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July/August 2015 VOL 04 ISSUE 06

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**Design + Strategy**  
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# Upgradeable Rack PDU Intelligence:

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The image shows a close-up of a black PDU chassis. On the left, a circuit board is visible with a yellow component labeled "CIRCUIT 2". To the right, a smart module is inserted into the chassis. The module has a small LCD screen displaying "00 00 00" and the text "UPGRADE READY". Below the screen are three circular buttons with symbols: a triangle, a square, and a circle. The module also has the GEIST logo and the text "IMD-02E" and "Find out more at: [geistglobal.com/upgradeablePDU](http://geistglobal.com/upgradeablePDU)".

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# The Cool Revolution

**W**e're a global publication, but our center of gravity is in the Northern Hemisphere, so in July and August our thoughts turn to cooling. As I write this, London is sizzling, and a blast from an air-conditioner feels like a good idea.

Of course, in data centers the big idea is to cool less and let your equipment run warmer. That way we consume less energy, cut emissions and – maybe – stop the planet from overheating. With London temperatures hitting 30°C, we're actually only as warm as the inlet temperatures that some people are starting to recommend.

**The move to this kind** of temperature is slower than many expected, but in the long term it seems clear that data centers won't be the arctic places they always used to be. But this way, later this century we may still have some actual Arctic left. Read more in our cooling supplement (p37).

If you want cool, though, head to San Francisco with us in July for the DCD Internet event, which this year also includes the StackingIT conference trend. Pulling together all the various parts of the movement to build open, software-defined data centers, this will be a report from the vanguard of a real revolution (p32).

But data centers aren't built in isolation. They have to interact with the authorities, who these days welcome them with open arms – and generous tax breaks (p25). They also have to fend off the attention of malicious hackers, who these days are turning to distributed denial of service (DDoS) attacks to get past the physical barriers around the site (p30).

**But it also takes** people to run a data center, and they need looking after, just as much as the switches and servers. The current recommended working temperature of a server is now considerably hotter than that of a human being, and you can't let your people overheat.

•  
Peter Judge - Global Editor  
@PeterJudgeDCD



29.4°C

Facebook's inlet temperature

*The current recommended working temperature of a server is now considerably hotter than that of a human being*

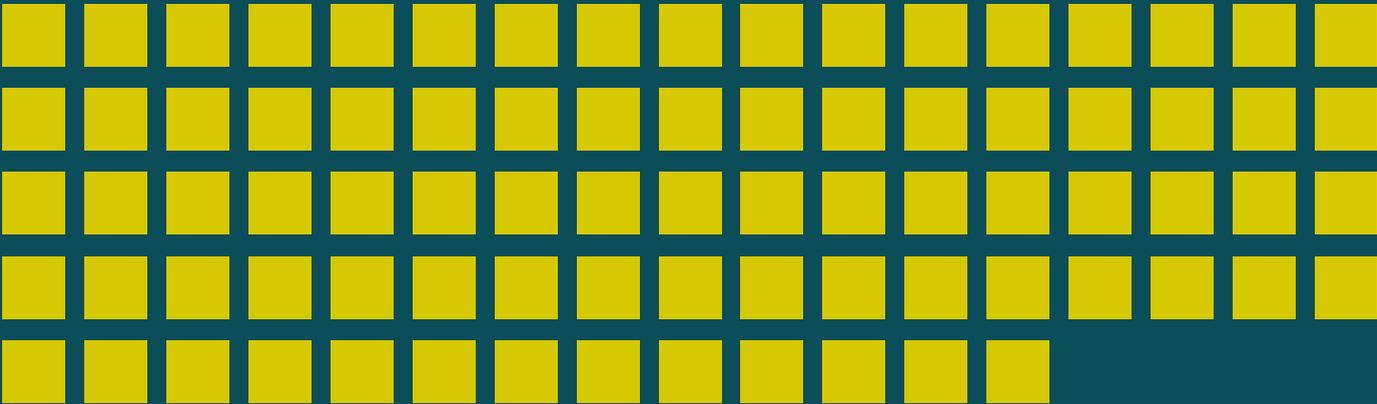
# White space in China

SHARE OF ASIA PACIFIC WHITE SPACE BY COUNTRY, 2014

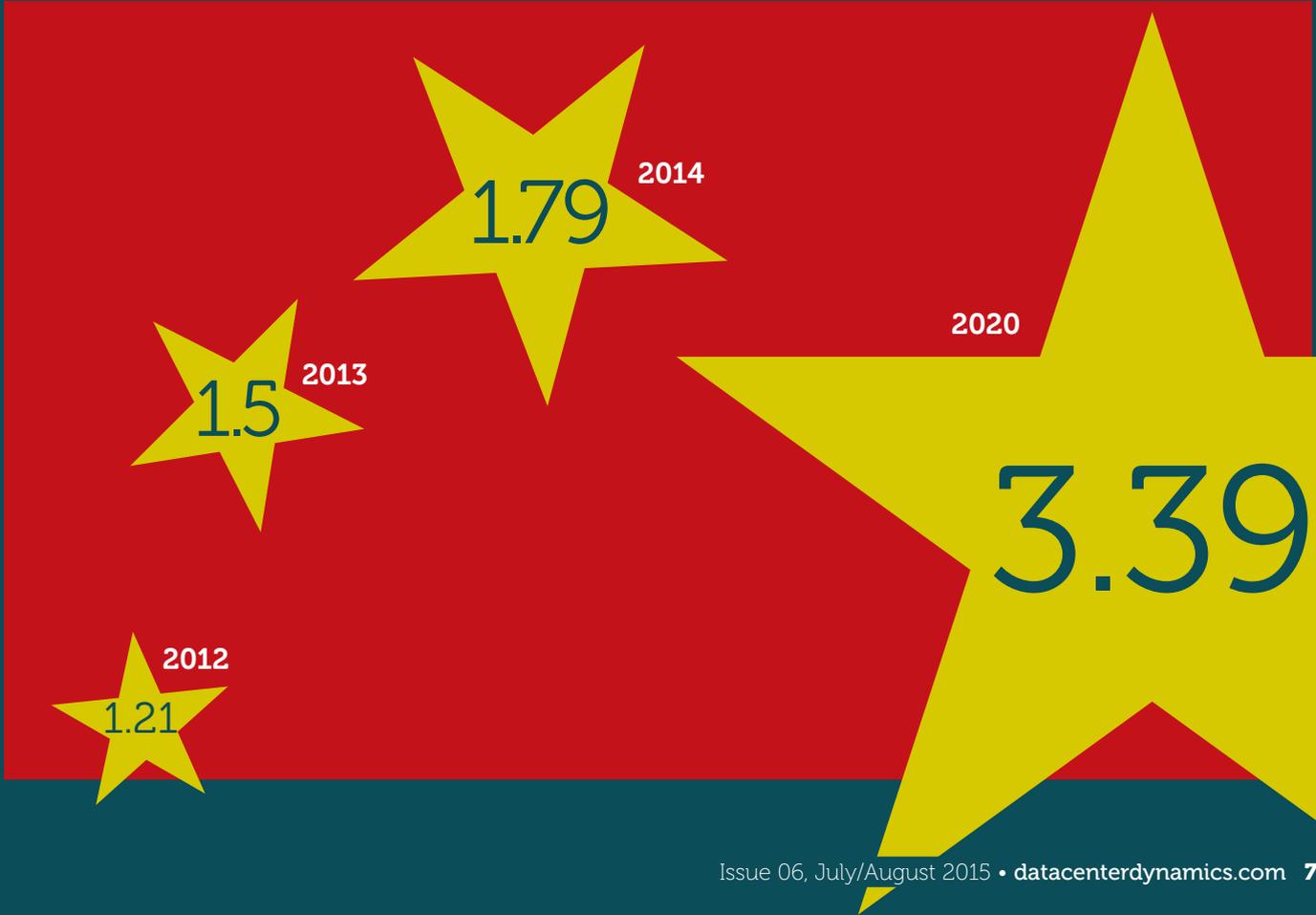
China



Rest of Asia Pacific



DATA CENTER WHITE SPACE IN CHINA (MILLION SQ M)



SG  
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**21Vianet comes to US**

Chinese data center provider 21Vianet has opened for business at Server Farm Realty (SFR) in Silicon Valley. SFR will also build a new Silicon Valley facility for 21Vianet. <http://bit.ly/1eUSBya>

**Oracle takes AWS head-on**

Software giant Oracle has launched cloud services to compete with Amazon Web Services. "You can now move all your applications from the data center and into the Oracle cloud," said Larry Ellison. <http://bit.ly/1Kply2a>

**Raritan spins off DCIM**

Raritan's data center infrastructure management (DCIM) business is spinning off as a separate firm called Sunbird Software as part of Raritan's acquisition by Legrand. <http://bit.ly/1eeuuJG>

**Amazon solar farm deal**

Amazon is paying for an 80MW solar farm in Virginia. The agreement follows the company's 150MW wind power deal in Arizona. <http://bit.ly/1HskFp4>



**Google plans new site in disused Alabama facility**

Google plans to build a \$600m data center in Stevenson, Alabama, on the site of the recently closed Widows Creek coal-fired power station. The facility will buy renewable power and make use of some of the power lines left by the power station.

The data center will be Google's seventh in the US, and its 14th worldwide, and will bring some 75-100 jobs to Stevenson, said Google at the announcement.

Building is scheduled to start in 2016, and will reuse land on the

350-acre site, made available by the retirement of Units 1-6 of the Widows Creek power station.

The shutdown of the local coal-fired generation plants by the Tennessee Valley Authority (TVA) has left the area with a complex of power lines, many of which Google will be able to use to draw power into the new facility. Google said the data center will use power only from renewable resources, but it has so far not been specific about what those sources will be.

While not heavily discussed outside the immediate area, nearby Tennessee will shortly have a new zero-carbon power source, though it will be one that won't suit all environmentalists. The TVA is shortly bringing online the first new nuclear power station in the US this century. Watts Bar Unit 2, in nearby Tennessee, will deliver 1150MW with no carbon emissions.

"Jackson County [Alabama] has the right combination of energy infrastructure and developable land," said Google representative A.J. Jongewaard. We look forward to being a part of this community for many years to come."

The TVA said it is committed to finding jobs for the employees laid off in the power plant closures, but points out that the TVA itself is downsizing and that any available jobs may not be in the local area.

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

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# China looks for profit in its public cloud

In 2014, China's public cloud service providers invested \$1bn in IT but only had a total revenue of \$900m. A Shanghai event examined the urgent issue of how to turn this loss into profit.

In recent years, China's public cloud market has been growing at about 50 percent, but its profitability is poor, said Yao Gang, assistant VP of enterprise research at IDC, speaking at the IDC IT Directions Forum in Shanghai in May.

"Last year, about 45 percent of IT expenditure of China's public cloud service providers served individual consumers in terms of services such as email and network drives, which do not directly generate revenues. And only 55 percent of such IT expenditure serves commercial customers. It is a loss-making market as a whole," said Yao in a keynote speech on the profitability of China's public cloud.

China's cloud market is growing rapidly, but it is still at the startup stage, said Yao: "In 2014, the revenue of

China's cloud market only accounted for 2.4 percent of that of the US, and it is predicted this will reach 3.5 percent by 2018. By 2017, China's IT expenditure will reach 33 percent of that of the US and will exceed Japan as the second-largest IT expenditure country in the world. However, China's cloud revenue will still be less than four percent of that of the US," Yao said.

"IaaS is just another way of selling physical machines via cloud. China's IaaS is becoming increasingly homogeneous, and the practice of winning customers by launching a price war can only lower the profitability of the whole market. However, IaaS accounts for 44 percent of the total revenue of China's cloud market, and it is predicted this percentage will reach 60 percent by 2018. This is the major reason for the low profitability of China's public cloud market."

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## Container rivals create open standard and start acronym war

Potential rivals in the world of containerized software have united to agree common standards. The Open Container Project (OCP) includes rivals Docker and CoreOS and will be managed by the Linux Foundation.

Linux-based application containers package apps and their binaries in individual virtual environments that require less overhead than virtual machines. With various software vendors developing their own implementations of application containers, there is a real danger of fragmentation among the 40,000 public projects based on the Docker format. Docker, regarded as the de facto standard, will be the basis of the project, while CoreOS will contribute standards developed under its own Application Container Specification (APPC) initiative.

The aim is to finish migrating code and publish a draft specification by the end of September 2015. One group that might have mixed feelings is the Open Compute Project, which is already using the OCP acronym.

<http://bit.ly/tSXRSKU> ●



## TeliaSonera builds Finland's largest shared data center

Scandinavian telecommunications giant TeliaSonera is building Finland's largest shared data center in Helsinki. The facility will use 100 percent renewable energy and recycle all of its waste heat. It is expected to cost between €130m and €150m. The data center will begin offering cloud, colocation and "Internet of Things (IoT) aware capabilities" to businesses in Finland at the end of 2017.

The history of TeliaSonera stretches back more than 150 years. Its components – Sweden's Telia and Finland's Sonera – were early pioneers of mobile communications and led the development of the GSM standard. Today, TeliaSonera is the largest Nordic and Baltic fixed-voice, broadband and mobile operator by revenue and customer base. The new facility is intended to satisfy growing demand for cloud services around the Finnish capital, where electricity is cheap and the winters are cold. It will offer initial capacity of 30MW, increased to 100MW in the future.

TeliaSonera Finland's CEO, Valdur Laid, compared the site to Google's data center in nearby Hamina, famed for using seawater for cooling. "From the point of view of Finland's economy, this is an important project. Digitalization plays a key role when we want to improve profitability, and data centers form the foundation for the global digital infrastructure. It is important that this infrastructure is located within Finland's boundaries and that the welfare it generates stays in Finland," said Laid.

Climate conditions often play a key role in choosing the location for a data center, but Finland also prides itself on political stability, respect for privacy, good fiber links to Europe and serious attitudes towards cyber security.

<http://bit.ly/IgznRLG> ●

## Tanzania government pushes cloud



Tanzania is making a bid to become the data hub for East Africa, with the government announcing a \$93.6m data center and appointing Huawei as its advisor.

The data center will be solar-powered with battery backup and have high-bandwidth, courtesy of Huawei, according to Professor Makame Mbarawa, Tanzania's minister for communications, science and technology, speaking at the Huawei Clouds Conference in Dar es Salaam. It will be built in the Kijitonyama suburb of Dar es Salaam's Kinondoni district.

"This will be the best data center for ICT and the IT industry across East Africa," said Mbarawa. Construction is due to start in July, and the center will have high-tech infrastructure to host services from government and business, including telecoms companies.

Mbarawa hopes the center will connect to neighboring Kenya, Uganda, Burundi and Rwanda, and serve businesses operating there. "Cellular network companies will soon no longer depend on other country's data centers, thanks to this center, which will also be used by other East African countries," said Mbarawa. It will have fast fiber connectivity and will be independent of Tanzania's electric grid relying on solar power and batteries.

At the same event, the Tanzanian government signed an agreement with Huawei Tanzania, making the Chinese firm an ICT development adviser to Tanzania. Huawei has been in the country for 17 years, and the Chinese Ambassador to Tanzania, Lv Youqing, said it has favorable conditions to become a local ICT hub.

<http://bit.ly/tLy6PkN> ●

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# Wholesale data center opens in Dallas Infomart

Infomart has opened its own wholesale colocation facility in the long-established Infomart carrier hotel in Dallas, Texas, in a move to broaden its business.

The 24,000 sq ft (2,230 sq m) of colo space is on the fourth floor of an impressive building created in 1985 to offer services to local high-tech firms, with a design based on Queen Victoria's Crystal Palace, which graced 19th-century London.

The tech palace already contains at least one data center run by Equinix. Infomart has tended to focus on networking but is branching out into running data centers after its October 2014 merger with Fortune Data Centers. Its new colo space takes up only a

fraction of the 1.6 million sq ft (148,600 sq m) available in the building. The space and its 3MW of capacity represents phase one of a project that will take the facility to 500,000 sq ft (46,500 sq m) and 40MW of IT power within the next 10 years.

The 24,000 sq ft data center contains 16,000 sq ft (1,500 sq m) of raised floor space and is part of an initiative that Infomart hopes to see resulting in SSAE 16, LEED Gold, PCI DSS and HIPAA certifications, as well as Uptime Institute's M&O Stamp of Approval, achieved within a year.

The \$40m investment is the first wholesale data center space offered by Infomart at this location. While Infomart expects many takers for its services in



north Texas, it is not the first colo in the building. Equinix has over 100,000 sq ft (9,300 sq m) of colo space in four data centers available at this location.

The Infomart building is one of the most connected in the world, with every Tier I provider having a presence onsite, with more than a dozen Tier II and Tier III providers also available. True 2N power is available, with a maximum power density of 12kW per cabinet, and power

costs are passed directly from the provider to the end-user customer, with no markup from Infomart (current cost is approximately \$0.05/kWh).

The facility has been designed with a target PUE of 1.37 and is offering a 1.5 PUE guarantee to its customers. Green initiatives are in place, ranging from LED lighting to low-emission diesel backup generators.

<http://bit.ly/1GVema8>

## TALKBACK



*"Only open source can innovate at the speed to meet the challenges faced by tomorrow's global scale data centers"*

**Alan Clark,**  
Chair, OpenStack  
Foundation



*"There's no doubt that the data center industry is overdue for massive disruption"*

**Cole Crawford**  
CEO, Vapor IO  
Chair, StackingIT



*"A service delivery paradigm shift has emerged for the enterprise with cloud computing"*

**Sherrie Brown Littlejohn**  
Head of enterprise  
architecture, Wells Fargo

Hear from these speakers at:  
**DCD Internet, San Francisco** 30 July  
<http://www.dcdconverged.com/conferences/internet>



\$3bn  
OpenStack global  
revenue in 2018  
(451 Research)

# OpenStack's Blue Box and Piston bought by giants

OpenStack, the open source cloud platform, has lost two of its independent players, as Cisco and IBM have bought into the growing movement.

Network giant Cisco bought OpenStack provider Piston Cloud Computing to beef up the Intercloud hybrid cloud strategy Cisco launched in 2014. Meanwhile, IBM bought private cloud provider Blue Box.

Cisco said the acquisition of Piston would bring more experience to bear on Cisco's OpenStack-based private cloud. Piston has its own OpenStack distribution, as well as proven ability in automated deployment of the open source cloud platform. Founded in 2011 by Joshua McKenty, Piston was one of the co-inventors of the concepts behind OpenStack

while working at NASA. He helped create the Nebula compute platform, which is a key part of OpenStack.

IBM stated that its purchase of Blue Box was intended to add OpenStack expertise: the 12-year-old service provider offers a simple private cloud platform, and IBM hopes this will help it deploy services quicker and more simply.

Built on OpenStack, Blue Box will become part of the Bluemix managed cloud service built on Cloud Foundry.

Around 72 percent of organizations are expected to run hybrid clouds this year, according to Gartner research, and IBM and Cisco both need skills to support this demand, with OpenStack sitting alongside other clouds, both public and on-premise.

Like Cisco, IBM already has expertise with the OpenStack open source cloud platform, but Blue Box brings its own remote management offering, which should help with those hybrid implementations. IBM now has 500 developers working on open cloud projects and claims to have twice as many customers on the IBM private cloud platform as the next closest vendor, according to Forrester Research.

IBM claims cloud revenue for public private and hybrid deployments was \$7.7bn over the year ending in March 2015; having grown more than 60 percent in Q1 2015, IBM's cloud service business is based on its purchase of SoftLayer and the rollout of data centers worldwide.

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

## VOX BOX / DCD VIDEO



Steve Ichinaga  
President  
Hyve Solutions

### How does the Open Compute Project work?

Our business came out of Facebook and the Open Compute project. You customize everything – from how you source the product to how you deliver the product. What the big guys want is what you do, and the big guys are what validates the concept. You can't put the genie back in the bottle.

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



Christian Kaufmann  
Director of network  
architecture  
Akamai

### Is efficiency important in an edge data center for content delivery?

Efficiency is important, but in general it is more important to be closer to the end-user and have a certain performance. Iceland has green energy and cooling, and it is cheap, but it is far from your home – unless you live in Iceland.

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

## UK's Slough booms as IO arrives and CenturyLink expands

Modular colocation provider IO has opened a UK data center in Slough, with Goldman Sachs in place as anchor tenant. Meanwhile, CenturyLink has expanded its facility in the UK's data center capital.

IO's 10,000 sq m (100,000 sq ft) site can have up to 20MW of power in its first phase, and is only the company's second site outside the US. Financial firm Goldman Sachs is a long-term partner, and was already the initial tenant in IO's sites in New Jersey and in Singapore. This opening is a sign of the company's ongoing commitment to expansion, enabling it to serve its global customers in one of the fastest-growing markets in the world. As is to be expected with IO's modular model, the site was mostly a giant empty hangar when *DatacenterDynamics* visited. Modules will be created as customers demand them in the Arizona factory of Baselayar – the modular hardware firm that IO spun off as a separate company last year.

The IO data center is designed to Tier III standards and currently has power for a quarter of the space in the hangar. Inside there is a row of "show" modules in one corner, installed on the raised flooring required by IO's water-cooling system, and a row owned by Goldman Sachs in another corner, sitting lower to the ground and using a free cooling system, which Goldman requested.

Meanwhile, CenturyLink has added more capacity to one of its Slough data centers, while also adding support for the open source Cloud Foundry Platform-as-a-Service (PaaS) offering from Pivotal.

An extra 2.4MW of power and 39,000 sq ft of space at the LO5 data center, one of two CenturyLink facilities in Slough, will support more colocation customers.

By offering the racks and the cloud, CenturyLink simplifies support and service, said David Shachochis of CenturyLink. "We are one throat to choke," he said, before correcting this to the more complimentary "one back to pat."

The extension to LO5 doubles it, so it can go up to 4.8MW, with 119,000 sq ft of floor space. CenturyLink has five data centers in London, and its provision in this country is largely based on what it acquired when it bought Savvis in 2013.

<http://bit.ly/1BQV9qZ>



### Belfast fire cuts BT off

A fire at a BT data center in Belfast disrupted internet services in Northern Ireland for a day. The fire started at 6am on 24 June in a comms room on the fourth floor of BT's Telephone House. The data center floors lost power and connectivity, but were not directly affected by the fire. The cause is believed to have been an accident affecting the power supply to that room, and the circumstances have been described as "not suspicious." Network fibers were undamaged, and services were restored after a day's disruption. Six fire engines and an aerial appliance were called to the fire, which was put out by eight firefighters who entered the building.

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

### Asia invests in UK Virtus

Singapore-based investor ST Telemedia has bought a 49 percent stake in UK data center provider Virtus, forming a joint venture with Virtus's existing owner, Brockton Capital. The investment will fund growth for Virtus in the UK, adding data center experience from ST Telemedia, which has been investing in data centers and telecoms since the late 1990s, when it began to develop internet exchanges in Asia. ST Telemedia launched a data center arm – i-STT – in 2000, which merged with Equinix, making STT the largest shareholder in Equinix, until it divested from the company. It has also invested in Savvis (now CenturyLink) in the past.

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### Telin-3: in brief

- The data center will have a gross floor area of 20,000 sq m (215,000 sq ft)
- It is the first plot of land awarded in the landmark Singapore DCP
- When complete, the site will have 16.8MW dedicated for the IT load
- Designed to meet the Threat and Vulnerability Risk Assessment (TVRA) guidelines adopted by the Singapore Monetary Authority (MAS) for financial organizations



# Telin tales in Singapore

Asian telco Telin says that building in Singapore's Data Centre Park will plug it into the heart of the Smart Nation initiative. *Paul Mah* investigates

**T**elekomunikasi Indonesia International (Telin Singapore) recently started work on a new five-story data center and telecommunications hub at the Singapore Data Centre Park (DCP) in Jurong. To be built on an 8,000 sq m (86,000 sq ft) plot of land, the new Telin-3 data center will have a gross floor area of 20,000 sq m (215,000 sq ft).

Telin already has a data center in the east part of the island, by Changi Airport, and a private area within Global Switch's data center at Tai Seng. Interest is high in Telin-3, however, because it is the first plot of land awarded in the landmark Singapore DCP – a project that has suffered from delays.

As with practically all multistory data centers, Telin-3 will see the majority of plant equipment for power and cooling placed on

the first level, while the data center floors will be housed on levels two through five, says Freddi Huang, head of network engineering and operations at Telin Singapore.

The first stage will see 4.2MW, and the first data center floor on level two will be ready for operation in Q3 2016. Telin-3 will be able to support ultra-high power requirements of 20–30kVA, but only after careful planning on the cooling front; in-row and in-rack cooling may additionally be needed.

**According to Huang,** Telin-3 will have 16.8MW dedicated for the IT load when it is completely built. Telin Singapore will connect its Changi data center with Telin-3, Tai Seng and other major points of presence in Singapore using its own fiber infrastructure. Projected to be ready at the same time as Telin-3, these links will be built using the latest

Photo courtesy  
Jakarta Globe



cor wavelength within a fiber-optic strand.

Supporting 100Gbps from the start instead of aggregating 10Gbps links gives more headroom for future expansion, Huang says: "I think the key thing about the data center is that it is not about the building – but it is well-connected to the rest of the world."

Plans are afoot to get Telin-3 certified for Green Mark Platinum when completed, with a PUE of 1.5 or better. It will be one of the few

data centers in Asia designed to meet at least Uptime Institute's Tier III and Tier IV standards, but it will also offer Tier II and Tier I standards to organizations that don't need the redundancy offered by the higher tiers. Does that mean

Telin Singapore is targeting customers from the lower end of the spectrum? It's more about offering choice, says Huang. "With multi-tier, customers can put their less-critical applications in the lower tier, which gives them long-term cost savings."

**Basically, it's about delivering** what customers want at a competitive rate, rather than picking up accreditations that justify a

premium rate – even if customers do not need those features. Huang says Telin Singapore customers could be granted direct DCIM access to uninterruptible power supply (UPS) and air-cooling systems.

Telin-3 is designed to meet the Threat and Vulnerability Risk Assessment (TVRA) guidelines adopted by the Singapore Monetary Authority (MAS) for financial organizations, says Huang, and is expected to join the handful of TVRA-accredited data centers when it is ready. Of course, it is not the only provider with networks to offer. I-Net Singapore recently announced its Data Center Corridor initiative, and is leasing capacity from Epsilon and KVH to interconnect data centers in the region at 1Gbps or 10Gbps. Similarly, AIMS in Malaysia is using dark optical fiber within Cyberjaya to connect participating data centers at 10Gbps.

**So, why did Telin** build in the Singapore DCP? Because of the infrastructure available within the DCP itself, the access to power substations, and the telecoms infrastructure piped in company, explains Huang.

The DCP also has implicit endorsement from the Singapore government, known for its meticulous, long-term planning. Huang says that building a data center there is akin to plugging into the heart of the Smart Nation initiative currently championed by Singapore's Infocomm Development Authority (IDA).

Finally, Singapore is a strategic hub for connectivity to Indonesia, since most of the subsea cables from Indonesia land in Singapore. The massive population of Indonesia creates huge opportunities when combined with Singapore's hyper-wired population, which

can now get 2Gbps internet connectivity, with trials of 10Gbps 'fiber to the home' internet service already announced. "I think we need to build adequate capacity," says Huang. "The growth will be there, primarily because this is Asia Pacific. The penetration of

the internet is contributing to the demand for data centers." The Smart Nation initiative will also need servers and applications in place, says Huang. But what about the danger of a supply glut? "I don't think that demand will shrink, looking at how people talk about storage, content and storage as a service," says Huang.

So, will Telin Singapore need a fourth data center any time soon? "I think we will definitely keep moving on," says Huang. ●

*Customers can put their less-critical applications in the lower tier and get long-term cost savings*



**Freddi Huang,  
Telin Singapore**

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**C**olombia's recent political and economic stability has allowed the country to cook up a healthy demand for data center services, and now everyone wants a piece of that cake.

The number of square meters of data center in Colombia will grow 12 percent this year, while investment will grow at 17 percent, according to DCD Intelligence. But within that, there's a more important figure – a 29 percent growth in service providers' data centers. Major players opening data centers have included Telefónica, IBM and leading Colombian telco ETB.

This growth reflects the increasing maturity of a market that is seeing increased demand for infrastructure, with high levels of reliability and availability. Dairo Ortiz, senior product manager for data centers at BT Latin America, says Colombia still has to catch up with other countries in the region, such as Brazil, Chile and Mexico, which have experienced very rapid growth in data centers, along with the rest of their economies.

“Unfortunately, in my experience this development has been a little behind in Colombia,” says Ortiz. Three years ago, customers were not asking for certifications, and the infrastructure looked very different.

Since then, new suppliers have helped the market evolve, and Ortiz believes 2016 will see a particularly high growth in white space: “Customers expect a wider choice of white space – in quantity and also in quality.”

**Nilson Aranguren**, data center product specialist at Level 3 Communications, agrees: “The demand here is high – there is much competition and many suppliers. In fact, there are several with plans to build one or two more data centers in Bogotá.”

For this reason, BT has launched Naos, the first data center in Colombia to get Tier IV certification for design and construction.



**Virginia Toledo**  
Editor LATAM

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## Sweet success

Everyone wants a slice of Colombia's data center services market, says *Virginia Toledo*

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Located in the Tocancipá Free Zone, 40 minutes north of Bogotá, it has 1,400 sq m (about 15,000 sq ft) of white space and over 6,000 meters (65,000 sq ft) of built area. BT picked the location with an eye on distance to the city, travel times and costs of connectivity.

Distance matters, as it allows data center replication. Tocancipá is about 40km north of Bogotá, a similar distance to that between BT's existing Tier II and Tier III data centers Fontibon Free Zone, south-west of Bogotá.

The client can have a main data center in Bogotá and an alternate one in BT Naos, or have two data centers in other locations, and meet the best international practices for separation between replicated centers, providing reliability without adding to staff travel time, as would be the case if the second site were in another city.

BT Naos is connected by its own fiber, offering lower cost for high bandwidth. To gain tier certification, it also has two continuous energy sources: one provided by the Energy Company of Bogotá, and one from 18 redundant on-site generators. The market still needs educating, says Ortiz. "The real challenge has been that customers in Colombia are not yet fully aware of the benefits of dual Tier IV certification."

**Tier certification** was initially held up by a misinterpretation of Colombia's power regulations, which say you cannot have two different energy suppliers, Ortiz explains, but BT found an obvious answer: "We solve the issue with our own generating plant."

BT Naos uses a hybrid cooling system that combines chilled water and free cooling, and the design predicts a PUE of 1.4. It is not expected to reach this figure until the end of

2015 or early 2016, when the site will reach 50 percent load. To make the best use of cooling BT has divided the center into two rooms to allow large customers to be kept separate.

**The need for backup** is a sign of maturity, says Nilson Aranguren, data center product specialist at Level 3 Communications. Level 3 is planning a smaller data center in Cali that will offer colocation for that region. "The data center of Cali is intended more for cloud and colocation hosting, as an alternate main center to Bogotá," says Aranguren. "I would say it will be around 70 percent colo."

Cali will be a Tier II facility with 100 sq m (about 1010 sq ft) and 20 racks. With a PUE of around 1.8, it should be operational by October. It joins Level 3's network, which includes the recently expanded Tier III flagship, Colombia 15, located in Bogotá with 1,700 sq m (about 18,000 sq ft) in three rooms.

Mexico's America Móvil, which operates in Colombia under the Claro brand, expanded its Triara data center in Bogotá with 2,200 sq m (around 2,400 sq ft) of white space. The first 600 sq m is operational and 40 percent occupied, says lader Alberto Maldonado Robles, corporate director at Claro. Triara was designed for the Level 4 certification – certified high-security data center – of ICREA (International Computer Room Experts Association) but is aiming for Level 5, the world-class level. Claro has improved energy efficiency, says Maldonado, with the use of free and intelligent cooling: "We also have aisle enclosure and real-time monitoring of UPS batteries, which gives us great security from the point of view of availability."

With this level of activity, it seems Colombia really is a tasty dish. ●

# 17%

Investment growth in data centers in Colombia this year

## Free Zone Tocancipá

- 30,000 sq m for data centers
- 13,000 sq m committed
- Two-year operation
- BT Naos already in operation
- TV Azteca Communications close to construction
- Global Technology Services (GTS) is already planned
- Two more expected by the end of 2015



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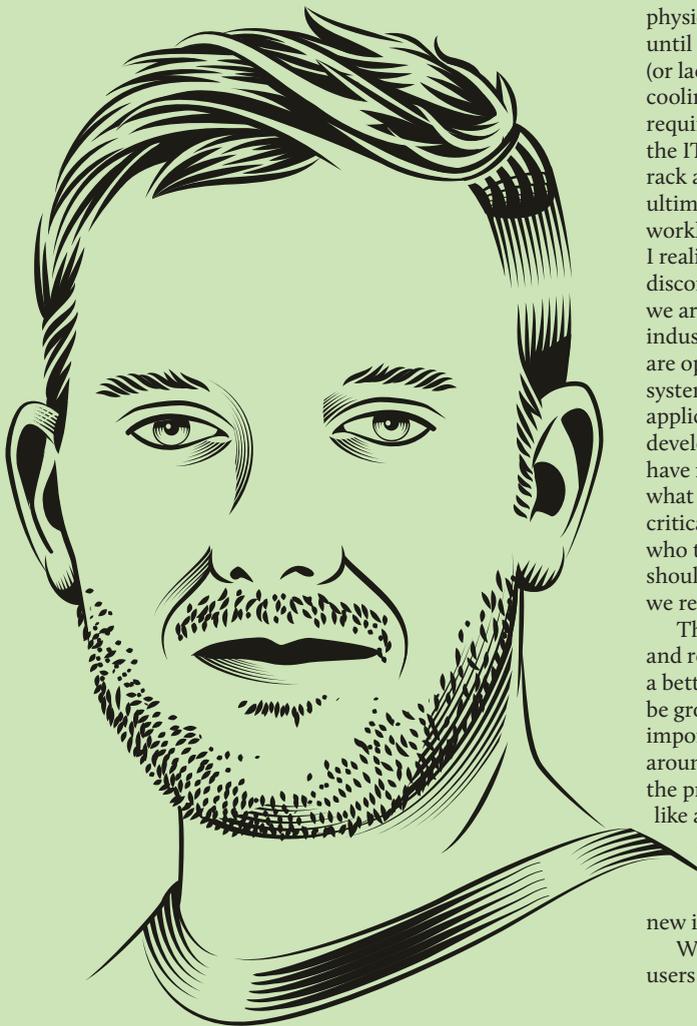


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# Nothing to fear...

Change is coming, and it will threaten the data center's traditions, says *Cole Crawford*



**T**here's no doubt the data center industry is overdue for massive disruption – and the changes that hit will be about performance, efficiency and cost.

Look at what OpenStack has done to cloud orchestration, and what Open Compute has done to hardware. These are two shining examples of change brought about by lowering the barrier of entry and increasing return on investment (ROI) for the data center industry.

**As this paradigm** shift occurs we must each step outside of our narrow field of view. I spent most of my professional life well north of the rack, up in application and OS land. When I first had to learn about the IT infrastructure itself, I thought I'd finally know how the physical data center acted. It wasn't until I understood the relationship (or lack thereof) between the cooling/facilities management requirements, the IT gear/rack and ultimately the workload that I realized how disconnected we are as an industry. There are operating system and application developers who have no clue what PUE stands for, and facilities/critical environment personnel who think REST means they should take a nap. This is an issue we really need to overcome.

These changes are inevitable, and really will make the world a better place, but there will be growing pains and the only important questions will revolve around how long and how painful the process of change will be. Pain, like attractiveness, is subjective and relative, and who gets hurt will depend on how quickly the industry adopts new ideas and improvements.

While vendors sink or swim, users will need a strategy –

something I personally define as hedging a good bet. Users need to understand their options and pick the winners they think have staying power. The only real insurance policy for users is to make sure they have options when it comes to where and how applications are served up to the world.

As much as I love public cloud, I'd never put all my workload there. I prefer to be the master of my own destiny, and one can't do that unless they own the policies and procedures associated with where and how their application should live. Data center owners and managers need to embrace the things that will save money for their customers and lock them in by the quality of the service offering, not through gratuitous differentiation.

**The reality is** that current economics aren't making much sense for new data centers outside

of strategic industries and verticals. For the rest, moving from carrier-neutral colo to carrier/vendor-neutral cloud is a very positive move.

As the pendulum of IT swings back and forth, some

data center traditions give historical evidence that an approach will work. For instance, IBM first invented virtualization in the 1970s, and we've now been deploying scale-out infrastructure clouds for decades.

To see where this is all heading we must listen to the thought leaders, because they are driving the decisions that business leaders are making. Change will not always happen in the same way – it's never all top down or bottom up. Add in where in the stack it starts from, and you have a three-dimensional issue trying to pinpoint something that will happen organically. In the end, the only universal constant is change – and you have to embrace it. ●

*As much as I love public cloud, I'd never put all my workload there*

# In the flash storage petting zoo

When *Bill Boyle* went to Silicon Valley to meet Micron, he expected revelations about flash storage – he didn't expect an invitation to the petting zoo...



**Bill Boyle**  
Global Managing  
Editor

 @BillBoyleDCD

**F**lash storage probably holds the most promise of all the new technologies to hit the data center in decades. In the same way that virtualization transformed the data center landscape, it looks as if increasing amounts of flash storage will be installed in every data center over the next decade – its performance, small footprint, power and reliability are such obvious benefits that they cannot be ignored.

The three most talked about trends of the moment are flash storage, software-defined anything and open source architecture. Together, however, they could provide a new way of building data centers.

Micron is at the center of this – it produces NAND flash chips, which can be written and read in small blocks (or pages). The company packages these chips into solid-state disks (SSDs) and PCIe flash cards to be added to servers and storage units in data centers, as well as in laptops and other systems.

The semiconductor market is bitterly competitive, and when we visited Micron in Silicon Valley it had just reported a three percent drop in revenue year on year in its quarterly results. The company says the dip is due to falling PC demand, and will be made good by its data center activities, as well as ambitious plans to expand into mobile.

**Micron is incorporating** improved chip manufacturing technology, moving from planar multi-level cell (MLC) flash to 3D triple-level cell (TLC) flash, with quad-level cell (QLC) on its way. The chips are currently made with 16nm technology, and Micron wouldn't say when this is likely to change, or to what process scale, but there is a prospect of faster, larger devices: Micron says 50TB SSDs could be on the way, and the next generation should allow for high-capacity in-memory applications.

Micron has set up a storage business unit (SBU), led by Darren Thomas, to go



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beyond selling chips and standard SSD/PCIe components: “We are not concentrating on the vendors – we are aiming at the big finance houses and super-users,” says Thomas.

He explained that 3D NAND enables the highest-density flash devices ever developed and that they are more efficient, engineered to achieve better cost efficiencies than 2D NAND.

Micron believes the new architecture offers better performance and endurance, beating the characteristics of spinning disks.

Storage specifically designed for the data center is in development.

Flash is only four percent of the storage market at the moment. It's generally felt that price holds it back, but Micron's vice president of storage marketing, Eric Endebruck, says it's more about the software layer. Micron is working with Oracle, VMWare and others to incorporate flash, says Endebruck.

The company says it has developments in the pipeline for the next 12 to 14 months that will change the way the industry views flash storage. It talks of the “servification of storage,” and contends that the move to scale-out architectures is forcing cloud operators to use flash.

Some markets are moving faster, says Rob Peglar, vice president of advanced storage at Micron's storage business unit: “The vertical markets

we are most interested in are commercial laboratories and high-performance computing, electronic design and automation, financial services, especially high-frequency trading and hedge fund management companies, the life sciences, media and entertainment, oil and gas, and video surveillance.

**And Micron** most definitely wants to be out of the ghetto of storage subsystems, says Thomas: “We're taking a very hard look at taking Micron into the systems level. Watch this space.”

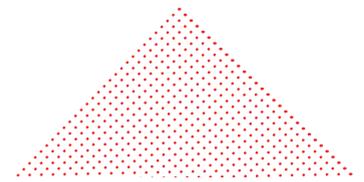
During our visit, Micron showed us its ‘petting zoo’. It's basically a tech playground, where developers play with new-generation products. In the zoo, we saw the ‘superbox,’ a high-performance, high-density iSCSI proof-of-concept demo server. A 1U rack-mounted box, it features an x86 CPU with 64GB of RAM, running Linux, and 12 x 8TB SSDs. The 96TB server delivers two million IOPS with over 15Gbps of bandwidth. Micron wants to deliver 3D TLC NAND in fast modules, with lower-cost 3D QLC for the flash vaults. Micron calls them ‘tubs,’ while others call

them ‘data lakes’ – such is the mangling of the English language by the eternal IT marketing machines. But whether they are tubs or lakes, the data pools that Micron wants to help us store and use are big enough to drown in.

Micron has a big jump to move from the small animals of its ‘petting zoo’ to the big beasts in the data center. But if it works, the future may be very flash indeed. ●

*We're taking a hard look at getting into the systems level. Watch this space*

**Darren Thomas**



# 50tb

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# If the sweet goes sour...

US states are competing for data center business, offering inexpensive power and tax incentives to attract major corporations. *David Chernicoff* wonders if the sweetheart deals are too generous



**David Chernicoff**  
US Correspondent  
@DavidChernicoff

**H**ey, governments – have I got a deal for you! You give me millions in tax breaks that extend over the next decade or more. Make sure I don't pay property tax on millions of dollars' worth of equipment I'll be buying. Negotiate a sweetheart deal with the local power company, and smooth the permitting path for construction and operation of my business. In return you'll get some short-term construction jobs, a few high-paying tech jobs, and twenty or so midrange tech salaries. Presuming, of course, I don't decide to go lights out with my facility, in which case you'll get a bunch a security jobs and very few tech jobs. But, most importantly, you get to tell everybody that, for this deal, I picked you!

**To many standing** on the outside of recent data center location decisions, this certainly seems to be the process – communities giving away the near term, hoping to cash in on the end benefits of building a data center in their locale. But if – as many politicians and community leaders justifying these deals will say – the greatest benefits are in the intangibles, then what's the point in mortgaging the future tax base of your community in the hope of an ephemeral benefit?

Supporters can point to a number of projects that have drawn significant attention. When Apple started building in North Carolina, it was likely attracted by the region's relatively inexpensive power, but was persuaded to sign by real estate and ►

► property tax reductions for very little in return. Using the Apple deal as leverage with the local government, Google and Facebook also built data centers in North Carolina. Even non-technology companies have selected North Carolina: housewares retailer Bed Bath & Beyond announced a project worth almost \$40m that would open in 2018.

**Inexpensive power** has helped to attract data centers to other locations, such as Oregon, which has also drawn in Google, Apple and Facebook. Iowa's tax breaks – along with potentially inexpensive power and proximity to the fiber connection that runs cross country – have attracted Microsoft, Facebook and Google.

But even with all this building, new data centers are not contributing greatly to solving unemployment, and due to the rural nature of many of the communities selected for development, unemployment is always a major issue.

One of the few data center buildouts that has seen a direct impact on employment figures is Amazon's building in central Ohio. Amazon promised 1,000 jobs when the project was finished; it has not reached that goal, but there are far more Amazon jobs available in the region now than there were before the decision to build there was made.

But Amazon has an advantage that almost no other data center builder can meet: it also builds huge warehouses to meet customer demand for product. It is currently focused on same-day and two-day delivery, and the central Ohio region where the data centers are being built turned out to be quite suitable for the construction of warehouse facilities to serve this.

It should also be noted that the tax abatements offered by state legislatures differ widely, often because of existing regulation. Iowa, for example, does not automatically

assess property tax on business furnishings and equipment. Neither do 10 other states, but of those only Ohio has seen significant data center development.

Many of the statutory tax abatements have specific sets of rules, almost all defining the minimum investment necessary to qualify for the abatement offered, but not all require job creation as part of the project. Of those that do, even the most onerous only require the creation of 50 jobs. And of those that do require job creation, almost none provide direction as to the type of job created.

On the flip side of the coin, there are locations that have done little or nothing to attract data center development yet see more than their fair share. California has done little to make the state a desirable place to build a data center, yet there are quite a few significant facilities, primarily owned by tech companies with significant local presences, that want to keep a data center close at hand.

New Jersey, one of the 11 states that exempts assessments of business furnishings and equipment, is seeing quite a data center renaissance, driven primarily by its location in the center of the famed, heavily urbanized Boston-Washington corridor, and its ability to deliver primary and secondary data center services to one of the most densely populated business regions in the world.

Phoenix has used tax breaks to make itself a mini New Jersey, from the perspective of data center operators. The city's tax breaks for data centers make it attractive to develop there, but even with the tax abatements, it is the proximity to California businesses, and their need for primary and backup/disaster recovery facilities, that made this high desert location most suitable.

Loudoun County, Virginia, made similar inroads to getting data centers built; it offers tax breaks and a location that offers

convenient access to the Washington, DC area, and to the US hubs of major international network connectivity points.

**Though rarely spoken of** in the glowing terms as the headline investment, we do find one consistent benefit. Data centers have very little negative impact on the locations where they are built, and often provide significant infrastructure upgrades that are required for construction or operations. More than one data center location has had to build improved roads and supply an upgraded electrical grid.

They also have a smaller ongoing impact; they aren't running 40-ton trucks over the roads on a regular basis, they don't contribute to local traffic problems, nor do they add to potential overcrowding in local schools since the employment may only bring in a few new people to the area for ongoing operation.

If anything, the most difficult thing about data centers and tax breaks will be how politicians explain to voters why they granted the seemingly huge amount of corporate largesse. When the facilities are complete and the construction hubbub has died down, local residents see buildings occupying huge swaths of land, with little or no traffic, which makes them a major contrast to the large manufacturing concerns of yore. The numbers that are thrown around relating to data center investments are huge; the funds that make it into these smaller rural communities, where many of these projects end up, are minuscule by comparison.

The tax incentives are what made some of these locations the preferred choice; should they dry up, however, corporations won't hesitate to move, placing their data centers in the optimal locations for performance and efficiency. For most of these heavily abated installations, those locations will be elsewhere. ●

*Amazon has an advantage: it builds warehouses to meet customer demand for products*

**Missouri: show me the money**

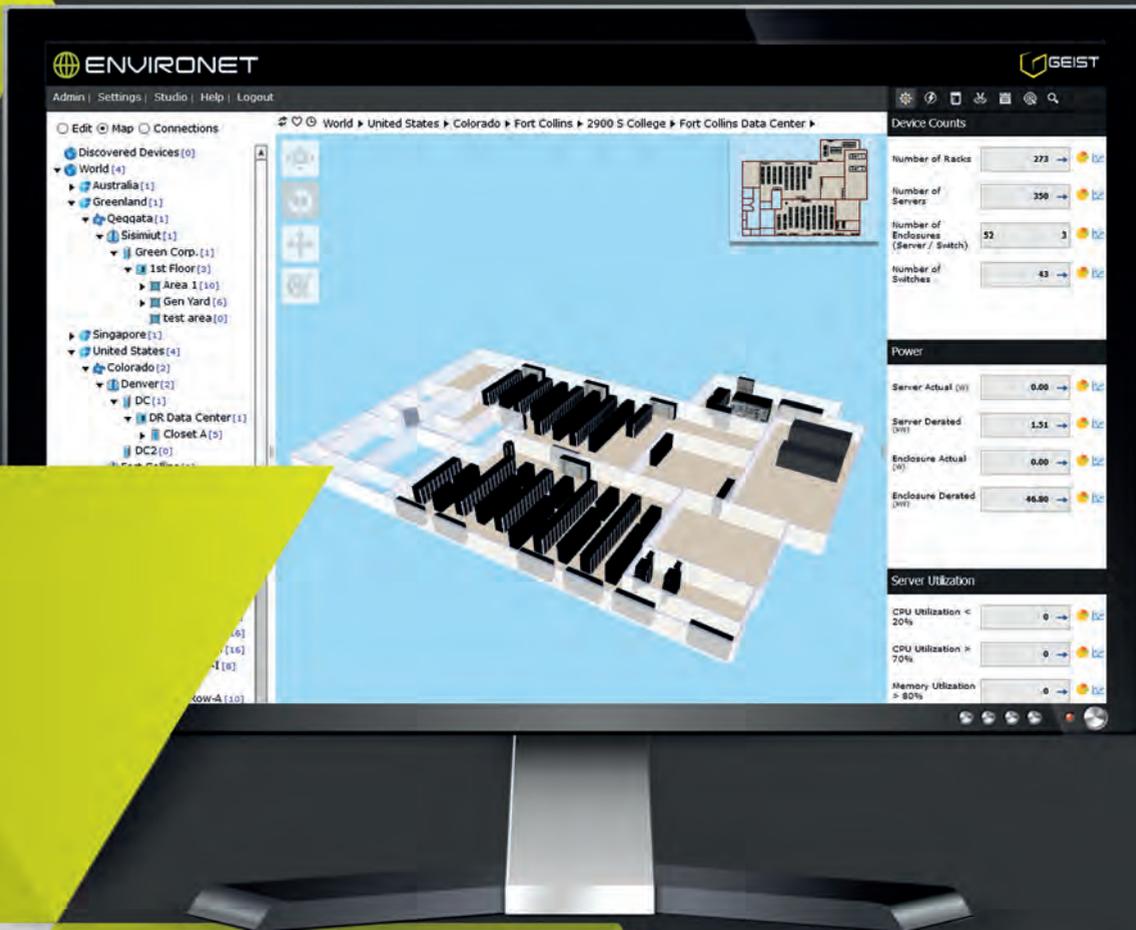
Every state has its own approach to attracting business. To qualify for state and sales tax exemption in Missouri, a data center operator must

provide at least \$25m in new investment, creating 10 new jobs, lasting at least three years, and paying 50 percent more than the county average.

It's not just for new builds – upgraded data centers have to put in \$5m of new investment and create at least five higher-paying jobs, lasting for two years.



# DCIM Environet: The whole picture through a single pane of glass





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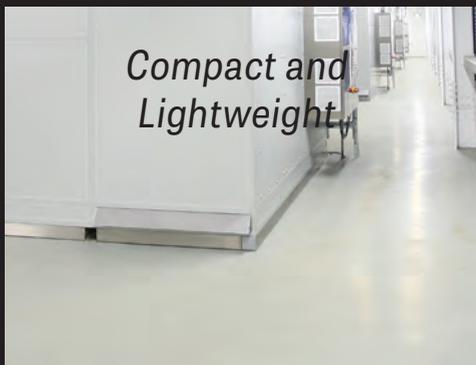
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Innovation  
First



# I'm afraid of Watson

Pundits are scared of AI. Max Smolaks only fears IBM's Watson

**A**rtificial intelligence is a hot topic. Sure, we've been talking about it for decades, but with the latest advances in machine learning and natural language processing, we're on the verge of a breakthrough.

So close, in fact, that some enthusiastic salespeople are jumping the gun. Being a part of this industry, you'll have seen announcements that one product or another delivers a functional AI. Empty promises, of course – we've yet to see a single computer system to conclusively pass the Turing test.

None of these products intimidate me – except one: IBM's Watson.

**The Watson** cognitive computing platform was developed with a specific goal in mind – to win *Jeopardy!*, an American quiz show, where participants are presented with answers and must phrase their responses in the form of questions.

That's not a Turing test, but it's a good demonstration of language ability – and in 2011, Watson managed to beat two of the best players in the show's history and walked away with one million dollars. The academic project was deemed a complete success.

And then, in January 2014, IBM announced it was creating a separate business division around Watson. That's the same month it agreed to sell the entire x86 server business to Lenovo. So what is it about cognitive computing that makes it more valuable than IBM's System X server range?

The software platform for *Jeopardy!* was built around IBM's Power silicon and a 4TB "brain" which, among other things, stored the full text of *Wikipedia*. Watson was designed to mirror the cognitive process of human beings. First it needs to collect raw

information, assembling what IBM calls "a corpus of knowledge". The information is then pre-processed to expose patterns and connections in a process called "ingestion".

Next, Watson needs to be trained by a human expert to learn how to interpret this data. The expert loads question and answer pairs that become the basis of Watson's decision-making. This ongoing feedback process will define the system's future use – is it going to be healthcare, retail or finance? At this stage, Watson can begin to adapt to different languages, different cultures, learn the jargon and how to avoid the common mistakes. Only then is it ready to assist humans.

Just like us, Watson has to specialize to master a particular field. And like humans, it needs to constantly learn from others in order to become smarter, better-suited to the task at hand. This creates a large degree of flexibility, when compared with the rigid logic of conventional computer programs.

The first commercial application of Watson was announced in 2013, and it shows just how serious IBM is about AI technology. The system was deployed to help diagnose cancer patients and choose the best form of treatment, taking into account their medical history, advances in research and clinical trials.

With enough training in watercooler conversation, will the same system be able to deceive its opponents into thinking it is human, passing the Turing test?

IBM has a history of playing games to prove a serious point: in 1997 it developed Deep Blue, the first computer chess-playing system to beat a reigning world champion. Deep Blue forever changed the way we look at computers. Watson is here to finish the job. ●



With enough training in watercooler conversation, will Watson be able to deceive us into thinking it is human?

**T**oday's commercial data centers are under attack, and in the worst possible way – distributed denial of service (DDoS). Denying services to customers strikes at the financial heart of a commercial data center, especially now when most operators are guaranteeing clients 100 percent uptime.

There are various types of attack, but in the simplest terms a DDoS attack is where an individual or group has decided to harm a data center, or client/s of the data center, by making it appear that the entity under attack cannot provide advertised services. To do this, the attacker will flood the provider with a stream of apparently legitimate requests, far too many to deal with, so the service will simply fail.

An analogy might be a wood chipper. Shoving a single branch – data center's normal traffic – through the wood chipper, not a problem. Whereas trying to chip the tree's entire trunk at one time – DDoS attack – would render the wood chipper inoperable.

With the advent of massive, rentable DDoS botnets, criminals of any ilk can overwhelm an entire data center's resources. So it is possible that, even if the attackers are only after a specific organization, it might be easier to target the entire data center.

**The first glimpse** outsiders had into the seriousness of DDoS attacks against data centers came in 2013 when the Ponemon Institute, sponsored by Emerson Network Power, released its white paper, *The Cost of Data Center Outages*. Ponemon researchers asked more than 560 organizations to take part in the survey. Of those, 83 agreed, and 50 organizations (67 separate data centers) permitted onsite benchmark analysis. One interesting statistic surfaced

Distributed denial of service attacks are hitting data centers hard. *Michael Kassner* explains why

# Flood. Warning

in the report: cyber crime based on DDoS was the only root cause for data center outages to get worse between 2010 and 2013.

In March of 2015, the Ponemon Institute took another look at DDoS attacks, interviewing more than 640 individuals who worked in IT operations, IT security, IT compliance, or data center administration, with a responsibility for detecting and or containing service-denial attacks. This time sponsored by Akamai Technologies, the Institute published its findings in *The Cost of Denial-of-Service Attacks*. The report listed the following as key findings:

**Monetary costs:** Companies in the study reported an average of \$1.5m in costs related to service denial over the past 12 months. On average, these companies withstood four service-denial attacks in the same time period.

**Causes downtime:** 34 percent of the

respondents said service-denial attacks shut down the entire data center, while 48 percent said the data center was partially shut down. On average, respondents said their systems were shut down nine hours during the past 12 months due to one or more DDoS attacks.

**Attacks will increase:** 44 percent of respondents said service-denial attacks increased over the past year; 49 percent said they will increase over the next 12 months. **The consequence:** 64 percent of respondents said the biggest consequence of a service-denial attack is reputation damage.

Imperva, a provider of data-security solutions, has released more specific information in a 2015 white paper called *Global DDoS Threat Landscape*. "Of attack-vector types, large-SYN flood (packet-size of 250 bytes and above) displays the most damage potential, followed by UDP flood," it states. "The latter is the most common type, used in over 55 percent of all documented DDoS attacks on the Incapsula network during the period of the report."

**Imperva also finds** that attack duration is increasing, with the longest attack lasting more than 64 days. More than 20 percent of the recorded attacks were over five days.

The Imperva report also claims, in what

I at first thought was a misprint:

"In the second quarter of 2015, we continued to see an increase in DDoS attack volumes from 2014, with the largest network layer assault peaking at over 253 Gigabits per second."

How do commercial data centers deal with that amount of unwanted traffic, plus normal client traffic, and still stay in operation, especially if an attack lasts more than 60 days?



9 hrs  
Average downtime  
per year due  
to DDoS

To find out how data centers fight back, I spoke with Tim Parker, vice president of network services at ViaWest, who confirms that service-denial attacks are indeed a huge problem: “It is ongoing, and the threat hurts everyone.”

But there are ways to reduce the impact, he says. ViaWest uses a Threat Mitigation Server (TMS) to monitor and deflect service-denial attacks. The server tracks normal traffic patterns, allowing it to identify anomalies. If an anomaly is detected, the TMS analyzes packet strings to differentiate attack traffic from client traffic, scrubs the unwanted attack traffic, and forwards the cleaned traffic to the proper client – all automatically.

It would take a huge amount of equipment to handle “perfect storm” DDoS attacks, in the range described by Imperva, and keeping this on standby in every data center would not be economical. The answer is to outsource the problem. If the TMS is close to being overwhelmed, traffic is rerouted to a company that specializes in DDoS-attack mitigation, where the attack traffic is removed. Parker said it may take up to two minutes for the traffic to be cleaned and returned, but the delay is preferable to “blackholing” all traffic addressed to the client under attack.

He says each side is trying to outmaneuver the other. To gain an edge, most commercial data center operators belong to North American Network Operators’ Group, an organization that allows members to share what works and what doesn’t, including their biggest nemesis – DDoS. But the dark side is also sharing its own “best practices” in the digital underground, so the cat-and-mouse game continues. ●

## Attack types

DDoS attacks attempt to take sites and services offline; however, there are different levels at which they can strike. The Ponemon Institute lists the following as the most effective:

### VOLUME-BASED ATTACKS

UDP floods, ICMP floods and other spoofed-packet floods – the goal is to saturate the bandwidth of the attacked site.

### PROTOCOL ATTACKS

SYN floods, fragmented-packet attacks, Ping of Death, and Smurf DDoS – these types of attack consume actual server and/or network equipment resources.

### APPLICATION-LAYER ATTACKS

Slowloris, Zero-day DDoS or DDoS attacks targeting Apache, Windows or OpenBSD vulnerabilities – when a large quantity of seemingly legitimate requests try to crash web servers.

Effective attacks make use of networks of machines to carry it out. Most usually, these are botnets, where the attacking machines are computers that have been subverted with malware that implants a remote control attack agent.



# Are we nearly open yet?

Open systems and open standards are moving us to a world of software-defined everything.

Peter Judge reports on progress



Peter Judge  
Global Editor

 @peterjudgeDCD

**T**here's a revolution coming. Across the industry, and at multiple levels in the data center stack, industry groups are making common cause to change the way things are done. Six months ago, we saw a coherent movement developing around open source and open standards (see box), and we relaunched this magazine with a cover celebrating that fact. Half a year on, does this really look like a revolution?

Eddie Schutter certainly thinks so. The director of product development engineering at AT&T Labs pointed out that there is a new generation of innovators collaborating on inter-related ideas for interoperable platforms.

"In my view, while the ideas and innovations of today may seem like remixes of the industry cycles before, there are clear differences in how the data center and infrastructure industry must adapt," Schutter tells *DCD*. "The winners will be those who apply solutions vertically to address full-stack needs, horizontally for optimized costs and performance, and with a global awareness."

That won't always be easy for users to adapt to, says Sherrie Brown Littlejohn, head of enterprise architecture at Wells Fargo:

"Software-defined everything, data-driven, autonomous data center and cloud are not silver or platinum bullets. For some, the paradigm shift required to realize their value is significant as it requires a mindset reset – learning, relearning and some unlearning."

But she's onside, along with increasing numbers of significant user companies.

To help users over this hump, these ideas need to be defined and packaged into consumable products and services. And that's where the industry bodies come in.

**Take Open Compute.** Launched by Facebook in 2011, this started as a way for large organizations to share their specifications for "no-frills" servers that trim the waste from data centers.

It's now gathering and sharing specifications for bare metal switches, and it's possible to pick these up and use them. And, meanwhile, the group is sharing radical ideas that significantly change data centers. Microsoft, for instance, gave the Open Compute Foundation the specification for a "distributed UPS," replacing giant backup systems with individual rechargeable batteries in each server to create a cheaper and more granular system.

## The strands of open

Multiple movements are converging to create an open approach to data centers. The following are central to the upcoming changes:

### Open Compute

The Facebook-inspired Open Compute Foundation shares data center hardware designs as open source hardware, so in principle

all data center managers can build with low-cost, energy-efficient switches and servers.

### OpenStack

This free open source cloud computing platform was created by Rackspace and NASA. It includes modules for provisioning compute, networking and storage and cloud services.

### Linux

The open source OS is the de facto standard for building cloud services, offering infinite scalability thanks to its licensing model, and with new features added by a lively community.

### Containers

Docker has led the movement to

deliver workloads in containers, or cut-down modules that have fewer overheads than traditional virtual machines. Linux OS and platforms such as Windows are adding container support.

### Hadoop

Hadoop ecosystem allows distributed compute and storage to

deliver analytics quickly from large data sets.

### SDN

The OpenDaylight specification is the frontrunner of the software-defined networking (SDN) movement, which aims to replace proprietary network switches with commodity hardware running open software.



At the software level, OpenStack is concentrating on how to manage and deliver services, turning the movement from a “good idea” to a foundation for business. That means a focus on automation and orchestration, says Alan Clark, the OpenStack chair. “For business to effectively garner ROI from the software-defined movement, particularly with cloud infrastructure, the liberal application of automation will be required. Orchestration still lags behind peer components, and remains one of the least understood, non-standardized and deployed automation technology areas.”

**The OpenStack** movement is consolidating slightly, with some early pioneers acquired by the late-adopting giants. Cisco bought Piston Cloud, and IBM bought Blue Box (see news, p14), in both cases to build in-house expertise to meet increasing customer demands.

Meanwhile, containers – which shrink application loads to the bare minimum without the fuss associated with virtual machines – have become an accepted part of cloud infrastructure, and it looks as if a possible dispute between leaders CoreOs and Docker has been headed off by a new standards agreement.

Linux, the operating system that first showed the strength of open source, is somewhere near the center of all this, and the Linux Foundation is providing a home for many of the open platform movements, as well as an example of how to enrich a platform with new technologies. Linux platforms like Ubuntu are having containerized services moved into their heart to fit them for the software-defined data center.

All told, the revolution is ticking along nicely, and DCD will have a ringside seat as the series of StackingIT events this year (see box) present the latest developments in the open movements.

“The set of infrastructure solutions that emerge from this climate of innovation becomes a key to underpinning an unrivaled age of insight and discovery,” says Eric Wells, vice president of data center services at Fidelity Investments. “The products and solutions that enable the principles of adaptability and ‘open’ will be the ones to watch.” ●

## StackingIT

A new event strand, StackingIT pulls together data center professionals working to rethink the fabric, the rack infrastructure, software platform and critical environment of the data center.

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- DCD as-a-service  
*Chicago, October 27-28*
- Singapore Data Center Week  
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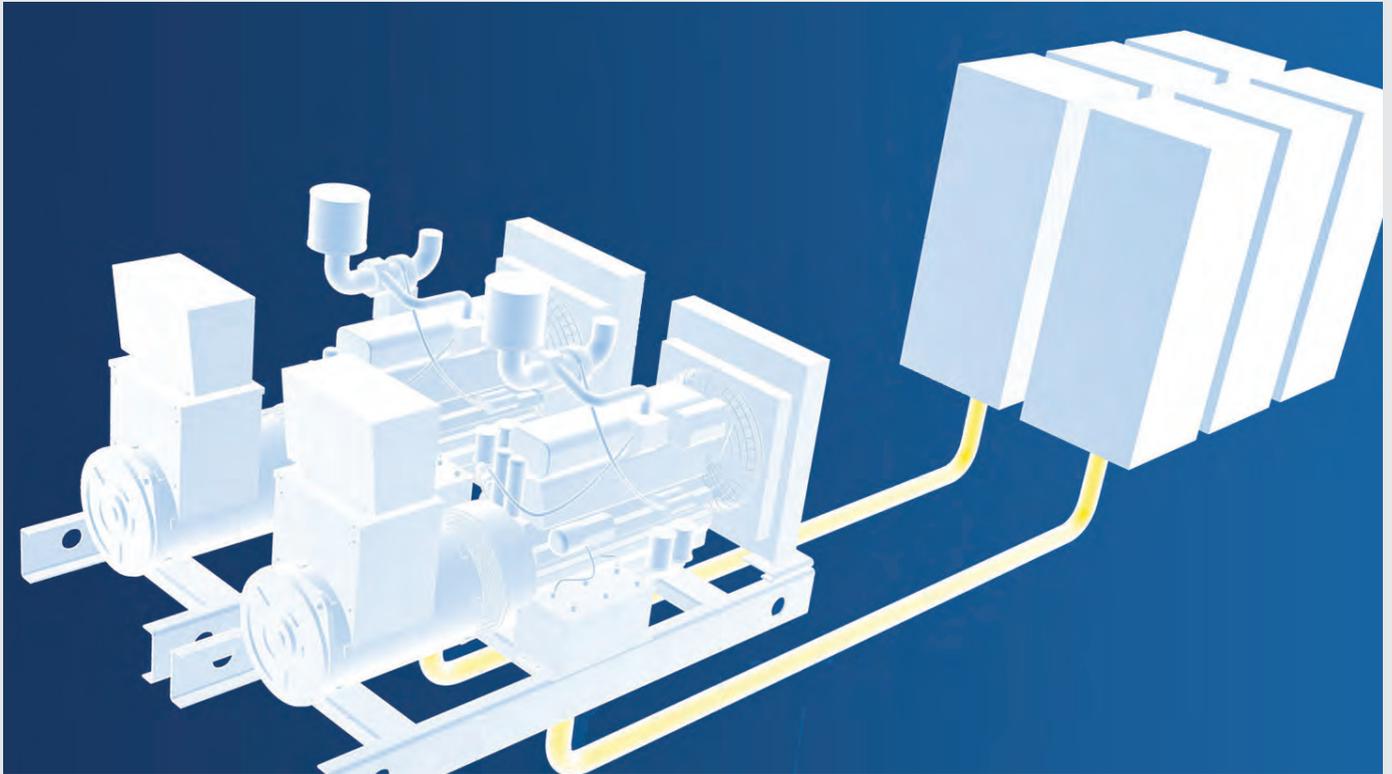
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Power Optimization

# Power optimization through intelligent power chain

Data center managers need to consider capacity, system resiliency, unpredictable IT application requirements and cost when building or retrofitting a data center power system.

## Knowledge is POWER: Intelligence Drives Better Decision Making

The increasing need for people to have continuous access to the Internet has been the main driver behind the growth of data computing and storage. To keep up with this growth, data centers are frequently adding more servers; however, because space comes at a premium, facilities are facing severe constraints when housing additional IT equipment. As a result, servers have been designed to incorporate higher processing power in less space. These new servers consume three to five times more power than previous generations in the same footprint, so

power densities per rack are on the rise.

Data center managers are looking for ways to increase energy efficiency while providing a highly adaptable IT environment to support service-oriented architectures and rapid changes. As a result of the increased cabinet densities, the cost to a business if those cabinets were to fail also increases. As outages become more costly, it's not just money that's on the line—it's the reputation for reliability, which can mean lost customers and business.

One of the main causes of data center outages is an accident, such as knocking loose a power connection or performing maintenance on the wrong UPS. It isn't

feasible to think that one could prevent a data center outage from ever occurring. They will happen; however, what one can control is each outages frequency and duration. By knowing the second there is a problem and having accurate data on what exactly caused the outage on demand, problems can be solved quicker and at less cost to the business. However, without a power chain that contains intelligent hardware and analytics, it makes it more difficult to diagnose the cause of an outage, delaying repairs that could threaten the bottom line.

Chris Mooney, Anixter's Marketing Manager for Data Center Solutions, saw firsthand how the lack of an intelligent power chain can affect a company during his time at a proprietary trading firm. "There were several times when facilities had to perform maintenance on a UPS and we had to inform our affected users," he said. "The problem was we didn't have accurate documentation or a system in place that could tell us with 100 percent certainty which trade desk's servers would be affected downstream, which caused headaches for the business and for us."

## Money Talks: Why Not Investing in Intelligence Could Prove Costly

Scrambling to get servers online before the start of trading isn't the best way to prevent an outage. In a survey by the Ponemon Institute of 67 independent data centers in the U.S., the cost of a data center outage ranges from \$45 to \$95 per square foot with a minimum cost of

\$74,223 going up to \$1,734,433.

The consequences of not measuring the entire power chain:

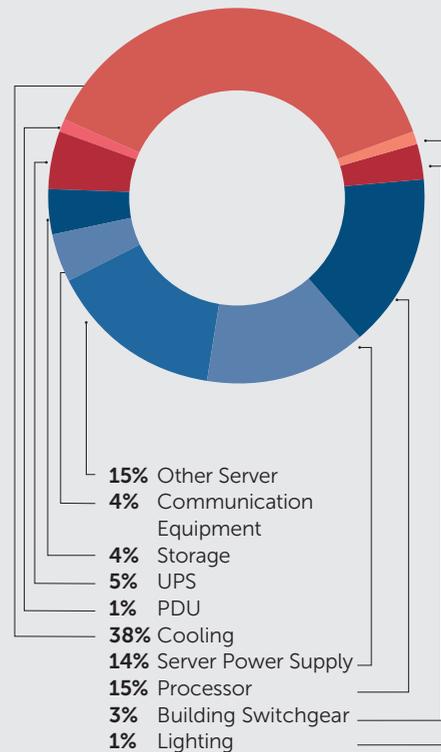
- Potential for **STRANDED CAPACITY**
- **DECREASED RESPONSE TIME** to outages
- Increased risk of equipment **FAILURES**
- Increased risk of **OUTAGES**
- Unnecessary **CAPITAL** expenditures
- Increased **OPERATIONAL** overheads

### The Walking Dead: Hoards of Zombie Servers Could Be Consuming Your Data Center's Power

According to an analysis performed by Emerson Network Power on a typical 5,000-square-foot data center, the IT equipment demand is the biggest power draw in the data center, using up to 52 percent of total power consumed (see Figure 1). Unfortunately, many servers aren't being used at all—unbeknownst to IT. These devices, known as zombie servers, are as scary as they sound, consuming your data center's precious power undetected. According to a survey performed by the Uptime Institute, 20 percent of servers in the data center are obsolete, outdated or unused. (<http://journal.uptimeinstitute.com/2014-data-center-industry-survey/>). What is more troubling is that very few of the survey respondents believe they have any zombie servers or a scheduled audit to identify and remove their unused hardware. One of the main reasons there isn't a plan in place to audit is due to a lack of available IT resources as well as the time it takes to perform the audit. This creates unaccountable IT growth, inaccurate planning and waste. However, incorporating intelligent PDUs with outlet level monitoring would help identify these devices faster and reporting will help automate the audit process.

IT power requirements are constantly changing with new servers and IT hardware being added on demand, but the amount of power available to the room is usually fixed. Without visibility into the entire power

Figure 1: Data Center Power Consumption



chain, budgeting for current power demands and forecasting for the future becomes difficult—potentially paralyzing operations. It's important that multiple areas, from the building entrance to the IT equipment, are monitored to have full visibility into the entire power chain.

### Creating the Intelligent Power Chain

The best way to mitigate risk of an outage is to add intelligence throughout the entire power chain. Highly efficient power designs start with a selection of the proper components for your specific environment. However, other factors may be considered for optimal power distribution: reliability, equipment availability, safety and cost. Anixter suggests addressing five key subsystems to optimize power through intelligent design and software analytics, as referenced in Table 1 below.

Like almost every aspect of data center design and infrastructure, enhancing the power distribution system is a complex undertaking. By breaking it down into five subsystems and following best practices to make improvements along each system, it makes it a bit easier to achieve incremental gains that together can be substantial. To learn more about power optimization in the data center including more details on the five subsystems and the best practices for greater efficiencies, visit [anixter.com/datacenterdynamics](http://anixter.com/datacenterdynamics).



**Contact Details**  
 Phone: 1-800-ANIXTER  
[anixter.com/datacenterdynamics](http://anixter.com/datacenterdynamics)

Table 1: Best Practices in the Five Subsystems of an Intelligent Power Train

ENTRANCE FEED	UPS SYSTEMS	ROOM DISTRIBUTION	CABINET DISTRIBUTION	IT EQUIPMENT
<ul style="list-style-type: none"> <li>• Install distribution or industrial grade cable.</li> <li>• Use critical routing and spacing of power cables.</li> <li>• Consider installation sensitivity of heavy-duty infrastructure.</li> <li>• Use application-specific termination hardware.</li> </ul>	<ul style="list-style-type: none"> <li>• Consider eco-mode operation for 2–8% efficiency gains.</li> <li>• Run system closer to peak loads.</li> <li>• Use scalable UPS systems.</li> <li>• Consider transformerless UPS systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Use standard communication protocols.</li> <li>• Consider higher voltage delivery to the cabinet.</li> <li>• Install CT clamps/BCM solutions.</li> <li>• Consider overhead cabling or bus bar technology.</li> </ul>	<ul style="list-style-type: none"> <li>• Use PDUs with color-coded alternating phase outlets.</li> <li>• Use outlet level monitoring for device level data.</li> <li>• Use PDUs with locking receptacles.</li> <li>• Take advantage of PDUs with “daisy chaining” capabilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Use high-voltage power supplies.</li> <li>• Hibernate servers not in use.</li> <li>• Use power capping.</li> <li>• Replace servers older than three years.</li> </ul>

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# Less is more



**Peter Judge**  
Global Editor  
@peterjudgeDCD

**J**azz fans and designers all agree. Minimal is cool. It's the same in the data center. The less heat you produce the better, and the less energy you use to remove that heat the better. Hang onto that thought, because the outworking of this simple truth can get complex.

In this supplement, we've explored the options – from DX air-conditioning systems to indirect evaporative cooling units. Your job is to manage the cooling you have, to get the best out of it. There's plenty of guidance. ASHRAE will tell you how hot you can let your servers get, while a host of vendors can offer options to get there in the most cost-effective way, bearing in mind both capex and opex. And if you ever do reach nirvana with your air-cooling system, there's plenty more to think of. What about reusing your heat, for example? If you have a district heating system nearby, or a swimming pool, you

can plug your exhaust air through a heat pump into that and the heat will be well-used, and save some secondary carbon emissions.

And what about liquid cooling? Right now, it's just an option for high-performance computing (HPC) and some would say that's where it will stay. But if you really have got your air-cooling tuned to perfection, there's a new challenge for you there.

Your colleagues might balk at the suggestion of ripping out that perfect cooling circuit in favor of a leading-edge, comparatively untried system, but the thermodynamics are in its favour, and there are people out there who believe that one day all our servers will run on fluid.

For now, though, you've probably got plenty of work to do on the current system, with blanking plates and containment system. Remember, it's all about minimalism. Less is more. ●



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## Interxion cools Copenhagen site with groundwater

When Interxion opened a new data center in Copenhagen it took advantage of the region's geology and supplemented the free air-cooling afforded by the Danish location with a custom groundwater cooling system.

Using two large chambers dug 70 meters below the surface into the chalk substrate, Interxion provides naturally cooled water to its chillers

for the cost of pumping. The water is circulated through the chillers, providing 1,200MW of cooling relief before being recycled back down to the subterranean chamber, where the waste heat is bled off into the surrounding chalk walls.

The system is unlike other groundwater cooling systems, says the Danish manufacturer Grundfos, in being built from

plug-and-play components. Grundfos believes the system can be replicated on other sites blessed with suitable geology.

Bob Landstrom, director of product management at Interxion, says the system in Copenhagen is simple and secure, with no risk to the local aquifer. In fact, the water used is potable and marked as a reserve supply for city use in the event of an emergency. The system should save Interxion 1.2GWh per year if fully operational.

Groundwater cooling is also common in Amsterdam, where Telecity and its parent Equinix both have sites cooled this way.

Interxion, meanwhile, has been using seawater cooling in its Stockholm center since 2013.

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

## Demand for precision DC kit on the up

The global market for precision air-conditioning equipment in data centers is growing at nearly 14 percent per year, according to Technavio. The analyst firm upped its estimate from 12 percent last year and predicts the market will grow at that rate until at least 2019.

The growth is down to new data centers opening, while older data centers get renovated with better air-conditioning. "Vendors are focusing on providing data center infrastructure management systems to customers, as they facilitate remote monitoring and infrastructure management by using remote software and sensors attached to the cooling systems," says Faisal Ghaus, VP of Technavio.

As customers demand greener, quieter data centers, vendors are designing cooling systems that operate with no moving parts.

<http://bit.ly/1Hu7AJT>

## Schneider Electric adds cooling to StruxureWare DCIM suite

Energy management specialist Schneider Electric has added a module to its StruxureWare data center infrastructure management (DCIM) suite to make cooling systems more intelligent.

The cooling optimization module adds intelligence to existing data center

cooling systems, allowing them to address current rather than legacy needs, says Schneider VP, Soeren Brogaard Jensen: "Most data center cooling systems are specified to ensure that the hottest racks in the facility have a sufficient cold air supply. This results in a large amount

of energy being wasted as the entire facility is over-cooled to provide this legacy design capacity."

The module lets data center managers demonstrate the airflow within their facilities, including all heat sources, cooling influences and dependencies. It will

learn from any actions, such as inlet temperature adjustments, or equipment adds, moves and changes, and respond to keep the data center cooling continuously optimized. It should let operators monitor

status in real-time, so overheating, hotspots and capacity issues can be predicted and avoided. It also helps avoid wasteful over-cooling and stranded cooling capacity.



<http://bit.ly/1RS4GQK>





*Keeping your inlet temperature below 24°C – that's paranoia*

**Ian Bitterlin**

**Relax, says Peter Judge.  
With cooling, the trick is not to overdo it**



**Peter Judge**  
Global Editor



@peterjudgeDCD

**K**ick back, get an ice cream, and let's talk about how to handle cooling in your data center.

The best way to beat the heat is to do as little as possible; any lizard knows that, and so do the coolest data center managers. Overworking just wastes energy.

But a lot of data centers are still doing just that – overworking and overcooling their spaces. In the process, they are wasting vast quantities of energy and – ironically – contributing to global warming and melting the world's polar ice caps.

Chilly data centers date back to the 1950s, when tape drives could not stand high temperatures, and humidity crashed the system by making punchcards stick together. We are no longer in that era, and yet a lot of data centers still have aggressive and unnecessary cooling regimes, rigidly keeping their ambient temperature at 21°C (70°F).

Things started to change when ASHRAE (the American Society of Heating, Refrigerating and Air-conditioning Engineers) defined where temperatures should be measured, with a specific recommendation for the server inlet temperature, which has been increasing as the increased reliability of IT kit is more widely accepted and now stands at 27°C (80°F).

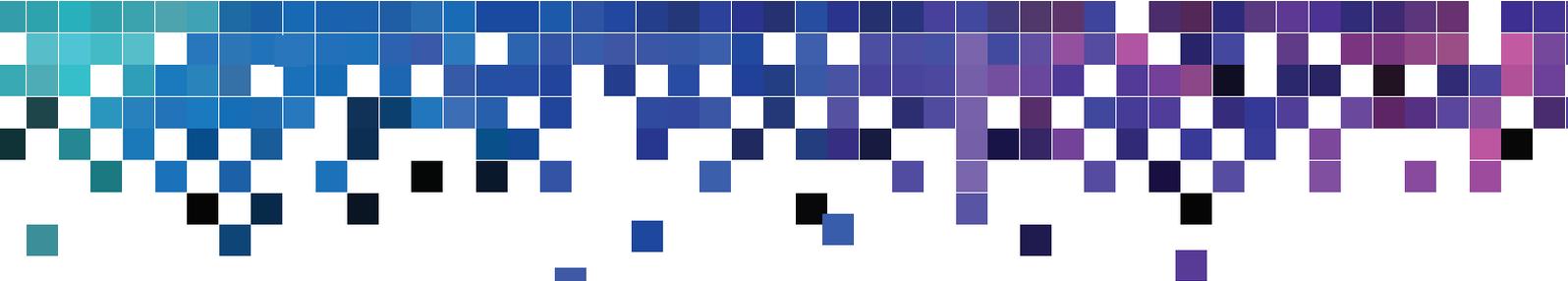
**Web-scale data centers** pay attention to this, and through a process of trial are operating at higher temperatures still. But enterprise data centers are seriously lagging.

In early 2015, IDC surveyed 404 data center managers in the US, all of whom have at least 100 physical servers, and who have an average IT budget of \$1.2m. Fully 75 percent of them were operating below 24°C, and only five percent were at 27°C or above.

These facilities have PUE (power usage effectiveness) ratings of around 2.4 to 2.8 – meaning that 60 to 65 percent of the power they consume doesn't reach their IT equipment.

The result is doubly shocking when you consider two facts. First, IDC found out that these IT managers are spending 10 percent of their budget on cooling, out of a 24 percent segment for power and cooling combined. So each of these organizations is spending \$1,200 a year on cooling, much of which may be unnecessary.

The other fact to consider is that, while the efficient web-scale cloud providers get the media attention, they are only a small ►



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▶ percentage of the data centers of the world. At least half the world's racks are in those overcooled enterprise sites. To make an impact on global emissions, these are the data centers that need to change.

So why are data centers still too cool? Ian Bitterlin of Critical Facilities Consulting is in no doubt that fear is what drives it: "It's paranoia." People are excessively risk-averse.

But it might be more rational than that. At least one study has found that raising the air inlet temperature actually increased the amount of energy used in cooling.

"We went in fully sure we would be saving energy," says Victor Avelar, senior research analyst at Schneider Electric, describing a study that compared the cooling energy needed at different temperatures for data centers in Chicago, Miami and Seattle. "But we found that above 27°C cooling took more energy and capital expense."

**The Schneider study** – due for publication in July 2015 – compared data centers with a standard chiller unit. The surprising result came about because of the complexity of the system. At higher temperatures, server fans come into play and more energy is used moving air around.

If you look into this, you will need to know your technology options. We are mostly starting – as the Schneider study did – from cooling using a traditional air-conditioning unit with a compressor, often referred to as a "direct expansion" (DX) unit.

In most locations, there's no other way to maintain the ultra-low temperatures that many people still think are necessary, and in many places the DX is in the mix to cover extreme conditions and reassure the service users.

If this is what you have, there are two main things you can do to cut your energy bills before you think of changing your cooling technology. First, as ASHRAE pointed out, you can feed your servers warmer air, thus cutting down the amount of cooling you do. Though Schneider also stresses that if you do this, you should know what the fans in your servers will be doing.

If you let the inlet temperature go up to 27°C, the temperature in the hot aisle at the back of the servers will be around 35°C. You will want to make sure all the connectors are on the front of the system, as no one will want to spend much time in the hot aisle.

Secondly, any cooling system works more efficiently when it is working on a high temperature difference (delta-T). That's slightly counter-intuitive, but it's basic thermodynamics: there's a bigger driving force to move the heat when delta-T is greater.

This is one reason why it's good to contain the hot air coming out of the back of your servers and exclude the cool air that slips past the racks. Hot-aisle containment means your cooling system is only working on the air that needs to be cooled.

Once you have done all that, your DX system will be doing less work, and you could have a partial PUE (pPUE) of around 1.16, according to Bitterlin. Alternatively a chilled water system (where the refrigeration unit's cooling is distributed using water) can get down to a pPUE of 1.12.

But do you need your DX at all? ASHRAE publishes maps showing where in the world the climate is cool enough so outside air can be used to cool a data center all year around. Most of the US is in this zone, and so is the UK, where the record dry bulb temperature is 34°C and the highest wet bulb temperature (with evaporation) is 23°C.

This is the world of "outside air" cooling, "free" cooling or "adiabatic" cooling – all words that mean cooling without using the air-con. Sometimes filtered outside air is circulated through the data center ("direct" free cooling) and sometimes a secondary circuit is set up ("indirect" free cooling). Adding water evaporation on the cooling coils can be needed when the outside temperature is higher.

This might get you to a pPUE of 1.05, says Bitterlin, but there are some complications. One issue is that PUE depends on the utilization of a data center. If there are unused servers, this can increase the PUE, but adiabatic cooling has an opposite trend: "Under a partial load, adiabatic gets better," he says. This means that beyond a certain point, chasing a lower PUE can be counter-productive. "We caution against being enslaved to PUE and having all your future strategies dictated by it," says IDC research manager Kelly Quinn.

Avelar agrees: "PUE has done great things for the industry, but it is important to not look at that blindly." In his example, when the server fans switched on, the PUE of the data center would go down, even while the overall energy used to cool it was going up and its efficiency was getting worse.

**Avelar warns that** adiabatic cooling kit can raise availability concerns. These might be "paranoid," but there are physical limits to what outside air can achieve, and in some parts of the world the concern will be justified.

More practically, adiabatic units are big and heavy, and will be tricky to retrofit into older data centers. New sites will try to put it on the roof, although it has to be fairly close to the IT floor.

Sound complicated? It all boils down to keeping a cool head and doing the math while your servers get warmer. ●

75%  
Of data centers  
operate at  
<24°C

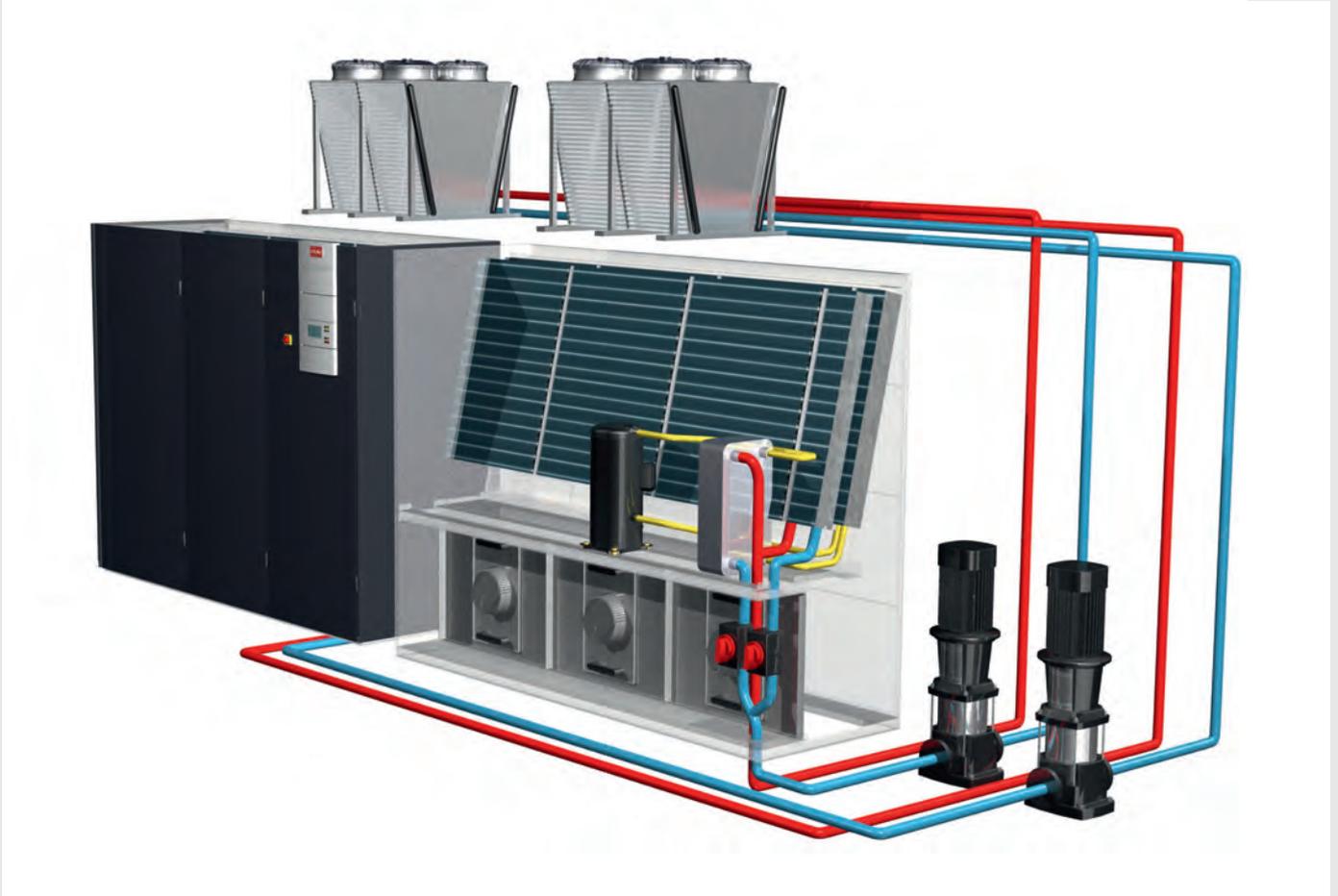
29.4°C  
Facebook  
2011

27°C  
ASHRAE  
2008

25°C  
ASHRAE  
2004

22°C  
Room temp

INLET TEMPERATURE LIMIT



STULZ GE system: Hybrid system with Indirect Free Cooling

# Climate. Customized. Our smart standard

As a specialist in data center air conditioning, STULZ has been offering made-to-measure air conditioning solutions since 1971. From the very beginning, STULZ's philosophy has meant that we have never been satisfied simply with standard solutions.

Even though these days an extensive range of international standards, compliance requirements and country-specific regulations have to be observed during the development of precision air conditioning systems, STULZ still pursues the goal of incorporating each customer's individual requirements in its work. For us, it doesn't matter whether an air conditioning system is a traditional closed-circuit air conditioning unit with raised floor, a row-based air conditioning solution, chillers or an air handling unit for outdoor installation.

## **Data center and cooling system standards**

When planning an air conditioning solution, the specialist engineers at STULZ always encourage customers to use the "2011 ASHRAE Thermal Guidelines for Data Processing Environments" for guidance. These guidelines should not be regarded as a universal solution to all types of data center cooling, however. Rather, the recommendations are based on precisely defined classes and ambient conditions. So, every data center operator must determine exactly to which class a data center or a

between capital investment, operating costs and energy efficiency.

**Safety first**

Today, Free Cooling systems are a fundamental component of any energy efficient data center air conditioning system. Free Cooling, in particular, offers many possibilities for designing air conditioning systems precisely for a data center's requirements, by installing the appropriate Free Cooling modules. First, a choice has to be made between Indirect and Direct Free Cooling. Indirect Free Cooling is a closed system, so that no outside air gets into the data center. Direct Free Cooling, on the other hand, consists of an open system in which filtered outside air is conveyed directly into the data center and flows through the server racks. It is immediately clear that Direct Free Cooling is not suitable for every data center. Experience has shown that Direct Free Cooling is not always desirable, even in temperate climates. Factors that are difficult to calculate, such as smog, dust or dense smoke in the vicinity of the data center, can clog filter systems within minutes and ultimately cause the Free Cooling to shut down. If the mechanical cooling system is then unable to provide suitable power reserves, this can rapidly lead to load shedding, or even unwanted downtime. For this reason, STULZ air conditioning systems with Free Cooling are always equipped with appropriate power reserves in the form of mechanical cooling units. They are capable of generating the full amount of required cooling, even if the Free Cooling currently has no cooling capacity at all.

**Variety of options for your optimum air conditioning solution**

The STULZ product range includes traditional room cooling, high-density cooling, chillers, container modules and air handling units with adiabatic cooling. All systems are available with Indirect Free Cooling. STULZ offers Direct Free Cooling for CRAC systems, air handling units and modular data centers. Together with its various sizes, extensive additional options and modularity, STULZ therefore boasts a product range that is unique in the world and can make optimum air conditioning a reality for practically every data center project.



**Contact Details**  
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 Phone: +49 40 5585-269  
[www.stulz.com](http://www.stulz.com)



CyberHandler



CyberAir 3

match over time. The downside is not just unnecessarily high energy costs, but also a lack of flexibility during future expansion, or even shortcomings in operational reliability. To prevent problems like this, air conditioning solutions that come into question should be subjected to intense analysis in collaboration with the in-house IT department, consultants, manufacturers and specialist air conditioning firms far in advance of the actual project phase, to determine each type's individual strengths and weaknesses. Then, in this open dialog, it will quickly become clear which manufacturer brings the necessary experience in data center air conditioning, and offers an appropriately broad product range to satisfy even the most individualized requirements. And you also have to bear in mind that some requirements will only arise during a data center's normal life cycle.

**Climate. Customized. Our smart standard**

Even if the interiors of data centers and server rooms all over the world are scarcely distinguishable from one another, the requirements for data center air conditioning are becoming increasingly individualized. Many operators face technical and planning challenges when expanding their data center, as they have to take account of numerous parameters such as local climate, spatial and room considerations, environmental and noise protection, not to mention safety requirements. For all this, STULZ offers individual, modular system solutions, which can be adapted to suit virtually every project requirement and expansion phase. From the STULZ CyberAir 3 product line alone, customers can choose between 8 different cooling systems, 7 sizes, with upflow or downflow and optional Free Cooling. In addition, the solutions from STULZ boast a diverse range of options in terms of mechanical parts, cooling technique, heating, condensers, humidifiers, electrics and refrigerant. This wealth of individualization options enables each project to achieve the optimum balance

particular data center segment belongs to. Only then is it possible at all to plan a reliable air conditioning system for individual zones that suits the data center's needs.

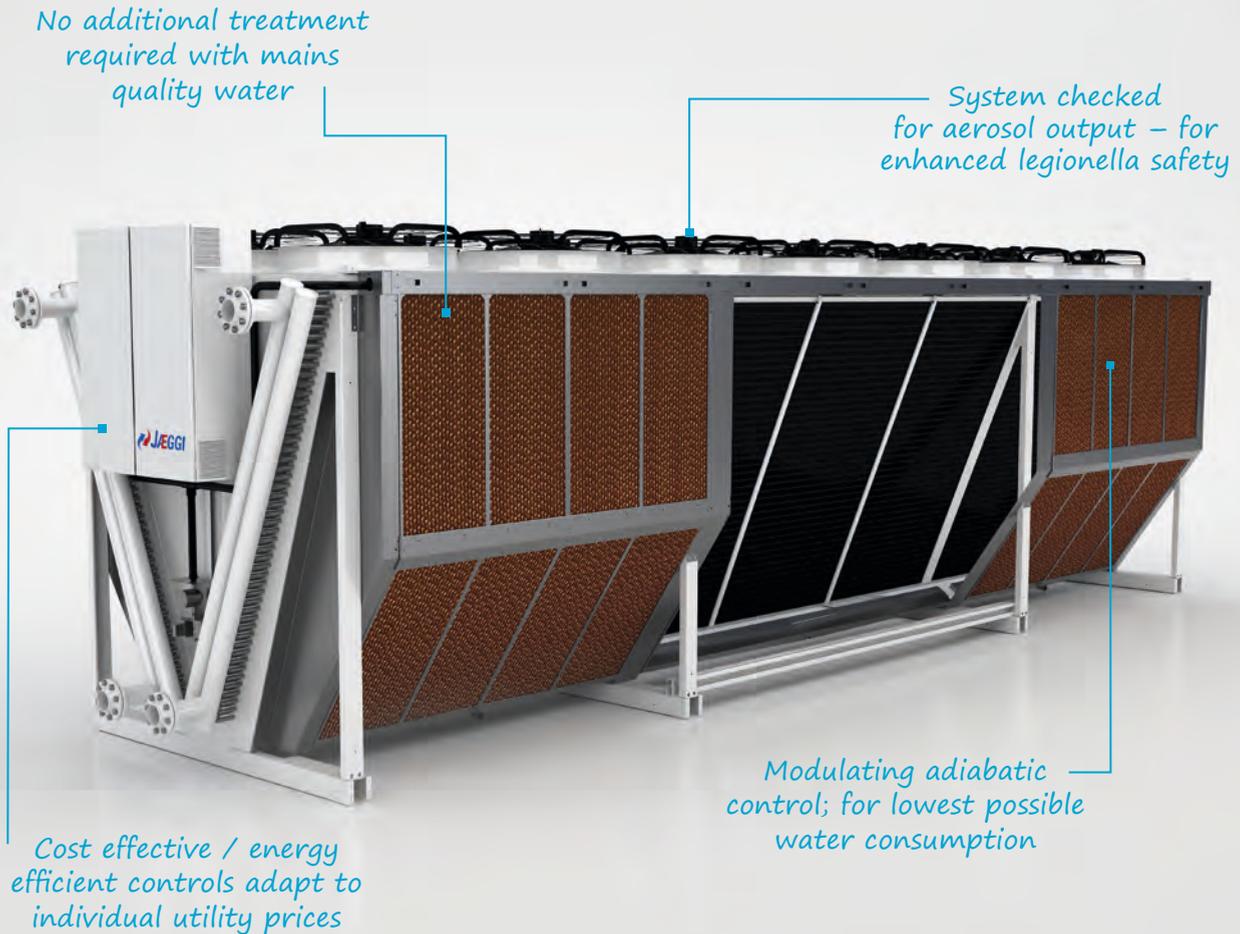
Moreover, the global rise of energy prices and stringent compliance and availability requirements mean that today, air conditioning solutions can no longer be designed on the "one size fits all" principle. Instead, every data center must be regarded as an individual project. Here, parameters such as location, redundancy-levels, hardware specifications and expected growth rates must be weighed up as accurately as possible, so that efficient and reliable cooling can also be guaranteed during future operation.

**The unstoppable rise of individualization**

These days, customers can choose from a wide selection of different cooling systems, performance variables and manufacturers. Indeed, data center operators can find themselves confronted by an overwhelming array of potential solutions, all of which must be evaluated. In particular, in the field of air conditioning there is a high risk of choosing a solution that may well be sufficient for the data center's planned usage profile, but turns out to no longer be a 100%

# Better safe than sorry

## Energy Efficient and Hygienic Adiabatic Cooling solutions



## Wet or dry operation

The *Hybrid Blue* from JAEGGI combines the simplicity of a dry cooler with the flexible capacity increase of an adiabatic pre-cooling performed by humidification pads – for a hygienic operation without water treatment. The unit's capacity range from 50 kW to 2 MW at an impressively small footprint and its intelligent control for speed and humidification virtually covers each and every dry cooling application in the fields of industrial, HVAC and data centre applications.



[www.jaeggi-hybrid.eu/adc](http://www.jaeggi-hybrid.eu/adc)

# fl Go with the w



Cooling with liquid can be more efficient.  
David Chernicoff dives in



David Chernicoff  
US Correspondent  
@DavidChernicoff

**D**ata center operators are no strangers to liquid cooling. They've been plumbing water-cooled equipment into their CRAC and CRAH chillers to try to keep up with the waste heat generated by IT loads for years. But as IT load density has continued to increase, and servers have gotten more powerful – with faster CPUs and more memory – it is an ongoing battle for cooling capacity to keep up with the data center's ability to generate heat.

Cutting-edge data centers can take three paths regarding liquids in their facilities: they can try to remove the water-cooling environment, making as much possible use of free air and related cooling technologies that depend on environmental factors to maintain temperatures in the data center; they can look at alternative ways to supply and cool the water they use to keep their facilities cool with technologies such as groundwater and seawater cooling; and they can fully embrace the liquid world and opt for technologies such as direct-to-chip liquid cooling and immersive cooling.

**Asetek is a major** driving force behind using liquid for primary cooling of specific server components. It gained extensive

experience in building cooling systems for high-end workstations and gaming systems, and is now applying this to data centers. The technology has been used reliably for years in standalone servers and workstations, and even in some of the fastest supercomputers in the world, but Asetek is looking to make the technology easily accessible to data center operators on the scale that today's high-efficiency data center requires.

**The Asetek** RackCDU D2C technology provides liquid-cooled heat sinks for CPUs, GPUs and memory controllers in the servers in your data center. The technology uses a liquid-to-liquid heat exchanger system; there is never any actual contact between the liquid being pumped through the facility and the liquid circulating within the servers.

The RackCDU is a zero-U 10.5 rack extension that contains space for three additional PDUs, the cooling distribution unit, and the connections for the direct-to-chip cooling units that are a direct replacement for the standard heat sinks found in servers. Those cooling units contain the fluid pump and the cold plate that rests on the CPU in the same way a standard heat sink does. The water being pumped to ►

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**Fast technological advances, rising energy costs, continuous design updates and unpredictable heating loads are the main challenges of data center cooling.**

With 40-year leading experience in HVAC and HPAC, Climaveneta air conditioners for IT cooling are the ideal solutions to provide improved energy efficiency and PUE in every data center application. Integrating central units and indoor CRAC into complete solutions, enhanced by the innovative application of the most advanced technologies, Climaveneta IT cooling systems are designed to match even the most demanding data center cooling requirements, with highest reliability and flexibility.



▶ the CDU can be as warm as 105°F (40°C) and can come from dry coolers or cooling towers. As the heated water is being circulated away from the servers, it can be used to provide heat for the facility.

Existing racks and servers can be configured with the Asetek equipment. The coolers use dripless quick connects that are external to the physical server to connect to the overall cooling system. Asetek's website shows video of Cisco rack servers having their existing server heat sinks replaced with the company's CPU/GPU cooling equipment to show the minimal amount of time such configuration would take. Of course, multiplying this example by dozens or hundreds of servers shows that the upgrade is not a trivial task. Designing this technology from the start and making use of the Asetek racks would simplify the process.

**So far the primary** adopters of this technology have been specialized projects in high-performance computing and government agencies, and most are still doing side-by-side comparison programs to determine the effectiveness of this cooling solution. Asetek claims the RackCDU D2C system can reduce data center cooling costs by more than 50 percent while potentially allowing data center IT load density to quintuple. Overall efficiency improvements come from improved cooling, higher densities, waste heat reuse and reduced cost to provide cooled air/water/fluids.

But for those for whom simply cooling their processors and memory is just a start, we move on to immersion cooling. With this technology, the entire server (or storage blade) is submerged in a dielectric fluid that is circulated to transfer the heat from the IT equipment, to the fluid, to an external cooler, which can be as simple as a basic radiator. While the most basic dielectric fluid used with this technology is mineral oil, 3M has a range of engineered fluids, marketed under the name Novec, specifically for this application.

The best-known vendors in the total immersion business are Green Revolution Cooling (GRC) and Allied Control, with a start-up called LiquidCool Solutions making inroads, and Iceotope establishing itself in the UK. Hong Kong-based Allied Control was purchased earlier this year by BitCoin mining infrastructure provider BitFury in an attempt to provide a more energy-efficient infrastructure and to move the company into the supercomputer cooling business.

LiquidCool and Iceotope take the approach of cooling each blade separately using dielectric within a sealed case. In the LiquidCool system, the coolant circulates outside the rack, while the Iceotope system seals each blade separately and removes the heat by a secondary water-cooling circuit.

Meanwhile, GRC and Allied Control both immerse the IT equipment into a tank of fluid – although, again, their approaches are different. With Allied Control's passive 2-Phase immersion-cooling cycle, the coil or condenser uses an evaporative scheme to circulate the fluid, allowing the heat from the server chips to be a part of the process. With the GRC total-immersion system, the dielectric fluid is mechanically circulated. Allied also uses a modular system available in their custom Data Tank and in a flat rack.

**The simpler GRC** system uses a horizontal rack system. It uses normal-size racks but they are mounted horizontally, so the individual rack units sit vertically within the fluid. This allows for the use of standard servers but requires additional floor space when compared with vertically mounted rack units.

With the GRC CarnotJet the total immersion of the server rack allows the entire body of liquid to act as a heat sink. The liquid is pumped through a heat exchanger filter system, which uses external water cooling to provide cooling to the GreenDEF dielectric fluid used in the CarnotJet rack. GRC also uses a proprietary system to encapsulate hard drives, allowing them to be fully submerged in the cooling media.

Both technologies claim to reduce cooling power consumption by 90 percent or greater, and also reduce overall server energy consumption. LiquidCool uses the model of the total power needed to achieve 50kW of compute power. Using this metric, the claim is that the immersion solution requires only 320kW compared with 50kW for standard cooling technologies. In this model, just removing the power requirements for the server fans reduces power requirements by 83kW.

The earliest adopters of liquid-immersion technology have been in high-performance computing, where heat generation is a major issue. And while the GRC solution can be used with existing servers appropriately modified for immersion, all these solutions work best when applied from the ground up, as a fundamental part of a data center or data center hall design.

Liquid cooling is not for everyone, but it could easily find a home in special project needs on a large scale. Selecting these technologies to cool an entire data center is likely too big a step for almost any data center operator, but applying these technologies in situations where they can be most effective should be on any efficient operator's list of potential point solutions. ●

## Direct cooling: five ways to go

Taking liquid to the electronics may sound like a risk, but there are five distinct approaches. It all depends where the liquid is:

- 1** Circulated to the heatsink of the chip (Asetek)
- 2** In a sealed blade unit with secondary coolant (Iceotope)
- 3** In special 19-in tank with passive circulation (Allied Controls)
- 4** Circulating in a sealed blade unit (LiquidCool)
- 5** In large tanks to immerse entire racks (GRC)

A red circular graphic containing the text "STULZ Data Center Cooling" in white, bold, sans-serif font. The text is arranged with "STULZ" on the top line, "Data Center" on the second line, and "Cooling" on the third line.

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# Staying Alive

Data centers are a safe place to work, says *Peter Judge*.  
Let's keep it that way!



**Peter Judge**  
Global Editor

[@peterjudgeDCD](#)

**G**oing to work can be risky: around the world, someone dies at work every 15 seconds, according to the UN International Labour Organization. In the US, according to the Occupational Safety and Health Administration, 12 people die every week from work-related causes, and in 2013 a total of 71 people died from electrocution at work. The UN International Labour Organization also reports that in 2013-14, 28.2 million working days were lost in the UK due to work-related illness or injury, at a cost of £14.2bn.

If you work in a data center, of course you don't need to be quite so worried. The environment is carefully protected, and IT equipment is cosseted, so rarely does anything go wrong. Very few accidents are reported in tech facilities, so if you want a safe place to work, data centers should be high on your list.

But you should still keep on top of safety at work. It's an obvious moral duty – and it's also required by regulations such as the UK's Health and Safety at Work Act (1974).

**Workplace injury** can also be bad publicity. In the past few months, two relatively minor accidents in data centers received widespread media coverage because of where they

happened: in Apple facilities. What happens at Apple rarely stays at Apple, and no matter how hard the company tries to manage news coverage, media keeps a close watch on it. So, when Apple sites suffered a fire and a chemical leak, they made headlines. The fire started among solar panels on the roof of Apple's Mesa site in Arizona. No one was injured at that site, but when chlorine used for water purification spilled in Maiden, North Carolina, five people were hospitalized. They were all back at work the next day, however.

Besides fire and leaks, a more obvious danger in data centers is electric shock. Chris Crosby of Compass Data Centers recently pointed out that this risk does increase if the data center operator demands continuous operation, so staff are expected to work on live equipment.

**Electrical equipment** in a data centers can increase the risk of fire; the chemicals in fire suppression systems are another risk. There are other factors to consider, too, like staff training and experience. New workers have a higher risk of injury than those with more experience and a longer record. The UK's Health and Safety Executive found that workplace injury is four times higher for workers in their first few months of

employment than for those who have been there at least a year.

The data center is a young industry and the proportion of new workers is likely to be high. The most obvious way to keep staff safe is by offering training.

All told, the risks of working in a data center are small, though real, and it's worth making an effort to reduce them. ●

## 71

People died from electrocution at work in 2013 in US

## 28m

Working days lost in the UK due to work-related illness 2013-14

## 14bn

Cost in sterling of work-related illness to UK industry

### Safety training

As part of a campaign to help make the data center industry safer, DCProfessional Development is launching an online mission-critical health and safety course, intended as an online induction program for staff in the field. For more details, visit [www.dc-professional.com](http://www.dc-professional.com)

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RUN **LEANER.**  
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# DCD Community

When and where to catch up with DatacenterDynamics around the world

## Conference Snaps



Delegates at DCD Converged Middle East



In action at Enterprise China



Enterprise China delegates choose their sessions



Shah Sheikh, Nasser Ahmed and Simon Bradford of the Cloud Security Alliance,

## What You Said



**ZHU HUA**  
*Vice Director of IDC,  
Tencent*

DCD is a good communications platform as it attracts the participation of many parties, including product and services providers, clients and research institutions. We can share technical expertise on this platform and promote the development of the industry, creating a good ecological environment.

## DCD Converged



# DCD Com

We look at DCD Converged Middle East and DCD Enterprise China and find out the latest on the DCD international community, as well as what's in store for the rest of the summer.

Jin Mu

Alibaba Group

This is the nicest event I have participated in since I joined Alibaba. We can see that DCD takes the attendee's experience as a priority. This event attracted lots of people to participate, and was a good platform for communication – and I saw containerized data center solutions for the first time.

Linda Luo

Anixter

DCD provides a good platform for us to communicate with both old and new customers, which in turn helps us to find new business opportunities. We think this event is of great significance.

Bao Kai

SDS

As a long-time partner of DCD, we are very glad to participate in DCD Converged Shanghai this year. We do not treat DCD events as a simple exhibition service provider but as a platform that enables good communication between us and exhibitors. It is also promoting the development of enterprises and their learning processes.



Shah Sheikh

Cloud Security Alliance

DCD is an amazing platform for organisations to connect and develop next-generation data centers along with overcoming challenges with migrating their core infrastructure into the cloud.

Capt. Ahmed Suroor Al Shamsi, Deputy, Data Centers, Abu Dhabi Police, pictured at the DCD Converged Middle East gala dinner, celebrating the EMEA Awards 2014 finalists from the region.

# community

## DCD Awards

**ASIA PACIFIC**  
September 16, 2015  
Marina Bay Sands, Singapore

**LATIN AMERICA**  
October 6, 2015  
Club Ragger, Mexico City

**BRAZIL**  
November 10, 2015  
Buffet Dell'Orso, São Paulo

**US & CANADA**  
December 1, 2015  
Capitale, New York City

**EMEA**  
December 10, 2015  
Lancaster London Hotel, London

## Research

**OUT NOW REPORT**  
Global Data Center Market Overview and Forecasts 2014–20

**BRIEFING**  
China Data Center Market Trends 2015

**COMING SOON REPORT**  
Global Colocation Investment 2H 2015: Capturing The Next Wave of Demand (July 2015)

**BRIEFING**  
Securing Hybrid Data Center Environments (July 2015)

## New Webinars From The Leaders In Data Center Technology

### 5 REASONS WHY DCIM HAS FAILED

Wednesday, July 15  
11am BST, 12 noon CEST  
Speaker: Rhonda Ascierio, Research Director, 451 Group



DCIM systems have tended to overpromise and underdeliver. Vendors have supplied complex solutions that fail to address real business needs, yet the rewards can be vast. Join 451 Group's Rhonda Ascierio, and Panduit's Mike Akinla and Sander Kaempfer, to learn if there's a better approach.

Note: Attendees will receive a copy of the latest Panduit paper, *Organizational Benefits & Technical Capabilities of Next-Generation Intelligent DCIM*.

[www.datacenterdynamics.com/panduit-webinar](http://www.datacenterdynamics.com/panduit-webinar)

### POWER OPTIMIZATION – CAN OUR BUSINESS SURVIVE AN UNPLANNED OUTAGE?

Tuesday, August 25  
3pm BST, 4pm CEST, 1pm CST  
Wednesday, August 26, 1pm SGT  
Speaker: Jeff Wood, Anixter, National Sales Director (Power/Cooling/DCIM)

Most outages are accidental; by adopting an intelligent power chain, you can help mitigate them and reduce your mean-time to repair. Join Anixter and *DatacenterDynamics* for a webinar on the five best practices and measurement techniques to help you obtain the performance data you need to optimize your power chain.

Note: Attendees will receive a copy of the latest Anixter Briefing, *Five Paths to an Intelligent Power Chain*.

[www.datacenterdynamics.com/anixter-webinar](http://www.datacenterdynamics.com/anixter-webinar)



Simon Bradford  
*Microsoft*

The event has been really good. Sessions were very good and informative; overall, it was a very useful day for me.



Daniel Bianconi  
*Piller*

There is a very big push on the market and a high demand. I see many upcoming projects delivering more opportunities here in the Middle East.



## Cloudy with relief

A funny thing happened to me as I waited in line at a brothel near Naples last week. I was admiring the erotic friezes that decorate the ceiling around the entrance of the ancient building in the ruins of Pompei when I got a tap on the shoulder. It was the CEO of a large non-profit I had met in our tourist hotel the night before. He said:

“I’ve been thinking about that comment you made – that we should move to the cloud. But I’m still getting conflicting advice from my CTO. I’m confused.” My discussion with him had been interesting. I have believed for a long time that business leaders’ ignorance of basic IT functions gives them a huge disadvantage, particularly when they are dealing with rapacious systems integrators that provide much of the infrastructure of Europe.

My fears are articulated in a new report from Cobweb Solutions, which states that while cloud use is soaring, decision-making falls to the head of IT or the CIO in almost three-fifths (59 percent) of organizations. This means either the CEO and board are being ignored, or they are leaving critical decisions to the IT folks.

My advice to my not-for-profit friend was: “Move to the cloud now. You don’t need any of the old infrastructure or overheads.” But his CTO was saying no for all the old familiar reasons. And since he had experience, he was being listened to. Yet this poll shows that this vital decision is regularly being made not for business reasons but on the basis of the sum of old fears.

One of these is security, yet 99 percent of respondents to this survey, who are already in the cloud, have never experienced a security breach.

**There was better news** in another survey which revealed that 90 percent of European businesses are planning to adopt hyperconverged infrastructures in the next few years. At the moment 27 percent of EMEA respondents are using hyperconverged infrastructures compared with 24 percent in North America. More than 67 percent of those who have not yet adopted plan to deploy hyperconverged in their businesses within the next three years, compared with 51 percent in North America. EMEA respondents cited data center consolidation and the deployment of private cloud as motivating priorities. Now that’s a great relief.

•  
**Bill Boyle** - Global Managing Editor

 @billboyleDCD

*My advice was:  
“Move to the  
cloud now.  
You don’t need  
any of the old  
infrastructure”*



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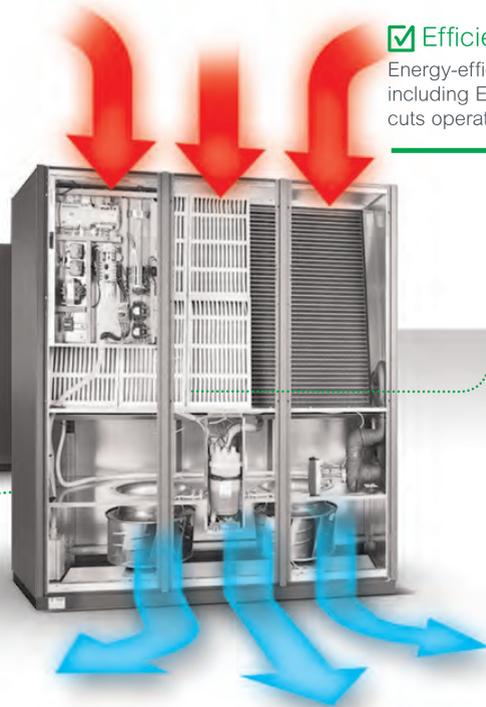
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