Margaret Thatcher eventually came to the conclusion that The Chicago Boys allowed the market too much freedom – we need elements of planning and the present skills shortage is showing us that.

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