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Cover Story
Building Webscale
The digital infrastructure makes new demands
16

Asia Pacific
Singapore signs up to 'green' its data centers
12

Ian Bitterlin
Using waste heat is great in theory, but tough in practice
29

Turn and face the change
New thoughts on colocation
22

Power to the people
There's more than one way to feed your data center
42

Contents

May/June 2016

VOL 04 // ISSUE 14

Our tracks guide your path through the DCD Magazine, website and events

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

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DCD MEDIA

Webscale wonderland

Building at webscale is different. Data centers created a new technology discipline when they served a small, defined community (say, the staff and customers of a major bank).

But when web services and the cloud went global, the reach of those data centers multiplied and the game suddenly changed.

Engineering at webscale faces different challenges and the cloud players have led the response to that. They have monolithic applications, and they want millisecond responses to requests from a user base around the world.

But although their requirements are different, the cloud giants are addressing some of the same underlying issues that face the rest of the data center world. We can all learn from their efforts.

Power and cooling, along with network bandwidth, remain the biggest fundamental needs of data centers. Webscale players can adopt massively economic giant-scale solutions, but everyone needs to keep re-addressing the subject from first principles.

There's a balance between power and cooling. All the power that is used in a data center will become heat. And all that heat needs to make its way out of the data center racks, or else they get too hot.

So trimming the power needs of the IT kit reduces the need for cooling, and improving the effectiveness of cooling allows for more power.

Webscale players are pushing this forward, but there's plenty of scope for anyone to up their game, and our supplement looks at both sides of the coin.

Colocation still lives. Despite the efforts of cloud providers to blot up all the enterprise and consumer IT needs of the planet, individual organizations still need to put servers somewhere, and those that don't have their own facilities will put them in colo spaces.

The good news here is that those colo players are learning the lessons of webscale builders. They don't have a monolithic application to run. In fact, they may have a variety of clients renting parts of their space for diverse jobs, and the rules of the game say that every one of those customers is right. So colo players are getting creative about how to satisfy all their customers.

And any colo player worth its salt is also (up)selling the option, either directly or through a partner, of shifting all or some of that IT resource into the cloud.

And if it works, just maybe, those players could themselves reach webscale.

•

Peter Judge – *Global Editor*
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Webscale players are pushing things forward, but there's scope for everyone to up their game

50%

of enterprises will use webscale architecture by 2017 (Gartner)

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Equinix to sell eight data centers to Digital Realty

US-based infrastructure specialist Digital Realty has agreed to acquire eight European data centers, which European regulators have instructed its competitor Equinix to sell.

Digital Realty will pay approximately $874m for five facilities in London, two in Amsterdam and one in Frankfurt. Equinix has been told to sell some of its estate as a condition of approval for its $3.8bn acquisition of European colocation player TelecityGroup. European regulators imposed the sale to stop Equinix from having a dominant position on the retail colocation market.

According to Digital Realty, the portfolio of eight facilities contains approximately 213,000 square feet of white space and 24.4 megawatts of IT load, serving more than 650 customers. The properties are 72 percent utilized, and can be expanded to support another 14.9MW of IT equipment.

Digital Realty will acquire an interest in one data center in Amsterdam and leasehold interests in the other seven facilities, lasting an average of 23 years. In return, Equinix will get an option to acquire Digital Realty's data center at rue Ambroise Croizat in Paris, where Equinix is currently a tenant, for a purchase price of approximately $215m. This part of the deal is yet to pass regulatory scrutiny.

"Selling to Digital has got to have caused pain for Equinix," commented Nicola Hayes, analyst at Andrasta Consulting. "Before Christmas they were inundated with interest from investors, but they all fell by the wayside because of the inherent difficulties in turning these sites into a new business."

According to Hayes, Equinix would have preferred to sell the sites off piecemeal, preferably to newcomers, who would have trouble competing on a global stage. She added that the deal involves old data centers that will require substantial upgrades – something that is difficult to achieve when the data halls are nearly full. Only a company already in the industry with existing data centers in these markets, such as Digital Realty, could pull this off.

Tim Anker of Colo-X added that the deal was "good news for the customers and people who worked in those data centers," adding that Digital Realty's possible move into retail colocation, using the Telx brand it acquired, would be good for competition here.

http://bit.ly/1sLFjKJ

Linking ARMs

Backers of ARM and Power processors, including IBM, AMD, Huawei and Qualcomm, have teamed up to make their RISC processors more compatible with the dominant x86 instruction set. The CCIX Consortium will develop a Cache Coherent Interconnect for Accelerators (CCIX). This will let processors with different instruction set architectures share data with application acceleration engines.

Salesforce goes to AWS

Social CRM maker Salesforce has signed a deal with Amazon Web Services (AWS) that could be worth $400m over four years. Salesforce will use the AWS Analytics Cloud, App Cloud, Community Cloud, Sales Cloud and Service Cloud platforms, although it still plans to retain its own computing infrastructure.

HPE spits out EDS

Hewlett Packard Enterprise (HPE) will spin off its Enterprise Services division and merge it with CSC to form a new company with expected annual revenues of $26bn. This follows HP's split into HPE and HP Inc in 2015, and effectively spits out EDS, the services company then-CEO Mark Hurd bought in 2008.

VOX BOX / DCD VIDEO

Julius Neudorfer
CTO
North American Access Technologies

Is liquid cooling necessary, or is air cooling enough?
There is a great deal of discontinuity between the liquid-cooled camp, and the air-cooled camp, but they will coexist. The reality is that right now, liquid cooling is a very small percentage of the market. What's driving liquid cooling is high performance computing (HPC), and there is great interest because energy efficiency for liquid cooling is substantially better.

http://bit.ly/1t1i53W

William Gast
Data Center
Design Director
CenturyLink

What is "chiller in a box"?
We were looking for ways to increase the efficiency of our data centers in a small footprint, so we incorporated all the parts of a water-cooled chiller plant – including the economizer – on a footprint the same size as an equivalent air-cooled chiller. We can do one-for-one swaps and increase the efficiency five times. It allows us to upgrade a facility without going inside and causing any downtime.

http://bit.ly/1jAiDbk

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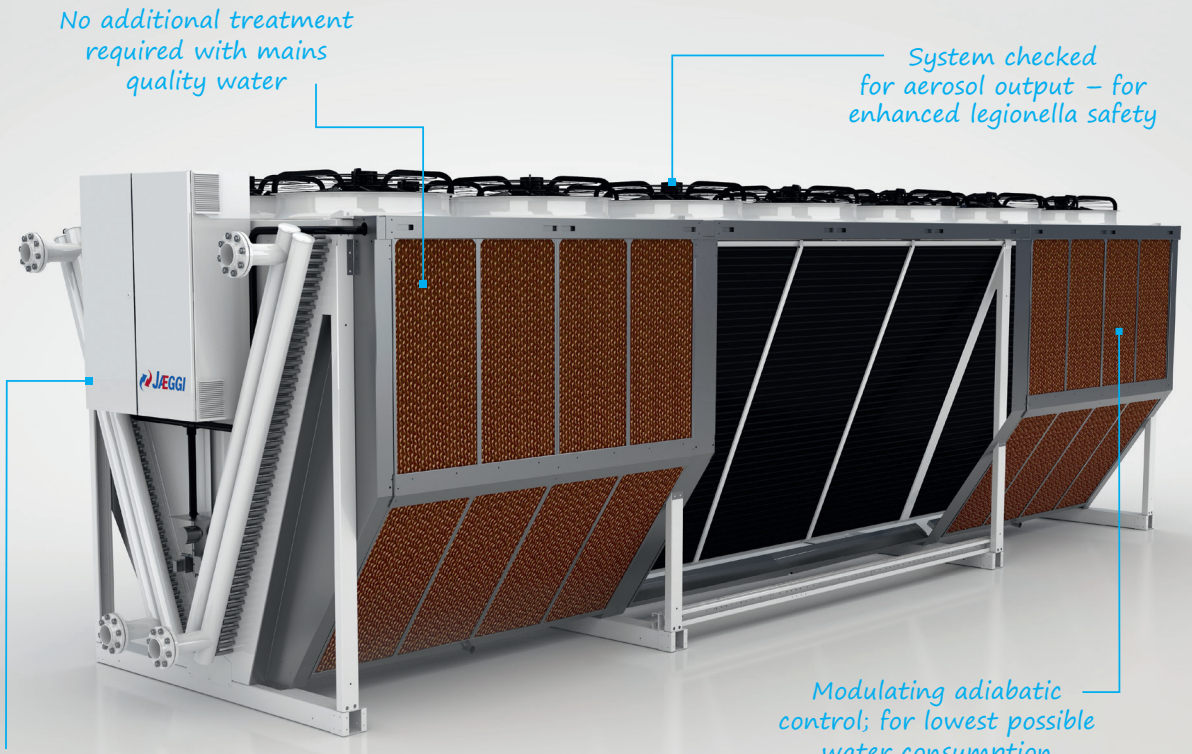

Wet or dry operation

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.

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Digital Realty fills Japan site with one deal

Digital Realty Trust has closed a deal with an unnamed cloud provider that has fully occupied the first phase of its data center in Osaka.

The center occupies 8,271 square meters (80,000 square feet) at a facility 20km from the Japanese city. In a financial report, the company's CEO, William Stein, said: "Leasing activity included a multi-megawatt lease with a hyperscale cloud service provider in Osaka, fully leasing phase one of our first project in Japan. We also entered Germany with the acquisition of a six-acre land parcel."

The first-phase deal for half of its Osaka provision has come at a time of growth for Digital Realty, which closed a deal to buy Telx for $1.9bn last October. This has massively boosted its presence in the US and given Telx the global reach it lacked before.

"Data center demand remains robust, driven by a rapidly growing trend towards corporate IT outsourcing, Stein added. "Our activity in Germany and Japan underscores the importance of scale and a global platform in providing data center solutions to meet customer needs."

Plans for the Osaka center were announced in late 2013, when it bought the 15,000 square meter facility (160,000 square feet) for $10.5m. The company started work in April 2015 and offers multi-rack, cage and private suites configurations, with power capacities ranging from 2kW to over 2,400kW.

http://bit.ly/1P4Z98F

Africa expansion brings first facility to Chad

Chad has its first data center, as a big expansion is predicted for facilities on the continent.

Swedish prefabricated data center specialist Flexenclosure has constructed the first data center in the landlocked country, sometimes referred to as the "dead heart of Africa." The news comes as a report predicts fast growth for the continent's facilities.

The communications and colocation center was built by Flexenclosure for Millicom subsidiary Tigo. At a cost of $6m, the 374 square meter facility, built in Sweden and shipped to Chad's capital N'Djamena, is designed to support an IT power load of 400kW. The building can double in capacity if needed. The design also had to take into account that N'Djamena is one of the hottest cities in the world, with an average daily high temperature of around 40° Celsius.

Africa has growth potential, according to a report published by BroadGroup for the Data Center Africa Summit held on June 8, thanks to the availability of greater surplus power, more submarine cables, a growing population that is increasingly affluent, and stabilizing government regimes.

Egypt, Kenya, Nigeria and South Africa are the growth leaders, and the continent's grid now allows some to produce a power surplus that is exported for profit, while new cables and satellites also arrive.

IBM has opened its first data center in South Africa, and Teraco is building Africa's largest data center there.

http://bit.ly/22xCHg7

10%

Growth in global colocation market 2015-2016

41%

Growth in NTT data center revenue 2015-2016 (Synergy)

South Korea to host Microsoft's cloud

Microsoft has announced plans to deliver cloud services from two new data center regions in South Korea, which include a facility based in the capital of Seoul. Microsoft's Azure cloud will also expand in Canada, with local data centers in Toronto and Quebec City, and Canadian data residency for Office 365 for business customers.

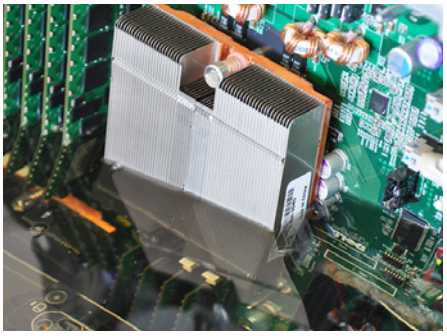
Microsoft has invested more than $15bn in its cloud operations to date and announced a total of 32 Azure regions around the world, 24 of which are generally available. According to Microsoft cloud VP Takeshi Numoto, that's more regions than any other major cloud provider.

In 2014, reports suggested Microsoft is planning a multi-billion-dollar data center in the South Korean city of Busan. While Busan wasn't mentioned by name here, the updated Microsoft Azure website does list a "Korea South" region, in addition to a "Korea Central" region, with the location shown as Seoul. This strongly suggests that any new data center located in Korea South is likely to be in Busan.

There is no question that Microsoft has been investing heavily in data center infrastructure over the past few years as it refashions itself from a software vendor into a services company. However, it is also facing intense competition from cloud providers such as Amazon Web Services (AWS) and IBM SoftLayer in the Asia Pacific region. For example, AWS South Korea went live in January as part of an accelerated expansion in the region, and it is reportedly building as many as five data centers in Mumbai, India.

http://bit.ly/22xCnxQ

Green Revolution Cooling launches the customizable Minimus range



Liquid cooling specialist Green Revolution Cooling (GRC) has partnered with Supermicro and Gigabyte to release a range of stripped-down servers that eschew most of the features traditionally offered by large OEMs.

The Minimus range enables customers to configure the hardware before they buy, and specify the exact components they need. According to GRC, this approach helps cut data center hardware costs in half.

The model is similar to the thinking behind the Open Compute Project, but is more suitable for smaller organizations, GRC said. "We saw that most OEM servers were not only full of unused features, they also cost significantly more than the cost of their components," explained Christiaan Best, founder and CEO of Green Revolution Cooling.

"There was a time in the industry when everyone believed that 'nobody gets fired for buying blue (IBM).' But those days are long gone, as servers are becoming a commodity, and paying a $2,000 premium for a nameplate is no longer acceptable… or necessary."

According to research carried out by the company, the main reason customers buy more expensive branded kit is reliability. But GRC claims that, when it looked at its own custom servers, the annual failure rate stood at less than one percent.

The company has collaborated with major server manufacturers Gigabyte and Supermicro to develop a standardized server design based on the ATX motherboard, with integrated rack-based liquid cooling and power distribution.

It then put all the pre-tested options into an online framework to enable customers to mix and match components without any reliability or compatibility worries.

http://bit.ly/1TPWiHT

France's OVH has plans down under

Hosting provider OVH of France wants to open a data center in Australia; sites in the US and Asia are also in the works. Maxim Hurtel, the public cloud product lead at OVH, revealed the plans in a speech at the OpenStack summit in Austin, Texas.

OVH builds its own servers and currently has 250,000 servers in its infrastructure, with 500 new ones added every day. According to Hurtel, OVH also builds and operates its own networks around the world, and has 32 points of presence globally.

OVH had announced plans for 12 new data centers on top of the existing 17 it already runs. These new data centers will be built over the span of two years, said OVH vice president Pascal Jaillon.

OVH could be entering the Australian market at an opportune moment, when the cloud-first policy of the Australian government is driving demand for more public cloud platforms. OVH could provide an alternative for organizations that prefer not to invest in Amazon Web Services (AWS) or Microsoft Azure.

http://bit.ly/1O552b1

China launches quantum communications satellite

China is set to launch the first-ever quantum communications satellite in an experiment that could potentially lead to an unbreakable encrypted wireless network. Later this year, the nation also hopes to complete an $80m, 2,000km quantum communications link that will connect government offices in Beijing to those in Shanghai.

Project leader professor Pan Jianwei, from the University of Science and Technology of China, successfully implemented quantum communications to exchange information securely among government officials during a military parade. "China is completely capable of making full use of quantum communications in a regional war," Pan told news service Caixin. "The direction of development in the future calls for using relay satellites to realize quantum communications and control that covers the entire army."

The network and satellite will transmit encoded data through quantum key distribution (QKD), which secures a channel using quantum entanglement. Two particles can share the same quantum state, irrespective of their spacial distance from each other, but the entanglement collapses when it is observed – so eavesdroppers cannot monitor data without immediately changing the quantum state and being noticed. "The Edward Snowden case has told us that the information in the transmission networks are exposed to risks of being monitored and attacked by hackers," said Pan.

Weighing in at 500kg, the experimental satellite contains a quantum key communicator, quantum entanglement emitter, entanglement source, processing unit and a laser communicator. It will orbit at an altitude of 1,000km and is expected to go live two years.

Quantum physics researcher Anton Zeilinger, of the University of Vienna, had hoped for the European Space Agency to develop its own satellite but found the organization too slow. "Its mechanisms are so slow that no decision was made," he told *Nature* in 2012. Instead, Zeilinger, who was previously Pan's Ph.D adviser, collaborated with the Chinese. In 2013, Austria and China announced the Quantum Experiments on Space Scale collaboration, with a ground station for the Chinese satellite being built in Vienna.

This January, Pan said: "Our first mission is to see if we can establish quantum key distribution between a ground station in Beijing and the satellite, and between the satellite and Vienna. Then we can see whether it is possible to establish a quantum key between Beijing and Vienna, using the satellite as a relay."

http://bit.ly/25ydBPR

Equinix plans expansion

Colocation giant Equinix will expand capacity over the next few quarters by pushing out its existing facilities and building extra data centers. In all, the company has 16 expansion projects underway and plans for four new facilities, according to CEO Steve Smith.

The capacity increase was announced in the company's 2016 Q1 earnings conference call, where Smith also said Equinix's Internetwork Business Exchange (IBX) centers are at 80 percent occupancy.

The New York NY5 site will add 1,200 sellable cabinet equivalents (2.5 square meters per cabinet), with the commencement of a second phase of expansion. Japanese expansion is capped, following the acquisition of Bit-isle in 2015.

In San Jose, California, Silicon Valley demand is being met with 2,600 cabinets in a new SV10 facility on land purchased adjacent to Equinix's existing Great Oaks campus.

In São Paulo, Brazil, a slightly larger facility SP3 will be created to provide approximately 2,775 cabinets, and the Sydney SY4 build will contain 3,000 cabinets opened in two 1,500 cabinet phases. A second phase of 1,385 cabinets is due this year at London LD6.

http://bit.ly/22xCKby

ST Telemedia buys Tata's Indian sites

Singapore Technologies Telemedia (ST Telemedia) is to buy a majority stake in the data center business of Tata Communications, which has been on sale for nearly a year. The deal, valued at around $170m, sets up a joint venture, with Tata keeping a minority stake.

ST Telemedia will buy 74 percent of the data centers in India and Singapore owned by Tata Communications. Tata will keep the remaining 26 percent, and shift its focus back to its core business of networks and managed services. ST Telemedia has been the frontrunner to buy the data centers since soon after they were put on the market.

Tata Communications, part of the giant Tata conglomerate, rapidly built up a massive data center portfolio, mostly through acquisitions in 2013 and 2014. The organization runs about a quarter of India's data centers.

The company says it has more than a million square feet of data center space, in 44 facilities, distributed around the world, including Singapore, the US and the UK. This deal only affects Tata's three sites in Singapore and 14 colocation facilities in India, in cities including New Delhi, Mumbai, Bengaluru, Chennai, Kolkata and Pune. In 2014, Tata transferred these sites to an independent subsidiary – Tata Communications Data Centers (TCDC) – and then in 2015 set about selling a majority stake in the business.

When this deal goes through, the TCDC data centers, along with Tata's three facilities in Singapore, will be a joint venture, effectively run by ST Telemedia Global Data Centers (STT GDC). This group has a stake in data centers in all major economic areas, and last year bought a stake in Virtus of the UK. "I think Tata's priority here is to raise cash and pay down some of its debt," said Adi Kishore, analyst at DCD Intelligence. "Its Indian portfolio was probably the most attractive to ST Telemedia, which wants to expand in India and China. Long term, though, Tata would like to migrate its business to managed services and cloud.

http://bit.ly/1TPO2Yq

CyrusOne grows finance-focused Chicago site

Data center operator CyrusOne is expanding the data center it bought from Chicago Mercantile Exchange (CME) in March. CME is still in the building as a tenant, and CyrusOne wants to bring in other Chicago-based financial firms.

In March, CME sold its building to CyrusOne and signed a 15-year lease to remain as the anchor tenant for the facility. CyrusOne is now taking advantage of the site's prime position in Chicago to build on 15 acres of empty land included in the original deal. The extension will add another 500,000 square feet (46,500 square meters) of space, which the two firms will offer to other financial services players.

CyrusOne has said there is significant demand for additional colocation, and the deal allows both CyrusOne and CME to provide colocation services to interested customers in the original CME data center.

However, space is limited in that building. CME occupies over 72,000 square feet (6,700 square meters) of a data center which is reported to be more than 400,000 square feet (37,000 square meters) in size.

CyrusOne now says there are only 36,000 square feet (3,350 square meters) available to rent in the building, which indicates there may be other customers already, or other limitations with what can be done in the existing facility.

When the original acquisition of the data center was announced, both CyrusOne and CME talked about potential partnerships between the two firms to grow the business. The pair have said they plan to build additional space and to focus on "becoming the nexus for financial, energy, social media, and cloud companies."

http://bit.ly/1TXDwvj

The Paris Agreement on Climate Change

- Aims to keep global warming "well below 2C"
- Signed by 176 states
- Ratified by only 17 states, mostly small island nations
- The agreement comes into force only when ratified by the largest 55 countries
- Under a non-binding promise, developing countries could get $100bn. So far $3bn is committed

Singapore signs up to 'green' its data centers

As Singapore signs the Paris Agreement, new and old data centers will have to consider their climate impact, says *Paul Mah*

Paul Mah
SEA Correspondent
@paulmah

Singapore signed the Paris Agreement on Climate Change in April, and also pledged to reduce its emissions intensity by 36 percent by 2030 compared with 2005 levels. This milestone will be of small interest to the general public, but data center and cloud providers will take notice given Singapore's position as a data center hub with limited access to renewable sources of energy.

Data centers consume 6.9 percent of the total energy used in Singapore, despite accounting for just one percent of the total land area. With new data centers expected to launch just about every other month for the rest of 2016, the percentage is likely to increase, and industry will have to get moving to fall into step with the Singapore government's plan.

New data centers are more efficient and tend to be huge, multi-story facilities in land-strapped cities such as Singapore and Hong Kong. "A lot of them are very large, with very large energy consumption,"

says Hal Grant, executive vice president of IT business at Schneider Electric. "Maximizing the efficiency on every watt is very, very important to them."

There are innovations in cooling systems, and the designs of pods within data centers, and even how storage is lined up within the facilities. Data centers must be continually upgraded, because even a new data center today will be an "old" data center in five years' time, says Grant: "It is a lifelong challenge."

High power-density data centers are not necessarily the most energy efficient, as a high power deployment tends to mean more heat, which translates into the need for more cooling. But there is a strong demand for higher density; for example, NTT's recently opened FDC2 data center in Hong Kong has a power density of up to 24kVA per rack backed by a thermal storage system, while Singtel's upcoming DC West data center in Singapore has rooms dedicated for higher power deployments.

Improving an existing center isn't just a matter of swapping out older hardware for new components, says Grant. It could entail a rethinking of the systems that are implemented and integrated with the rest of the data center.

"[For] something designed many years ago, there could be a newer or better way of doing the system. First, understand where you are. Second, put together a pragmatic plan to drive improvement and efficiency," he says.

Air-conditioning equipment doesn't run as efficiently after 10 years if it is not maintained properly, and may need to be overhauled or even replaced. "If you don't pay attention to it all the time, if you're not constantly trying to improve things, then you fall behind," explains Grant.

Other improvements can be uncovered with the right data, says Pankaj Sharma, vice president of IT business in Schneider Electric's APAC region. Sharma recommends DCIM software to improve efficiency.

"DCIM looks at your cooling system and turns things on and off to ensure the most efficient use of DCs," says Sharma. "Software takes it to the next level: How many of these components need to run on a constant basis? What is the best way to get them to work together?"

Energy-efficiency projects don't have to be monolithic. DCIM vendors are increasingly willing to hook up to products from competitors to get usage information. "We partner with other companies, we train them, we sell them tools, we don't have to do everything ourselves," says Grant.

It is clear that energy efficiency is now being driven by several factors: increasing consumer awareness can overcome possible inertia by data center operators, while government initiatives and standards also push data center operators to make improvements.

> *Data centers need constant upgrades: today's new facility will be "old" in five years*

Government green standards include the BCA-IDA Green Mark for Data Centres, explains Sharma. "While they provide these standards, they also provide subsidies. It's like you get rewarded twice."

"If you have a finite number of square meters, and you are going to pack more into those square meters, then by definition you have to constantly be searching for efficiency in the data center and the buildings," says Grant. "And if we're really going to make a dent in energy efficiency, you have to spend just as much time on an existing data center as you would on a new one." ●

Market Focus: Latin America

Data centers are developing in major emerging markets within the region, reports Peter Judge

Peter Judge
Global Editor
@peterjudgeDCD

The countries that comprise Latin America aren't a homogeneous set, but they do share some common features – to a greater or lesser degree. Their economies are struggling and their currencies are often weak. Their governments are unstable and often accused of corruption.

Despite this, there is strong investment in the tech sector in the region, and mobile services are expanding. As in other countries, concerns over privacy are driving a move towards more local data storage, and public cloud services are competing to overcome inertia and win over in-house IT.

Data centers are worth $2bn in Latin America, according to the International Computer Room Experts Association (ICREA). Within the constraints mentioned, this year is expected to be strong. Prefabricated data centers are predicted to grow in the region, says Fernando Garcia of Ingenium Engineering. They can be delivered quickly in a market that faces rapid change.

There are a few large greenfield projects or new data centers, but many brownfield jobs and upgrades to existing facilities are being fulfilled by new players, says Garcia.

However, the market for brownfield projects – in other words adjustments, remodels and updates for existing sites – is bullish since companies are beginning to make common sense investments in infrastructure by capitalizing on the existing infrastructure they already own and optimizing further investments.

Brazil

At the time of writing, Brazil is contorted in a political crisis over suspended President Dilma Rousseff's handling of the economy. Inflation has been at 10 percent and the country has been plagued by the Zika virus, a public health crisis that remains difficult to quantify and predict, and which threatens the success of the Olympic Games.

Nevertheless, the country has seen investment in several major new colocation data centers. CapGemini has put $3.6m (13m reals) into a new data center in Campinas. Meanwhile, Equinix has put $21m (76m reals) into a data center in São Paulo. Players from neighbouring countries are also investing. Colombia's Internexa has opened an 820 square meter data center in Rio.

Alongside data centers, networks are being developed, and Brazil's position on the continent makes it a popular landing point for international fiber. Telefonica is linking Rio with Virginia Beach in the US via Puerto Rico, with an 11,000km link due to be operational in 2018.

Meanwhile, contrary to the usual Northern Hemisphere dominance, NEC is laying a 6000km fiber link for Angola Cables directly between Angola and Brazil.

Links along Brazil's coast are also proving useful to connect its cities: Google is funding the "Junior" system, which will link Rio and São Paulo via a sea-going loop.

Mexico

Mexico's government appears to be more stable, despite international criticism over its handling of the case of 43 students apparently abducted by police in 2014. The country's relationship with the US is perhaps more strained, thanks to the inflammatory language of US Republican hopeful Donald Trump.

Despite this, data centers in Mexico appear to be healthy, and the country makes up some 20 percent of the Latin American data center scene. The market for data centers in Mexico grew 18 percent in 2014, and will continue to grtow, according to ICREA.

Data centers are worth $2bn in Latin America, and this year is expected to be strong

As elsewhere, telecoms is growing fast, as the middle class expands, and uses more mobile services. Government data centers are not growing so fast in Mexico.

The colocation market in Mexico is dominated by just three players: Kio, Alestra and Triara, which between them own 80 percent of the space. This will make life difficult for any new entrants.

Alestra's position will be strengthened by its merger with Axtel, a large Mexican telco. Axtel now has six data centers, and says it will invest $250m a year in its infrastructure.

Colombia

After a long-running guerilla war with Marxist groups including FARC, Colombia is becoming more stable as peace talks progress under President Santos. As Colombia is Latin America's third-largest oil producer, its economy has been hit by the recent fall in oil prices. Despite this, growth in telecoms has driven data center growth. This year, GTD Flywan has opened a Tier III reliable facility in Colombia, and Level 3 has launched its third data center there, in Santiago de Cali, alongside two facilities in Bogota.

As in Brazil, marine cables are used to provide connections between Colombian cities, with Level 3 opening a link between Cali and Buenaventura that depends on a 300km link along the Caribbean coast.

Smaller than the Latin American giants Brazil and Mexico, Colombia is a prime location for subsidiaries of Brazilian and Mexican companies, and is seen as a route to access smaller markets such as Honduras, Guatemala and Nicaragua. Tier IV opened a Colombian subsidiary in 2015 and expects it to provide half of the company's growth in 2016.

Peru

Peaceful since the end of the insurgency and the self-imposed exile of President Fujimori in 2000, Peru has been consistently one of the fastest-growing economies in the region, although with a GDP of $180bn, it is only one-tenth the size of Brazil.

Nevertheless, Peru's economy is expected to grow at 5.4 percent per year until 2018, leading the region in growth terms, according to LatinFocus.

The country's data center sector has been characterized by a slow-moving but well-meaning public sector, while the rest of the tech community shows a will to innovate and get involved in emerging areas of technology, including securityh and satellites.

Recent announcements of data centers in Peru have therefore come from aerospace and academia. The new academic complex of the Universidad Nacional del Altiplano (UNA Puno) will contain a 24,000 square meter data center valued at 30m soles (about $9m), in the basement of a 15-story, high-tech research center.

Meanwhile, the National Commission for Aerospace Research and Development has created a virtual data center to gather images from a Peruvian satellite in low polar orbit.

More conservatively, the ubiquitous Latin American provider Telefonica has achieved Tier III certification for its data center in Monterrico, Surco, and the National Bank has adopted free cooling technology. And the National Bureau of Government of Peru (Onagi) has modernized with a data center, costing $330,000 (991,000 soles). ●

Brazil
- Population 201 million
- GDP $1.8tr

Mexico
- Population 113 million
- GDP $1.2tr

Colombia
- Population 45 million
- GDP $274bn

Peru
- Population 29 million
- GDP $131bn

BUILDING WEBSCALE INFRASTRUCTURE

As the human race constructs the greatest project the world has ever seen, the architects behind it consider its human impact. Peter Judge reports

Peter Judge
Global Editor
@peterjudgeDCD

Technology is changing human existence more rapidly than ever before, and the digital infrastructure is being built faster than any other building project in history. The scale of the project is unprecedented, and the underlying technology is being invented as the project proceeds.

We are building at webscale, and the size and shape of the infrastructure is dictated by massive issues and tiny concerns. Where do you build a data center that can store and process billions of pages for billions of people? And how do you collect data and send instructions to minuscule sensors that monitor and control more and more of our lives.

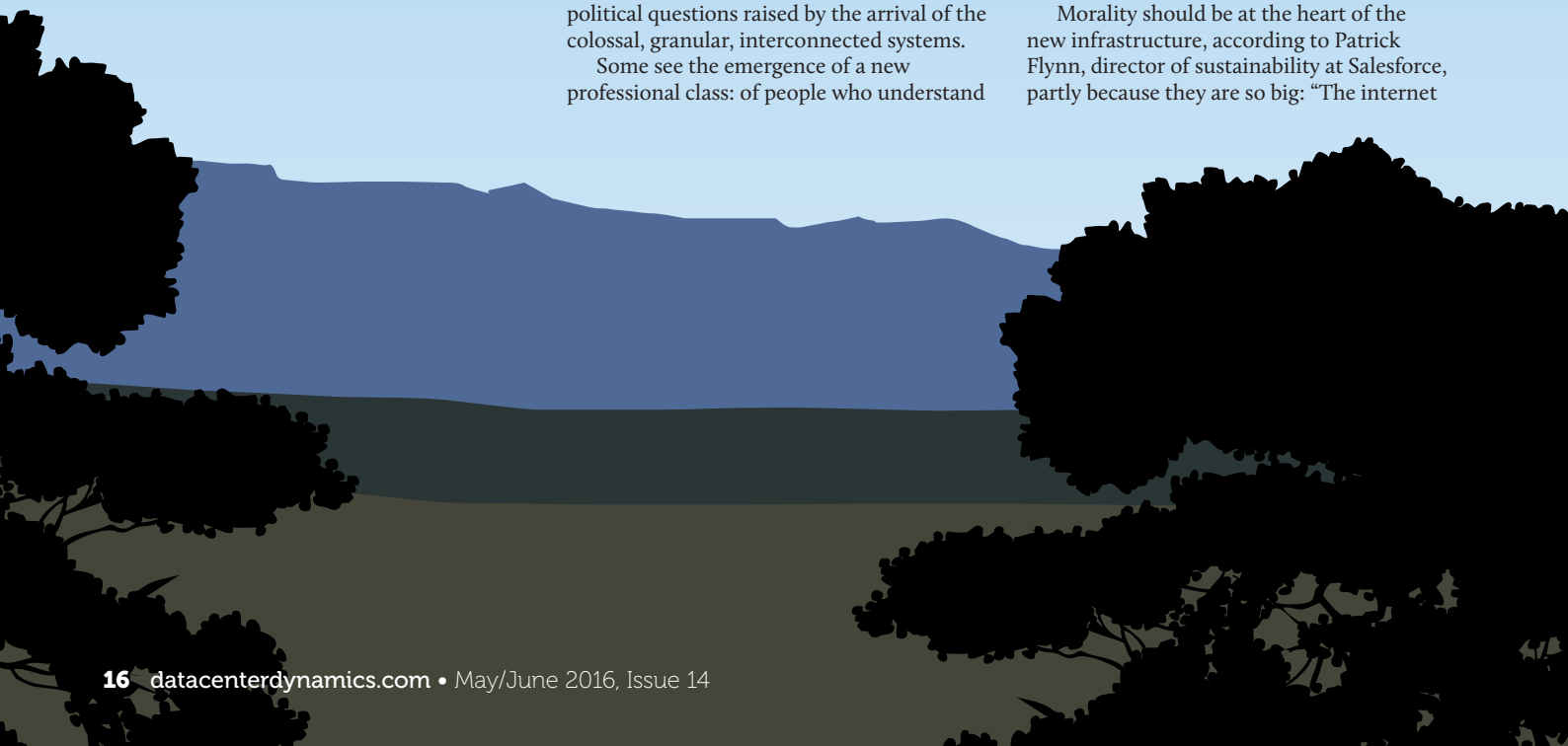
The architects and designers of the world's digital infrastructure are gathering at the DatacenterDynamics' Webscale event in San Jose, on July 19-20, and the agenda includes the technical, the organizational, and the political questions raised by the arrival of the colossal, granular, interconnected systems.

Some see the emergence of a new professional class: of people who understand and drive the creation of digital structures. These people are "Infrastructure Masons", according to Dean Nelson, who has set up a group of that name. The masons of medieval Europe built cathedrals and created organizations to develop and preserve knowledge of how to build in stone and regulate the morality of the profession.

"I am proud to be a part of the global community of people who build and manage this digital infrastructure," says Nelson, who previously ran ebay's data centers. "I think it's time the world recognizes them and appreciates the work they do."

The word 'Masons' gets across the scale of the projects and the need for human ingenuity in their delivery. In the Industrial Revolution and the Machine Age, similar roles were taken by people like Isambard Kingdom Brunel and Henry Ford, who understood the possibilities and honed the technology of their times.

Morality should be at the heart of the new infrastructure, according to Patrick Flynn, director of sustainability at Salesforce, partly because they are so big: "The internet



is a species-wide central nervous system," he says in a TEDx talk. "Data centers are the information factories. They are the biggest thing we will ever build, consuming more electricity than all but two countries on Earth."

Previous big structures have had unintended consequences, he says. The highway system enabled transport and communications but created smog, traffic congestion and the loss of community.

When our children look back on the information system, Flynn wants them to approve: "Unlike past mega projects, this one can have morals and values." Just making sure that the structures don't harm humans or the environment is a step towards this: control logic embeds morals into machines, he argues.

84%
revenue growth of top four public cloud providers, 2015 (Synergy)

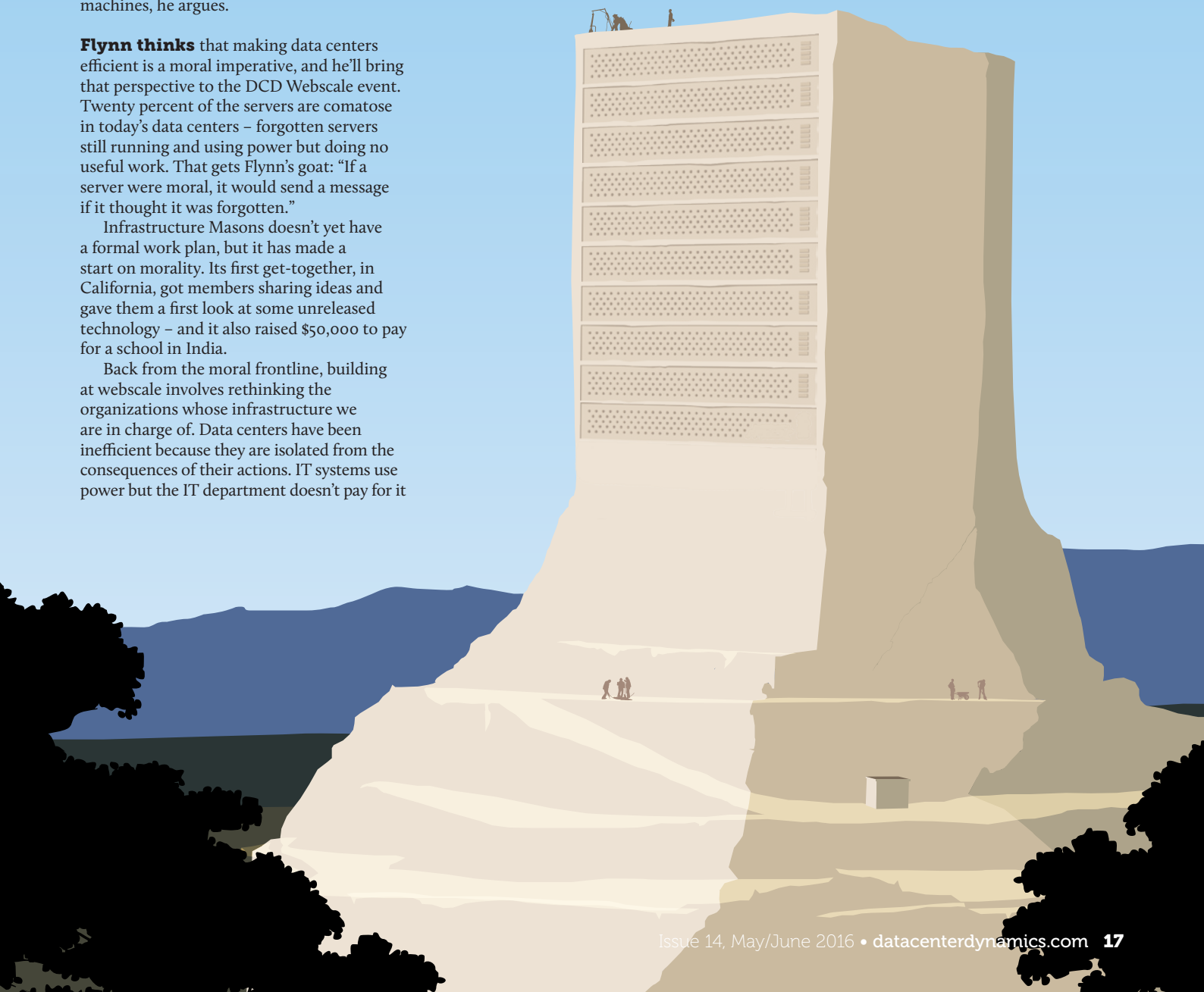
Flynn thinks that making data centers efficient is a moral imperative, and he'll bring that perspective to the DCD Webscale event. Twenty percent of the servers are comatose in today's data centers – forgotten servers still running and using power but doing no useful work. That gets Flynn's goat: "If a server were moral, it would send a message if it thought it was forgotten."

Infrastructure Masons doesn't yet have a formal work plan, but it has made a start on morality. Its first get-together, in California, got members sharing ideas and gave them a first look at some unreleased technology – and it also raised $50,000 to pay for a school in India.

Back from the moral frontline, building at webscale involves rethinking the organizations whose infrastructure we are in charge of. Data centers have been inefficient because they are isolated from the consequences of their actions. IT systems use power but the IT department doesn't pay for it directly and the systems in buildings that are controlled by other divisions of the business. Facilities management has been separate from the technology division, and that has led to a disappointing – and arguably immoral – situation. Power and cooling systems need to be managed more intelligently, but all too often the systems with the brainpower to do that can't talk to them. Even when air-conditioning systems are connected, they often use old technology such as dial-up modems. "Those systems are designed to never change," says Scott Noteboom, another Webscale speaker, and a former data center builder at Apple and Yahoo. "They're completely isolated from each other."

Merging those two silos results in cost savings at the very least, Noteboom points out, but they can also allows the kind of moral systems that Flynn wants to see. A system can't reduce its impact on the environment, until it is connected in such a way as to enable it to see what that environmental impact is.

The Internet of Things brings new connectivity, but it has the potential to create continually fragmenting infrastructure controls. In this world, Noteboom reminds data center people yet again of the importance of avoiding the silo effect, where different technology requirements result in independent infrastructures being developed, in this case between IT and facilities. ▶



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Noteboom says data center facilities management currently often takes a "North Korea" approach to providing security for the physical infrastructure. The machinery of the physical plant is hidden and isolated, while the other features of the data center get the advantage of an open and highly visible approach to security and management.

Noteboom is putting forward practical solutions to this with LitBit, based on the Apache Iota protocol, designed to automate information gathering and control in the Internet of Things, the emerging galaxy of networked devices that could make our lives better.

LitBit's RhythmOS is an open-source, orchestration backbone with open APIs for the development of third-party applications, tools, and compatible hardware and software that manage sponsor-driven devices. Within and beyond the data center it obviously has potential applications.

Noteboom's LitBit company is based around the group that originally set off the Apache Iota project, designed for the Internet of Things to eliminate the silo effect, while also providing a new and practical approach for dealing with these issues.

Project Iota set out to create industrial-grade open-source IoT tools, including hardware components and software platforms. Since the Iota platform itself is a Linux computer, more capable hardware platforms increase the size of the managed device environment. Improved performance can be achieved by the use of multiple management platforms in parallel.

Initial hardware platforms under consideration include devices on the scale of the Raspberry Pi. The system lets users create "Maestros" – orchestration components that add user- and system-defined orchestration capabilities. These user-created tools allow devices on LitBit's RythmOS platform to work together, and can be shared.

Webscale generally refers to the cloud providers and telcos that provide the massive capacity, the servers and communications, required by the users of the internet.

Customer-facing firms such as Google and Facebook have billions of users and petabytes of data to store and manage.

One step down, firms such as LinkedIn are still webscale, but at a smaller level. It's still worth their while making their own kit and acting as good infrastructure builders. Another Webscale speaker is Yuval Bachar, principal engineer at LinkedIn. He has presided over a program where the social media site designs its own network switches and propounds its own data center architecture.

LinkedIn has designed the "Pigeon" network switch, so all parts of its data centers get 100Gbps through a single fiber pair. Inside the racks this feeds a lot of activity, which is provided by servers operating at such high densities that Bachar has adopted cabinets with doors cooled by liquid.

"There are no hot and cold aisles like you would find in a typical data center," says Bachar. "Everything is cold aisle. The hot aisle is contained within the rack itself." Savings from this can reach millions of dollars in CapEx, and the resulting systems run better and faster.

It's a standout example where moral considerations and technical considerations are perfectly in line, where one of the builders of the digital infrastructure can take a pride in his work.

The social side of open source

Scott Noteboom was the go-to data center guy at Yahoo for two years, and then went to Apple for six years, providing the data center muscle to power the new Siri generation of products and services. His new company, LitBit, has just emerged from stealth mode, with the announcement of $7m in funding for an open-source software company with a focus on the IoT.

Open source is a crucial component of data centers and the rest of the new digital infrastructure, Noteboom will tell DCD Webscale. It doesn't just provide server and networking software but also serves as a methodology to drive the building and running of the digital infrastructure.

Facebook's formation of the Open Compute Project has created a generation of efficient open-source hardware, while Noteboom says open source is needed to supply the tools necessary to manage the physical side of the data center, from cooling fans to diesel backup generators.

Open-source solutions are often felt to be off-putting for less technical people, but Noteboom wants to have management that doesn't require a specialist or heavy-duty manuals. After his years at Apple, Noteboom believes that humans shouldn't need to read a manual, learn a programming language or need to hire a subject management expert in order to be successful in such an important world-changing activity.

This is important. Letting in ordinary people could help raise awareness of the issues that need to be solved before IoT and the rest of the digital infrastructure can be an effective development for business.

DCD webinars

DatacenterDynamics webinars are a useful, interactive medium for companies to deliver audiences targeted messages that reflect sales and marketing objectives. To that end, DCD delivers bespoke content to webinar attendees with the support of an expert editorial team to help clients, who run webinars with DCD, realize measurable payback on webinar campaigns.

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Tuesday, 28 June 2016 – (12pm CEST / 6pm SGT / 11am BST)

Attend this one-hour webinar, sponsored by Nexans, and learn from industry experts Nick Parfitt, Rob Cardigan and Stephen Worn.

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Best practice in modular design

Starline's **Mark Swift** joined our DCD webinar moderator **Stephen Worn** to discuss power management and distribution, and the pros and cons attached to both.

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SDN/NFV: The revolution is here. Are you ready?

This webinar explores the use of software-defined networking and the belief that it will deliver increased flexibility, reduced cost and greater productivity. We hear from IDC research director **Brad Casemore** and **Jeremy Rossbach** from CA Technologies.

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Anixter's 5 senses of DCIM

Does DCIM offer huge potential benefits and cost savings for your digital infrastructure? **Stephen Worn** and **Andy Jimenez** from Anixter debated the different components that make up a successful deployment.

Watch on demand here

http://bit.ly/1qGHfm9

Bruce Taylor
EVP, North America
@btaylor46

Good news, bad news…

This is the best of times. And if not the worst of times, then it's the most interestingly complex of times for the colocation industry.

The good news: the continued growth of the third-party, off-premises colocation data center is assured. Globally and unrelentingly. Data will grow ten-fold by the end of the decade. It is currently doubling year-over-year, more or less following Moore's and Metcalfe's Laws.

The colocation industry is on track to double in size to $50bn by the end of this decade. But the nature of colo is transforming under our feet. Enterprise hybrid and multi-cloud will drive that, and it will be a complex mélange of IaaS, PaaS, SaaS, DRaaS and E[verything]aaS.

In the coming time of data center as code, the physical facility and services industry will be both vital and volatile.

The bad news is that the colocation and cloud host data center industry is in the same disruptive upheaval as is the rest of the digital-transformation sector.

Precisely because of that transformation, along with the dizzying velocity of data growth in all economic sectors, and the equally dizzying array of potential solutions to managing the surging demand for IT capacity in the zettabyte era, more will be required of colocation infrastructure services providers than ever before.

Meanwhile, for those enterprises willing to try to manage on-premises data centers, the technology odds are tilting in their favor, but only if they are extraordinarily competent.

A colocation facility, at some point, may become just another physical expression of the true autonomous, software-defined data center, serving both enterprises and the cloud.

At the recent DCD Enterprise conference in New York City, at least two speakers looked out at the audience and said: "Don't worry, if you're smart, you'll all have jobs for a long time to come." But those jobs will consist of managing and mediating disruptive change.

•

Bruce Taylor- *EVP North America, DCD*
@btaylor46

Turn and face the change

The colocation world may be in crisis, but Bruce Taylor and Peter Judge see plenty of opportunity there

Stand by for disruptive change. As demand soars, capacity will be provided by both colocation and cloud infrastructure – often in the same facilities.

The primary marketing value proposition of colo owners used to be "your mess for less", but that is now is over and done with. Dead and gone.

Instead, the buyer has to consider multiple issues, with a set of colocation and cloud services decisions that have grown in number, importance and complexity.

If I am an enterprise IT shop, I can virtualize my data center footprint and get massive advantages through consolidation into a smaller and more compact set of IT resources. But when I consolidate, am I altering the performance above the rack of my enterprise applications? And below the rack, am I making different physical and electrical demands of my data centers?

Do I need higher density? Do I want to use lower-carbon power? Or do my applications and customers now need the responses of network edge capabilities?

Virtualization has been underway for 10 years, but it is nowhere as mature as we think. It has yet to be optimized in the vast swathe of enterprises. This leaves businesses with a set of questions to answer, and colocation providers that are ready to get involved in those decisions will have a ready-made advantage.

Any organization must consider whether it has the capacity to meet its current needs, and be sure that what it has is flexible enough to scale to meet any new requirements (or scale back for other business changes).

> *You must be ready for hybrid and multi-cloud, and have capacity at a moment's notice*

A colocation provider that locks a customer into any level of custom may be an unfortunate reminder of the rigidity of the in-house facility that customer is trying to escape.

Whether the resources are in-house, at a colo or in the cloud, they also have to operate efficiently, so the business is cost effective but also meets any regulations or energy-efficiency aspirations.

And then there is reliability. Everyone needs backup and disaster recovery. The cloud and the in-house data center provide those differently, and the colo can pick the best of both worlds.

Finally, the customer's very business model and organizational structure may push it to one model or another.

In all this, no organization is a monolith. Some workloads can be run quite easily in public clouds, while others need (or are perceived to need) in-house resources.

This decision should be informed by what expertise is available, both in-house and at the service providers, but it should not be absolutely driven by those skills. Don't build in house just because you have

the staff – that's no different to putting the cart before the horse.

New workload characteristics will probably have to be internet-facing to handle the shift in customer behavior. They will very likely also be more splintered into many app workloads that tend to be more "spiky" in nature. All this may push the customer to a different kind of network service than the core network capabilities of their own in-house services, but may also rule out many of the numerous service providers wanting to talk to them.

Colo operators will find that their customers will vary widely in their business needs. It will be difficult to decide in which sectors, and with what scale of organization, they can best compete.

And just when they think they have adjusted to the new business environment, and understand their customers' needs, the landscape will change again.

Despite the difficulty in assessing what to do, the key factor in any colo's business decision will be speed. Time-to-market velocity and agility will rule.

At the same time, of course, and creating a tension with the whole idea of moving quickly, security and risk will also be front-of-mind for buyers.

Cost is critically important, both in terms of return on investment (ROI) and total cost of ownership (TCO), but it can be trumped by long-term business advantage.

Owner/operators shouldn't obsess about their own issues but help customers think through their own issues. They should bite the bullet and become part of a transparent sourcing brokerage. That sounds like the end of any control of your margins, but if they don't go that way, they will be left out of big deals, where most of the future value lies.

Under all this, the classic issues remain for the CEO of any colo franchise. Site selection is the most basic jumping-off point. As the famous real estate trope puts it, the most important factors are location, location, location.

In the data center industry, this is true of building or converting, or rebuilding fresh capacity, but it is also just as true when considering acquisition. The real estate value is likely to be the least important criterion. Power prices, sources and availability will be more important. Taxes, labor costs and local regulations will be vital too. We will all have to consider power sourcing and the carbon weight of our energy.

Having bought into that location, the colocation provider then has to sell that location to the customers, and this means convincing them that this location will accelerate and secure their digital transformation.

So investors and developers need to understand the regional market for on-premises data centers. How many potential customers are there, and what are their pain points and long-term plans?

Colo backers also need to know what the competition is doing: how much colo capacity is there, and how mature and flexible is it?

They also need network capacity to link to the outside world, and to offer the streaming content, interactivity, big data and analytics features that customers will want.

They must also handle thermal management, running the site cost-effectively without harming resiliency and availability.

For both power management and cooling, colos will need underlying DCIM and DCSO, presented and packaged to the customer's advantage.

Uptime Institute Tier Classification could be important for branding and to keep the customer comfortable. Without it, the provider will have to explain and justify an equivalent availability standard in the face of increasing customer sophistication.

Workloads will be sourced and managed in an increasingly complex and multi-layered fashion. But organizations – both the colo and the end customer – will be expecting ever-increasing productivity, and this means staff will have to handle more virtual workloads.

This adds up to a requirement for simpler management. All these resources, whether in-house or in shared premises, must be automated and easier to manage.

Cloud and colo bodies will have to co-operate with open and private exchanges, and professional sourcing advisories and analytics.

If you're the enterprise CIO, you can now upgrade capacity while off-loading the capital costs, but you must be ready to understand and exploit that world.

If you are a colo operator, you must be ready for hybrid and multi-cloud operations. You must have capacity ready to spin up at a moment's notice, for just-in-time projects like devops, bare-metal builds and hyperscale open-source.

It's a brave world – if you can handle it.

Fast Facts

Colocation is the biggest data center sector, surpassing financial services.

26%

The percentage of data center investment in colo

$40bn

Total global investment 2015

12.8%

CAGR

Colo providers offer cloud:

2/3

The number that offer IaaS (infrastructure-as-a-service)

Cloud providers rely on colo:

40%

The percentage that need a facility

Source: DCDi

MOVERS & SHAKERS

Expansion, investment and colocation: 20 global leaders of some of the most successful and innovative companies present their strategies for the data center of the future

21VIANET

Josh Sheng Chen
Founder
www.21vianet.com

As the largest carrier-neutral internet data center services provider in China, 21Vianet took a strong cloud position in 2014 when it signed an exclusive deal to deliver Microsoft's Azure and Office 365 services in China. This has been followed with a deal to provide the infrastructure for IBM's Bluemix, a cloud service based on Pivotal's Cloud Foundry, in China.

21Vianet's data centers are built by Taiwanese manufacturing giant FoxConn, and the two companies are taking this partnership further, forming a joint venture – Smart Time Technologies – which will build data centers for other companies. That venture will start in China but is expected to reach beyond in due course.

Meanwhile, 21Vianet is one of the few Chinese giants to have invested in real estate in the US, opening a data center in Santa Clara, California. This one is a partnership with Server Farm Realty.

Things haven't always gone smoothly for the provider – its shares halved in 2014 on accusations of fraud. Those claims were not backed up, and the company bounced back, with fresh investment of $300m from Chinese software firms led by Kingsoft at the end of 2014.

CENTURYLINK

Glen F. Post III
CEO
www.centurylink.com

CenturyLink grew from a traditional telecoms company, expanding into data centers in 2011, with the purchase of Savvis. The company now owns or leases some 59 data centers, including significant facilities, such as the Titan data center in Moses Lake – a former US missile control base, hardened to survive a 10-megatonne nuclear strike.

The company has expanded internationally, opening its cloud in Australia and China with partners.

Despite all this, there is change in the air. Data centers have been seen as an opportunity for telcos, but in 2015 doubts emerged across the industry about whether it really adds value for one supplier to handle both kinds of business. Along with other large telecoms players, CenturyLink is exploring options to sell or split from its data center arm, to give it more freedom to operate.

Possible outcomes include a specialist partner owning the data centers, while CenturyLink sells their services.

CORESITE

Thomas M. Ray
CEO/President
www.coresite.com

CoreSite Realty Corporation (CoreSite) is a Real Estate Investment Trust (REIT) with around 17 data centers totalling 2.7 million square feet in the United States.

The company also operates Any2Exchange, a US peering community, as well as the CoreSite Open Cloud Exchange.

CoreSite owns rather than leases the majority of its space, and builds out in pace with customer demand. It offers space on a wholesale and retail basis.

For instance, the company recently announced it is building a $27m facility in Silicon Valley, which will be leased in its entirety to one Fortune 500 company.

The company started on the West Coast – in San Francisco and Los Angeles.

CYRUSONE

Gary J. Wojtaszek
CEO
www.cyrusone.com

CyrusOne started with a data center in Houston in 2001. Its headquarters is still in Texas, but the company now has 33 sites across the US, in the UK and in Singapore.

CyrusOne has direct experience of the question of whether there is much synergy between telcos and data centers. In 2010, it was bought by Cincinnati Bell, but the telco spun it back out in 2013. Cincinnati Bell still owns 9.5 percent of CyrusOne.

In recent months CyrusOne has been acquiring other providers, including Cervalis in the US northeast for $400m in April 2015. This deal gave CyrusOne four data centers in New York. The company also bought CME Group in March 2016.

DIGITAL REALTY

William Stein
CEO
www.digitalrealty.com

Digital Realty is the largest data center Real Estate Investment Trust (REIT) in the world, with a market capitalization of around $13bn, and around 140 properties in North America, Asia, Europe and Australia.

Digital Realty floated on the New York Stock Exchange in 2014 and has expanded rapidly. In 2015, it bought Telx for $1.9bn, in effect doubling its size.

The Telx acquisition means the company is now offering services and space to customers, as well as building and providing data centers for competitors such as Equinix.

Digital Realty bases its construction on standardized discrete units, sold in increments by kW of IT load.

DUPONT FABROS

Christopher P. Eldredge
CEO/President
www.dft.com

Dupont Fabros Technology (DFT) was founded as a real estate company in 1997 and has focused on data centers since 2000, becoming a Real Estate Investment Trust (REIT) in 2007.

DFT operates in the US, with a dozen data centers in four markets, which total approximately three million square feet and 270 megawatts of available critical load.

Along with other REITs, DFT straddles both retail and wholesale data center markets, but has recently made a clear indication that it is more interested in wholesale, putting its New Jersey facility up for sale.

The NJ1 data center in Piscataway, New Jersey, is half full and ready for future expansion. DFT plans to use any funds generated from the planned sale of NJ1 to expand in North American markets, including Toronto, Portland and Phoenix.

EQUINIX

Steve Smith
CEO
www.equinix.com

Equinix started out in 1998, offering business-class data centers, and through building and acquisition now has around 150 data centers and a market value of $2.7bn.

Equinix provides fast connections between businesses within its sites, which it calls International Business Exchanges (IBXs).

In 2015, it completed a $3.8bn merger, buying Telecity, whose 40 European data centers doubled Equinix's presence in the region. Other recent expansions include ALOG of Brazil in 2014 for $225m.

Equinix also became a REIT in 2015, gaining tax advantages from that status.

The company currently has more than three million square feet of data center space, and has published plans that take this to more than four million, including expansions in Amsterdam and Australia.

GLOBAL SWITCH

John Corcoran
CEO/Chairman
www.globalswitch.com

Global Switch has 300,000 square meters in Europe and the Asia Pacific region.

Fully owned by Reuben Brothers, property investors based in the UK, Global Switch's European facilities are in Paris, Frankfurt, Amsterdam, London and Madrid; its APAC data centers are located in Singapore, Hong Kong and Sydney.

INTERXION

David Ruberg
CEO
www.interxion.com

Founded in The Netherlands in 1998, Interxion has 40 data centers in 11 countries within Europe. These include London, Frankfurt, Paris, Amsterdam and Madrid – the main data center markets in Europe.

2015 was eventful for Interxion. The company was all set to be acquired by Telecity, for around $2bn, a deal that would have created a giant European colocation provider. At the last minute, this deal was sabotaged when Equinix bought Telecity.

IO

George D. Slessman
Co-founder & CEO
www.io.com

IO Data Centers has six locations around the world, including Denver, Ohio, New Jersey, Singapore and Phoenix. The most recent addition to this was a new 10,000 square meter, 20MW data center in Slough, UK. The anchor tenant for this new facility is finance firm Goldman Sachs, also a tenant in other IO spaces.

Much of IO's estate is built out using a distinctive modular data center technology, which is sold as "datacenter-as-a-service". In 2014, the modular technology was spun

off to form a separate company, Baselayer. The modules used in IO's facilities are designed for efficient performance, combining free air cooling with chilled water technology. Management is handled by a data center operating system that offers real-time monitoring and control.

Subsequent tenants can order up data center space as new modules within the shell, and IO promises this can be built in Baselayer's factory in Arizona, and delivered within 90 days.

KIO NETWORKS

Sergio Rosengaus
Founder
www.kionetworks.com

Kio Networks is a Mexican company, founded in 2002, which has 32 data centers in 13 technology campuses in Mexico, the US, Spain, Panama, Guatemala and the Dominican Republic.

The company offers managed hosting, cloud services, security, SAP services and disaster recovery, and aims to offer all services in every one of its facilities.

Alongside its fixed facilities, Kio offers its own Atom mobile containerized data center, designed for migration tasks, remote locations, temporary projects or disaster recovery.

Kio is also publicly committed to energy efficiency, and has won both Gold and Silver Certified Energy Efficiency in Data Centers Award (CEEDA) certifications for energy efficient data centers in Latin America.

NEXTDC

Craig Scroggie
CEO
www.nextdc.com

NextDC is an Australia-based vendor-neutral data center operator with sites located in Melbourne, Brisbane, Sydney, Perth and Canberra, currently valued at around AU$630m.

The company provides scalable "datacenter-as-a-service" and its customers include the Australian government.

NextDC has subsidiaries including OneDC, which provides cloud software for data center infrastructure management, and Axon, a virtual exchange that offers pay-per-hour cloud connections and links to public clouds, including IBM SoftLayer, Amazon's AWS and Microsoft Azure.

In late 2015, the company raised $100m and made a share offer to raise more, to fund the building of its second data centers in the Australian cities of Melbourne and Brisbane.

For services beyond Australia, NextDC has a partnership with CenturyLink.

NTT COMMUNICATIONS

Tetsuya Shoji
CEO
www.ntt.com

Japan's NTT Communications is growing a data center business, with significant acquisitions around the world, giving it some 140 locations delivering cloud and data center services.

The aggressive expansion is made possible by NSS's dominant position in Japan which, despite the country's small size, is still the largest market in Asia for data centers.

In 2013, NTT Com gained a large US foothold, buying 80 percent of RagingWire for $350m, and it bought German provider e-shelter in 2015 for an estimated $800m, giving it third position in the European market. It also bought Indonesia's Cyber CSF, with a 24MW facility in Jakarta.

During 2015, NTT Com expanded its floor space by more than 50 percent, going from 214,000 to 350,000 square meters. Its offerings are backed by a global Tier-1 IP network.

QTS REALTY TRUST

Chad Williams
Chairman & CEO
www.qtsdatacenters.com

One of the largest US data center operators, QTS owns, operates or manages 20 centers in North America, and has four partner sites in Europe and APAC.

QTS has been expanding its holdings, building what it describes as "mega data centers" in locations including Chicago and Dallas Fort Worth, and acquiring companies such as the public sector Virginia-based specialist Carpathia Hosting.

The company offers colocation, cloud and other services, and focuses on vertical markets including government and healthcare.

SABEY

John Sabey
President
www.sabeydatacenters.com

One of the oldest privately owned data center operators in the US, Sabey based its data center work on its experience of building clean rooms for Boeing Electronics and cell phone switches for McCaw.

Sabey has three million square feet of mission-critical space in five facilities under the Intergate brand, Intergate: Manhattan

and Intergate: Ashburn on the East Coast; and Intergate: Quincy, Intergate: Columbia and Intergate: Seattle on the West Coast.

ST TELEMEDIA

Stephen Geoffrey Miller
President, CEO & Senior EVP
www.sttelemedia.com

Singapore Technologies Telemedia (ST Telemedia) is an expanding Asian provider, with recent acquisitions outside the APAC region.

In 2015, it bought half of UK-based Virtus and also expanded within Singapore, buying a stake in the local MediaHub operation.

In 2016, it bought a 74 percent controlling stake in the Indian and Singapore data centers of Tata, expanding its own ambitions and enabling Tata to pay down some debt.

SWITCH

Rob Roy
CEO, Founder
www.supernap.com

Famed for its distinctive SuperNAP data centers, Switch has been built on the ideas of founder Rob Roy since 2000.

So far, Switch's data centers have been built in Nevada, with its SuperNAP data centers in Las Vegas adding up to more than 1.5 million square feet of space, certified as Tier IV resilient.

The company has announced a $4bn SuperNAP in Reno, Nevada, which it says will be the largest in the world, but it has already trumped that with a $5bn plan to build data centers in Michigan at the iconic pyramid building created by furniture maker Steelcase.

The company is expanding internationally, with plans for a $300m Tier IV SuperNAP in Thailand due to open in 2017. It also has plans for a European SuperNAP in Milan, Italy.

Switch will power all its data centers with renewable energy, and has financed the building of solar farms.

TATA COMMUNICATIONS

Vinod Kumar
Tata Communications CEO
www.tatacommunications.com

A subsidiary of Tata, the giant Indian conglomerate, Tata Communications has painstakingly built up a global portfolio of 44 data centers. This has now been reduced, as Tata has sold a controlling stake in its Indian and Singapore properties to ST Telemedia. Tata keeps a 26 percent stake in them.

Based in Mumbai and Singapore, Tata Communications started its data center business, and built it up until it provides a quarter of India's colocation data center space, with most of its facilities built during 2013.

The business was spun off as a fully owned subsidiary in 2014.

The Indian data center market is paradoxical. Despite high demand, it is difficult to deliver services because of patchy infrastructure. Tata has sold its data center business there to fill gaps in its balance sheet elsewhere and fund global expansion of its telecoms and data center business.

TELSTRA

Martijn Blanken
Group Managing Director, Global Enterprise Services
www.telstra.com

Telstra was Australia's incumbent telecommunications firm, and is still its largest telecoms firm. The company has been building up an international business, including telecoms and data center businesses in the region.

Telstra bought Singapore's Pacnet for $700m in 2015 and has since offloaded some ISP business while keeping data centers and subsea cables.

Meanwhile, the company made a strategic investment in Chinese cloud services provider Qiniu in 2016 through a Chinese subsidiary.

Telstra currently has some $5bn in the bank from its healthy Australian business, so we can look forward to more acquisitions in the region and further afield in the months and years to come.

ZAYO

Dan Caruso
Co-founder & CEO
www.zayo.com

Zayo Group is a networking and data center company based in Boulder, Colorado, and London. Its network offers dark fiber, wavelength, Ethernet and other connectivity solutions. Zayo has 45 data centers in 31 different markets.

Zayo is in an acquisitive mood and has recently bought Clearview, a provider with two facilities in Texas, as well as a 36,000 square feet data center in Dallas, previously owned by Stream Data Centers.

Building its telecoms base, the company bought London-based Viatel.

Investing in training

Human capital is a company's greatest asset. IO turned to training to develop and empower its staff

IO Singapore recently partnered with DCProfessional Development (DCPro) for its Mission-Critical Training Platform to address an industry-wide skills shortage, drive employee engagement and improve retention.

DCPro, with its state-of-the-art Learning Management System, offers true continual professional development. Choosing from a robust course catalog, IO provides staff with a training program that upskills them in key areas of data center design, operations and management. Employees can learn new skills and apply the training hours towards internationally-recognized credentials in the data center industry.

"IO Singapore is committed to the professional development of our mission-critical staff. We want to equip them with the right skills to succeed," said Aaron Rasmussen, director of IO Singapore. "As Singapore scales up to be a data center hub, there will be more demand for skilled data center staff. IO's vision is to upskill and drive retention through employee engagement."

For a mission-critical organization such as a data center, staffing is vital to deliver reliable operations. Even with automated systems, key personnel are still required to install, maintain and operate data center facilities. One of the main causes of downtime is human error, and training can reduce this.

The future employers of choice will be those with professional development pathways. More specific to the data center industry, there is a clear link between investing in staff and their development, and the reduction of operational risk, downtime and cost.

IO employees have expressed positive feedback and are applying the new knowledge and skills in their workplace.

Founded in 2007, IO supports legacy and cloud apps, operating the most highly efficient, sustainable and secure data centers for many of the world's most sophisticated companies, including Goldman Sachs, CBS Interactive, Allianz, LexisNexis and StarHub.

Skills shortage

According to IDA (Infocomm Development Authority of Singapore), Singapore may lack 30,000 information technology professionals by 2017. The annual *2016 Hays Asia Salary Guide* stated that 29 percent of employees stay in the jobs they have because of training or development opportunities.

Reusing heat is great, in theory...

Reusing your waste heat could halve your carbon footprint. But finding a user for that heat is not easy, says Ian Bitterlin

Illustration: studionippoldt.com

Any process that uses energy and converts it to heat is a candidate for reusing the heat, but it is only possible if you have an adjacent load that can absorb that heat.

A near-perfect example is a hospital that uses electricity for lighting and services and space/water heating in equal measure 24×7×365, hence why combined heat and power (CHP) can be used successfully.

If you can reuse all the heat (all of the time), then you can halve your carbon footprint and energy bill, but you will have had to invest money up-front.

The biggest problem with data centers is that they look like offices from the outside but their energy density is 30 to 50 times that of an office space – around 3kW to 4kW per square meter for an average European enterprise facility. So, if you want to heat your offices from your data center waste heat, then the data center has to be quite small, or the offices very large.

The grade (temperature) of the waste heat is low and can never be higher than 70-75° Celsius for liquid-cooled processors (a tiny niche so far) or 28-35° Celsius for air-cooled (the vast majority). This is a huge problem for exporting the heat over any distance, and all heat loads would have to be directly adjacent. Most data center users don't want an anaerobic digester for pig slurry next door. The grade of heat is just about suitable for space heating or pre-heating domestic hot water.

The typical data center operates 24×7 at (so far) fairly constant load. If your heat load can't absorb the waste continuously, then the financial payback quickly fades away.

If your city has the infrastructure for district cooling and heating (eg, Moscow, Stockholm and other Scandinavian cities), then pulling chilled water into the facility and returning the hot water via a heat exchanger is a no-brainer, but it only works if you have the power station in the city center – and most cities don't.

The grade of heat in the power station is much higher (~400° Celsius) and can be used to drive ammonia-based chillers that produce cold water from heat, as well as hot water (or steam) for the locals, for hospitals, adjacent greenhouses, or pre-heating water for industrial processes.

Smart cities could have many small distributed data centers instead of monolithic facilities in remote places where energy is cheap. At 200-300kW each, offices and hotels could absorb much of the waste.

It costs a lot to install the heat-recovery plant, and this large investment is not in your core business. For instance, a large colocation facility in east London had to install pipework and a heat exchanger to get planning permission, but none of the adjacent apartments showed any interest in the district heating scheme. The facility now uses around 70MW of power – far more than any local heating load could absorb!

Recovering heat costs money in extra maintenance, but energy effectiveness is not a key driver. In the average UK enterprise data center, 1kWh of energy passing through a server costs about £0.17 in electricity (10p/kWh × PUE of 1.7), but that £0.17 enables £130 worth of business, or more for banking and finance.

The point is that the cost of energy is not a #1 agenda item for most users. ●

> *It costs a lot to install a heat recovery plant, and this large investment is not in your core business*

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DatacenterDynamics

Guide to

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Inside

Savings through the Seasons with the Next Generation IDEC Unit from Nortek Air Solutions

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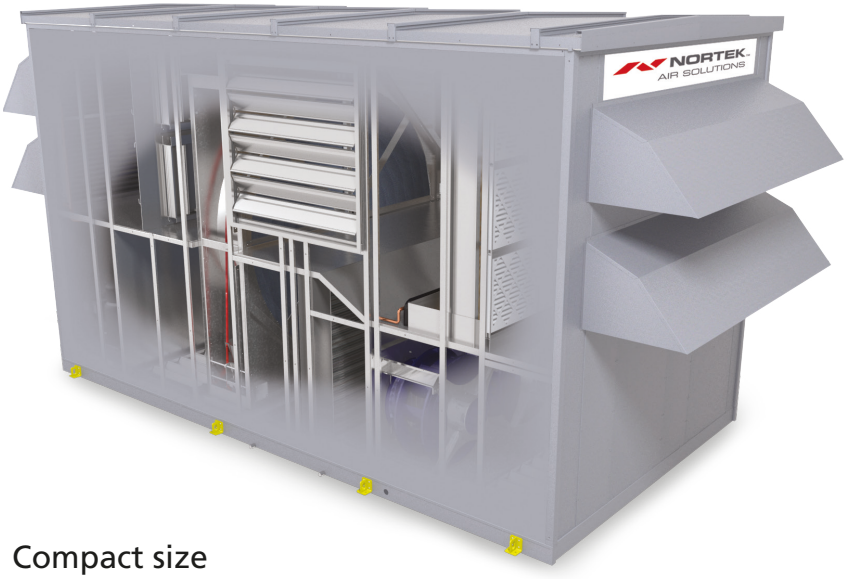

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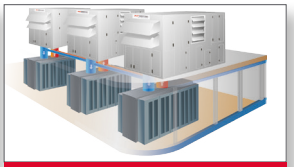
End-on Unit


Rooftop Unit


Stacked Unit

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For more information on the Cool³ IDEC unit, contact us at datacenterinfo@nortek.com or visit www.nortekair.com.

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Peter Judge
Global Editor
@peterjudgeDCD

Getting smarter

Looking at power and cooling for this issue, one thing stood out very clearly. Intelligence.

Data centers have always applied advanced technologies to ensure they are powered and cooled in the most efficient way possible. Fluid dynamics is one of the most complex and computationally demanding branches of physics, and we routinely use it to model the air flow past our servers.

But this year, power and cooling have continued to get smarter in ways that might not have been expected this time in 2015.

Energy use is still at the forefront of our minds, but this year has seen a resurgence in green thinking, with providers boosting their renewable energy use. That has included content delivery network (CDN) provider Akamai, working in the notoriously difficult-to-green edge network space.

Fuel cells and co-generation have been getting a lot of attention, and countries with hydroelectric power have been on a marketing binge, luring cloud providers and others.

Cooling is hot – literally so – as operators have saved energy by allowing temperatures to rise, and focusing their cooling efforts only where they are needed.

We still hear regularly that liquid cooling will never make the mainstream, as silicon gets less power-hungry, offsetting the power demands of denser racks. Long term, we wouldn't bet on that, as liquid gives the spinoffs of heat you can use elsewhere and a less cluttered data center.

But it's a global market, and we're starting to realize that data centers outside the cool zones of the Northern Hemisphere need to be treated differently.

The cloud seems to promise we can consolidate all the world's data centers into a few locations, but we now know that is not a political possibility. The demands of data residency could spark a new generation of power and cooling solutions tailored for the countries where they will be delivered.

•

Peter Judge – *Global Editor*
@peterjudgeDCD

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Smart cooling, better power

There's great new ways to power and cool your data center, says Peter Judge. But sometimes they balance each other out

There are plenty of advances in power and cooling, but data centers are a pretty conservative sector. Somewhat ironically, those advances can play off against each other, while best practise evolves slowly and by consensus.

"There's innovation at the high end in web scale facilities," says DCD Intelligence analyst Adi Kishore. "But small and mid-sized facilities don't seem to be particularly looking for new technology, or overly concerned with cooling efficiency."

There's a reason for that: if a server is making thousands of dollars with the services it provides, then saving a few dollars on its power may not be a priority, especially if those savings come with higher risk or investment. As Professor Ian Bitterlin points out (p29), 1kWh of energy costs pennies (around £0.17 in the UK). Take the value produced by a data center and divide by its electricity bill and, Bitterlin calculates, that data center will generate £130 from that amount of energy, or more if it is in the finance sector. When the financial return on electrical power is a thousand times its cost, then minimizing the amount spent is not the top priority.

Despite that, there is a solid level of good practise in the industry, and peer pressure is having its effect. No data center is going to launch with a published PUE of more than 1.2, and any big player with a public presence now has to have a policy about energy efficiency ▶

▶ and a move to renewable energy sources. Like we said, data center providers are conservative. They want technologies which are tried and tested - and have the good fortune to be in an industry where best practise is well known, well shared and well set out.

Power and cooling are intimately linked, because power distribution is all about getting electrical energy into the racks of equipment, where it does IT work. All the energy consumed ultimately turns into heat, and cooling is about getting that energy back out of the racks.

The big picture is about making that happen efficiently, to use as little energy as possible. Here bodies like ASHRAE and the Green Grid are setting out standards for efficiency (see ASHRAE's efficiency drive, p37).

There's another aspect of that big picture, which is to consider that no matter how efficiently data centers operate, they will still need electricity. It's possible to reduce the emissions of a data center by sourcing renewable power (see Getting real on renewables, p37).

At the nitty-gritty level, power distribution could be changing. Traditionally, within a data center, power is changed between AC and DC, with voltage stepped up and down. UPS batteries must be charged to keep the data center going for a short while in an emergency, a lot of equipment needs AC, and ultimately the individual IT components in the rack are powered by DC.

Stripped down designs created through groups like the Open Compute Foundation are suggesting ways to simplify that, using DC, and distributing smaller rechargable batteries to the servers, to remove wasteful changes in the power distribution system.

Meanwhile, what are the prospects of a big change in the way systems are cooled? The big development that's always proposed is a move to liquid cooling. Fundamentally, liquid cooling is great because it removes heat passively, with very little energy input, and the waste heat emerges in a highly concentrated and therefore useable form: water at more than 45C can be used to heat buildings or warm greenhouses to grow plants.

That's a generalization of course, because there are numerous kinds of liquid cooling, from low-impact systems that provide extra cooling to hot racks by running water through the doors, to systems which use more or less radical redesigns that immerse electronics in coolant, to futuristic scenarios running a two-phase coolant through capillaries directly on the surface of hot chips.

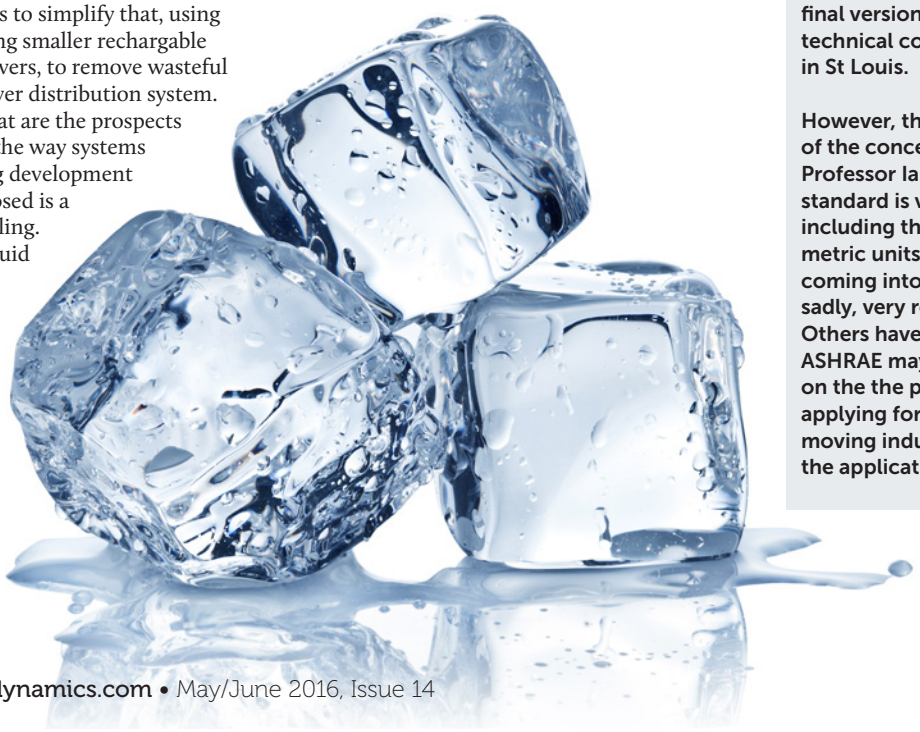
That sounds confusing, but some branches of the technology are well established. Cabinet door cooling is an interesting case in point. Running water through the doors of racks is a way to get cooling to where it is needed. It's been proposed for several years, and by 2013, solutions were well developed, but with some variations. Opticool, for instance, went for a system that pumps refrigerant - the same refrigerant used in big chillers - instead of water, to the rack doors.

This distributes the cooling to where it is needed. It can chill hotspots, or take over the entire data center's cooling needs, doing away with the need for raised floors and air handling in the process.

But liquid cooling has been, so to speak, treading water. It's used in high-performance computing (HPC) only. That's not a market to be ignored, but it doesn't have the giant opportunities of enterprise or webscale computing.

Those big markets obstinately keep cooling with air. They pack in more chips, but then - thanks in part to those power efficiency

$20bn
predicted value of data center power services in 2020
(Research and Markets)



ASHRAE's efficiency drive

The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) is a recognized authority on the efficiency of buildings, and its best practices are well-regarded. However, its effort to create a standard for data centers has been something of a struggle.

The proposed 90.4P standard for data center efficiency could be referenced in building codes throughout the US and beyond, and is due for publication in summer 2016. As we go to press, the final round of comments has been invited on the draft standard, and there is still some controversy. ASHRAE originally specified different levels of PUE, according to where, and in what climate, a data center would be located. The reference to PUE, the metric created by the Green Grid, was removed after criticism from the industry said this wasn't a good use of the PUE metric.

However, the requirement of different levels of efficiency remains, and some have warned that the resulting standard may increase bureaucracy and delays in building data centers.

As we go to press, ASHRAE has opened the draft standard to what it hopes wil be a final round of consultation, before it publishes a final version of the standard at its technical conference in late June in St Louis.

However, there is real criticism of the concept and its execution. Professor Ian Bitterlin says the standard is very US-centric, including the use of Imperial, non-metric units. "The chances of it coming into any use in Europe are, sadly, very remote," he says. Others have commented that ASHRAE may be making a mistake on the the principle involved: by applying formal standards to a fast moving industry, it may be limiting the application of new ideas.

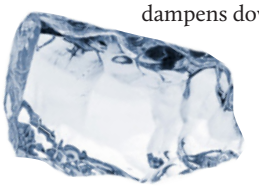
improvements - they waste less heat, so the power density (and the temperature) never gets to the point where it's economically necessary to turn on the liquid cooling taps.

This could change. Green Revolution Cooling, a company with a pretty specialised tank immersion system, recently came out with a range of servers that seem to be aiming towards a more general market, even using concepts similar to the Open Compute Project. Other firms in the same arena, like Britain's Iceotope with its Petagen range, are productizing techniques that used to be bespoke.

Meanwhile, Lenovo is selling water cooling for HPC. The solution was commissioned by the University of Birmingham, specifically to expand an iDataPlex installation which was pushing the limits of the power density the University could handle.

So liquid cooling is starting to become available in more consumable forms, and there's signs of a demand for it.

As ever, though, it's a race between power and cooling. If the power distribution system make a leap to greater efficiency, that reduces the amount of heat that needs to be removed, and dampens down the need for liquid cooling.



Getting real on renewables

It's clearly in a company's interest to reduce the amount of energy it uses, as this reduces its costs, and also reduces its environmental impact. However, the world as a whole needs to reduce its dependence on fossil fuels, so a move to renewable energy would contribute to the greater good.

Renewable energy tends to be more expensive, and come from sources like wind and solar which are intermittent, while data centers need continuous power.

Large cloud providers such as Microsoft, Facebook, Amazon and Google have promised to go 100 percent renewable, on various timescales, but they have two advantages. They can build in places like Sweden, with continuous renewable energy from hydroelectric sources. And they can also negotiate large "power purchase agreements" (PPAs), paying for renewable power which will offset the non-renewable power they actually burn.

In recent months, content delivery network Akamai has promised to go 50 percent renewable. That's a smaller commitment, but a bigger deal, because Akamai has an "edge" network, close to users. It rents space in colocation facilities, and cannot control its landlord's power usage.

Microsoft has promised to directly use more renewable energy such as biogas and fuel cells. There's not much detail, but it could help to retire fossil fuel plants.

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Cooling by any means possible

Most data centers use traditional chillers, but there's a whole range of other possibilities, says *David Chernicoff*

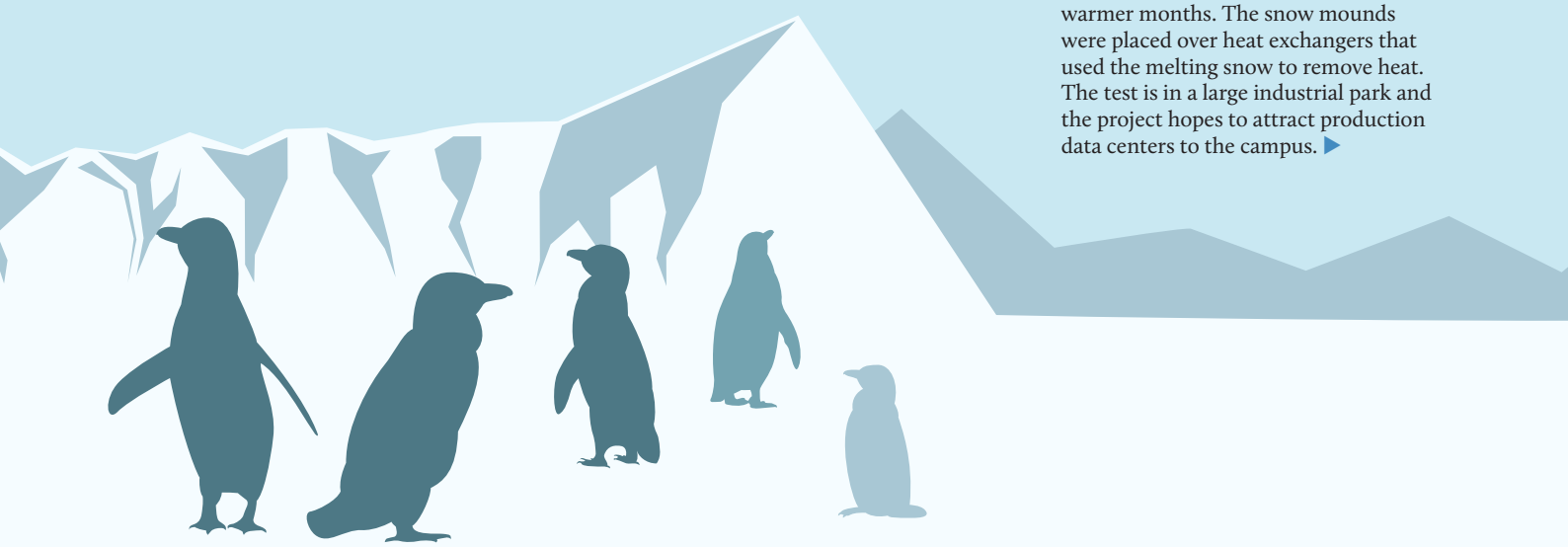
David Chernicoff
US Correspondent
@DavidChernicoff

The majority of data center operators still run relatively traditional cooling plants: the usual mixes of chillers, CRACs, hot-aisle and cold-aisle designs, and maybe some techniques for reducing overall cooling expenses. Techniques such as free air cooling are becoming standard parts of design considerations, but there are a large number of other, non-traditional options that are becoming more common.

Microsoft recently sank a test data center to the ocean floor. The resultant publicity showed that operators are interested in finding more efficient data center cooling techniques. The most promising ideas need to be built into the design rather than retrofitted to existing data centers, so they must be considered in the planning stages. Here are a few of the lesser-known cooling technologies.

Snow: It's either the opposite of free air cooling or a much wetter corollary, but projects have started that involve storing snow in areas of significant precipitation for use as a cooling medium when the weather becomes more temperate. The White Data Center Project in Hokkaido, Japan, has a pilot project where a small data center uses the cold from the snow mound to cool the test facility, and the hot air from the data center to warm a greenhouse.

The test project used mounds of snow collected in the winter, which were then covered with insulating material to limit the snow melt in the warmer months. The snow mounds were placed over heat exchangers that used the melting snow to remove heat. The test is in a large industrial park and the project hopes to attract production data centers to the campus. ▶



The technology goes back to 2012, when Lawson, a Japanese convenience store chain, introduced a self-contained snow-based cooling system for the air-conditioning system in a store in northern Japan. Rather than using piles of snow, the store was equipped with a 100 cubic meter insulated container that was able to maintain the snow in its solid state, without any additional cooling. Water running through pipes in the container is cooled by the snow and used in the air-conditioning system.

This demonstrates snow as a practical cooling medium all year around in a more contained environment than big piles outside a facility, but it still has the limitation of only being appropriate in areas that get sufficient winter snow and have a limited amount of warm weather in summer.

Thermal wheel: a rotary air-to-air heat exchanger system pulls in heated exhaust air for half its rotation and introduces cooler fresh air in the other half. A matrix surrounding the wheel absorbs the heat energy and is then itself cooled via fresh air.

This type of cooling technology only works in a properly architected facility, where the thermal apparatus is integrated in the design.

Used for years in industrial cooling applications, the thermal wheel appeared in the data center recently, when two European companies joined thermal wheel and hot-air containment technology to create a technology introduced by the company Kyoto Cooling in 2007.

The main benefit of the Kyoto wheel is that, unlike traditional air-to-air heat exchangers, the process is external to the data center, limiting pollution from outside air and minimizing humidity changes from unprocessed air.

Like other cooling technologies that use outside air, the thermal wheel is limited to areas with good cool air availability. In 2016, the QTS data center in Chicago, an area known for hot humid summer days and frigid winter winds, implemented a large Kyoto Cooling installation that should enable a PUE near 1.2 for the 48,000 square feet, 8MW data center.

Geothermal: using the natural temperature difference between the data center and the surrounding earth, geothermal cooling sets up a closed cooling loop that takes advantage of the 50F mean temperature that is found five feet underground in temperate climates. A closed loop means there is no contamination of the local ground water or introduction of outside contaminants.

A number of data centers in the US Midwest use geothermal cooling. In Scandinavia, some data centers pass their heated water through piping that leads to the ocean and takes advantage of the thermal differential found there. Google cools its data center in Hamina, Finland, using the North Sea.

Geothermal cooling requires data centers to be located in areas where subterranean excavation is possible and the ground temperature is appropriate.

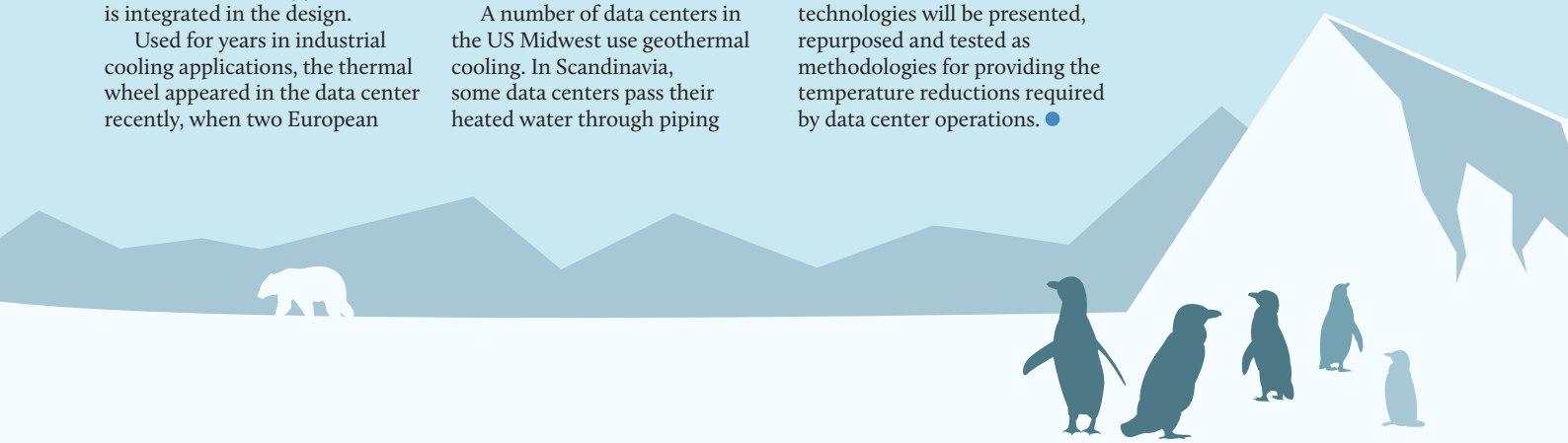
Evaporative coolers: this has been in use for hundreds, if not thousands, of years (ask any American Southerner about their swamp cooler), but it is relatively new in the data center.

Direct evaporative cooling works best in a hot, dry, climate as it uses the natural evaporation of water from a damp pad of material to cool the air blowing across the medium, turning warm dry air into cool moist air.

On the plus side, swamp coolers are simple and efficient in terms of construction and operational costs; the cooling doesn't involve any of the potentially polluting refrigerants found in air-conditioning units. On the down side, it only works in areas with the right temperature and humidity.

Cooling continues to be one of the most significant costs in the operation of data centers. New and old technologies will be presented, repurposed and tested as methodologies for providing the temperature reductions required by data center operations.

Techniques that use snow, air, or ground temperature will only work in certain geographical regions



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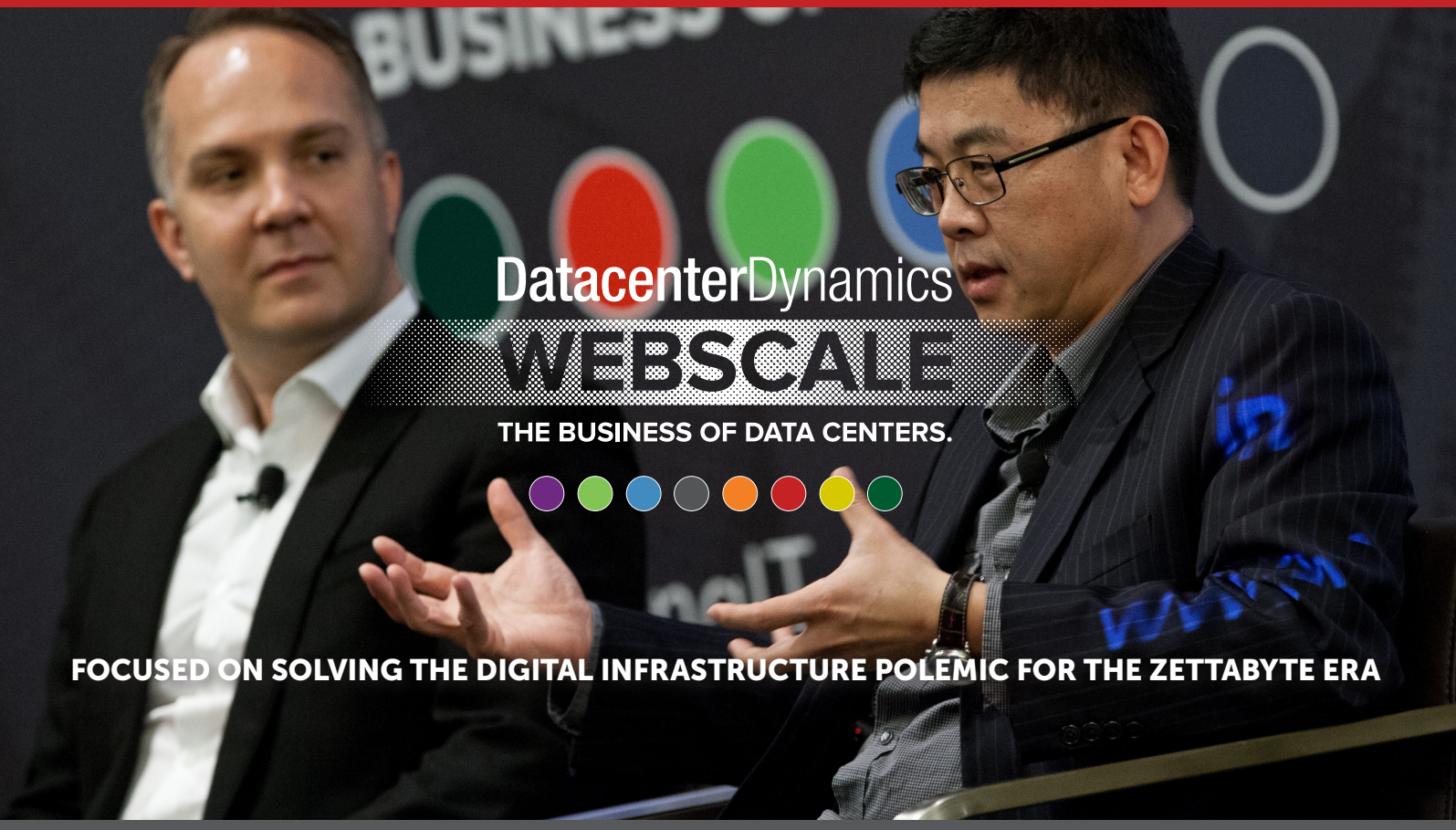

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Power to the people

Data centers don't have to depend on the utility grid any more. They can seize power, says David Chernicoff, and generate their own freedom

David Chernicoff
US Correspondent
@DavidChernicoff

Despite all the discussions on renewable, green and environmentally friendly power sources for the data center, the bottom line is reliability. Without a reliable power source you cannot have a reliable data center – it's as simple as that.

Some data centers generate power for their own use, and occasionally for sale back to the grid, but the vast majority rely on the public grid. When providers such as Google and Microsoft invest in solar and wind power, they are offsetting the less green alternatives they actually use.

That being said, there are smaller-scale technologies that are having a direct impact on providing power in the data center; these include fuel cells, micro turbines and flywheel power.

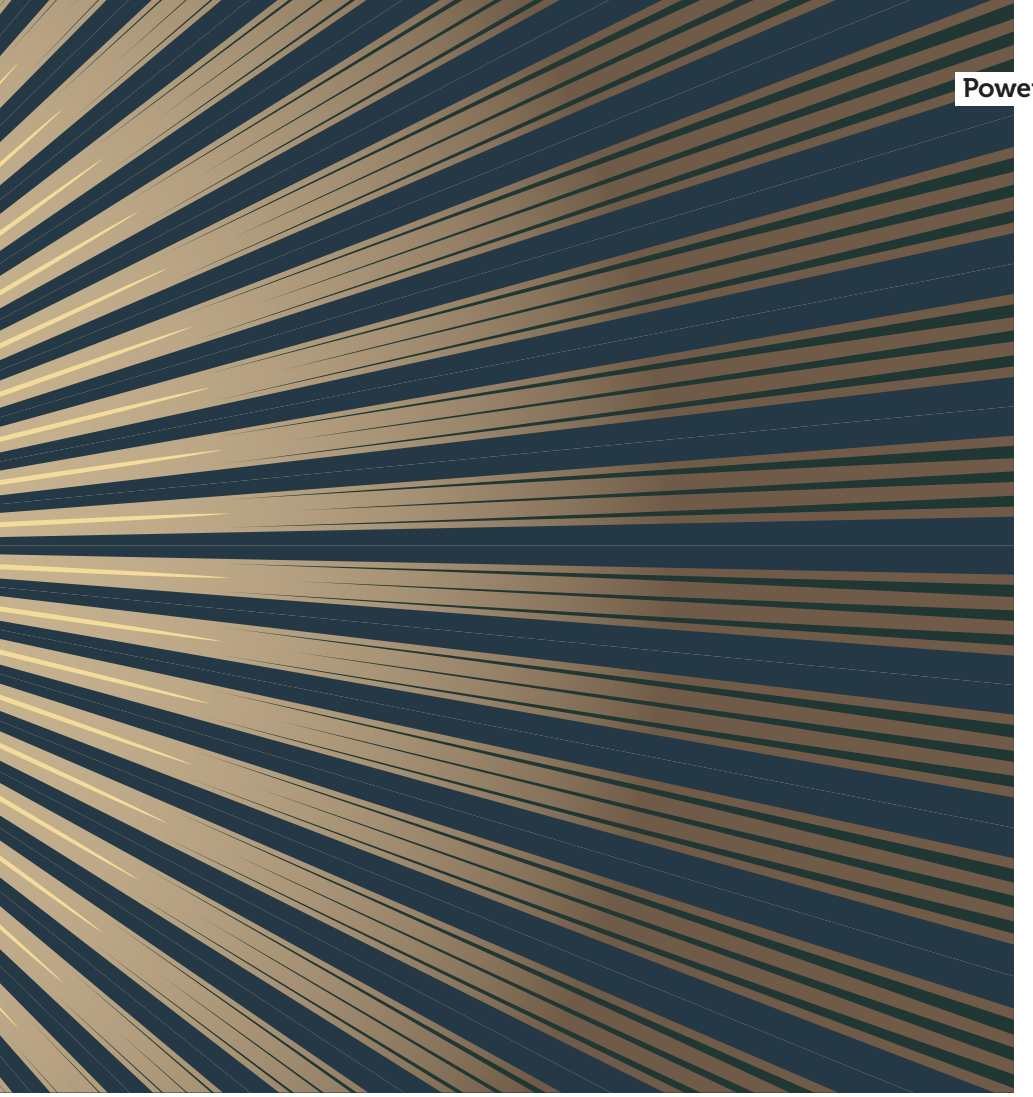
Fuel cell technology isn't new: the first fuel cells were constructed in 1838, but it took 125 years for the technology to come into wider use, when it found a home in the American space program, providing power for everything from satellites to manned spacecraft.

The average person probably became familiar with the term when an oxygen tank that was supplying a fuel cell exploded on Apollo 13 – the seventh manned mission from the American space program – and people were drawn to the life and death drama that ensued (either in real life or in the 1995 blockbuster recreation by director Ron Howard).

Fuel cells generate power from the chemical reaction of positively charged hydrogen ions with an oxidizing agent (most commonly oxygen).

$4bn global fuel cell market, 2017 (Freedonia)

For a long time, attention in the data center world has been drawn to Bloom Energy, the best known of the fuel cell providers. From installations in Google's headquarters in California, to a 50MW installation next to Apple's Malden, North Carolina, data center, to eBay's desert data center powered completely on the fuel cell energy, Bloom has been able to keep the concept of fuel cell power a viable one, despite the fact that the energy generated by the fuel



cells is usually more expensive on a per kWh basis than that drawn from the public utility grid. A smaller startup in the business, Redox Power Systems, is building a standardized one-meter cube that can be used for general-purpose power, not just the data center, which should help to push installation and deployment prices down.

Fuel cells check all the boxes for green, renewable, eco-friendly power sources (they can "burn" biogas). And the economies of scale will continue to drive the cost of fuel cell produced power down. What may really push fuel cells into the data center, however, could be Microsoft's experiments with an in-rack fuel cell.

In this model, a fuel cell is installed in a rack where it provides rectified DC power to the IT components in the rack. With no costs for power conversion or transport, the cost of delivering the power to the IT load drops significantly. The technology remains expensive to deploy in this model, and that cost is the primary roadblock to adoption.

However, what this particular fuel cell technology may have going for it is edge computing and the Internet of Things (IoT). The IoT aims to connect everything, and this requires small, local servers. Micro data centers consisting of a little more than a rack or two of IT and networking equipment may be needed in hundreds, if not thousands, of locations. A self-contained fuel cell model that simply gets hooked up to a local liquefied natural gas (LNG) supply could significantly simplify the deployment of these edge micro data centers.

Because on-site power generation for data centers is inherently more cost effective, data center operators have been looking at micro turbine power generation technology for the past few years, though it has yet to be widely deployed. Factors such as edge data centers and micro grids are starting to make the technology more practical to data center operators, despite the relatively low levels of power generation, with individual turbine systems topping out at about 1000 kW.

The trick, of course, is that the systems can be run in parallel, with vendors offering the ability to deliver up to 30MW or so at a single installation. The two major advantages of micro turbines, other than the value of on-site power generation, are the scalability of the products, allowing the installation to be sized to the demand with the flexibility to scale, and the fact that they can be run on just about any fuel – from landfill waste gas to diesel.

The micro turbines being offered by vendors Capstone Turbine Corporation and Ingersoll Rand Energy Systems are low maintenance, with comprehensive remote-monitoring tools, and are designed to be a simple addition to a project, not adding the level of complexity that building a full-scale power plant for co-generation brings.

Flywheels are not a power generation device but rather an energy storage tool designed to replace or supplement UPS and backup power solutions, but they are an alternative power source for the data center. Like backup batteries, the flywheel stores power, but it takes up less space, is generally more efficient and avoids the environmental issues of battery production.

Until relatively recently, flywheel power was the domain of small companies such as ActivePower and Powerthru, but today, a full range of flywheel products is available, even from leading backup power generation provider CAT, whose large diesel engines are a staple of backup power generation in the data center world.

Different vendors offer a range of options for flywheel power – from hybrid units that combine both batteries and flywheel technology, to large flywheel-only units that can provide more than 1kW of continuous power. Like the other technologies covered here, flywheels check all the boxes for green data center options.

Alternative power generation technologies face a difficult battle for broad acceptance in the data center world due to the scale that power is required in a data center and the very low cost of power provided by utility companies due to its scale of production.

When building or deploying special-purpose data centers, these technologies can become a much more viable option as their strengths can come into play.

Power sources

- **Biomass**
  A local source of landfill or farming waste can generate methane for fuel cells or turbines
- **Solar**
  Solar panels need a lot of space and generate a fluctuating level of power
- **Wind**
  Intermittent and sometimes unpredictable, wind is best as an offset
- **Geothermal**
  Steady enough for data centers, but only available in a few locations
- **Hydroelectric**
  Steady, viable on many rivers, and often already part of the local grid

AWARDS

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Energy Efficiency Improver's Award	SIMPLEX ISOLATION SYSTEMS	CenturyLink Columbus (CL1) Data Center Upgrade	CenturyLink Business / serverfarm
Data Center Transformation Project of the Year	QUALITY UPTIME SERVICES	Enterprise Services Data Center Transformation Program	Hewlett Packard Enterprise
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AWARDS CEREMONY DATE	*April 20*	*September 27*	*November 08*	*November 09*	*December 07*
Entries open	Closed	May 01	May 01	May 01	June 01
Entries closed	Closed	July 25	August 15	August 15	September 15
Finalists announced	Closed	August 22	September 15	September 15	November 02
Ceremony format	Dinner	Drinks reception	Drinks reception	Dinner	Dinner
Venue	Marriott Marquis, New York	Club Ragga	São Paulo venue tbc	Hong Kong Convention & Exhibition Center	Hilton on Park Lane, London

Why aren't data centers cooler?

Earlier this week, I was speaking to a colleague from the mainstream press – someone who is just getting to know the data center industry – and she was surprised at just how obscure this field is, considering that it underpins global economies and is getting increasingly critical to daily life.

And she's right – we are talking about smart cities, smart cars and smart homes, but not many people understand what a data center is, or realize that they are using it as they check their emails or watch a video.

The industry has an image problem. Maybe using multi-colored racks and building viewing galleries in your data center is actually a great idea. Or designing a facility that can be best described as a James Bond villain lair – like one of my personal favorites, the Bahnhof bunker in Pionen, Sweden.

Google recently commissioned four artists to get creative and paint giant murals on the walls of its data centers in the US, Belgium and Ireland. Definitely a step in the right direction.

TV shows (do we still call them TV shows when they are produced by Netflix or Amazon?) are also helping raise awareness: *Mr. Robot*, *House of Cards* and *Silicon Valley* have all recently sent their characters into data centers, and just two out of three are about technology.

Maybe using multi-colored racks and building viewing galleries is a great idea

Maybe data centers will get cool in the immediate future. Just look at personal computers – two decades ago, these were the symbols of the office worker and the businessman, the direct opposite of cool. Today, personal computers have shaken off the heritage of loud beige boxes that used to live beneath your desk, and it's almost impossible to be cool without a smartphone.

We just published a promotional video clip from G-Core, a company that maintains servers for the most hardcore members of the Eastern European gaming community (http://bit.ly/22AnhHX).

The video features slo-mo and dubstep, long panning shots of generators, and solar flares bouncing off the racks. There are CGI warships and tanks, exploding in glorious HD. This clip looks at the server farm as the pinnacle of civil engineering, and its staff as the heroes of the digital age.

We need more of this. And here at DCD, we promise to do our part.

•

Max Smolaks - *News Editor*
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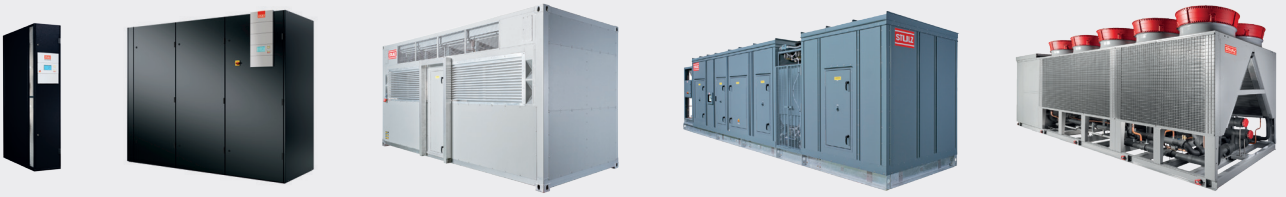

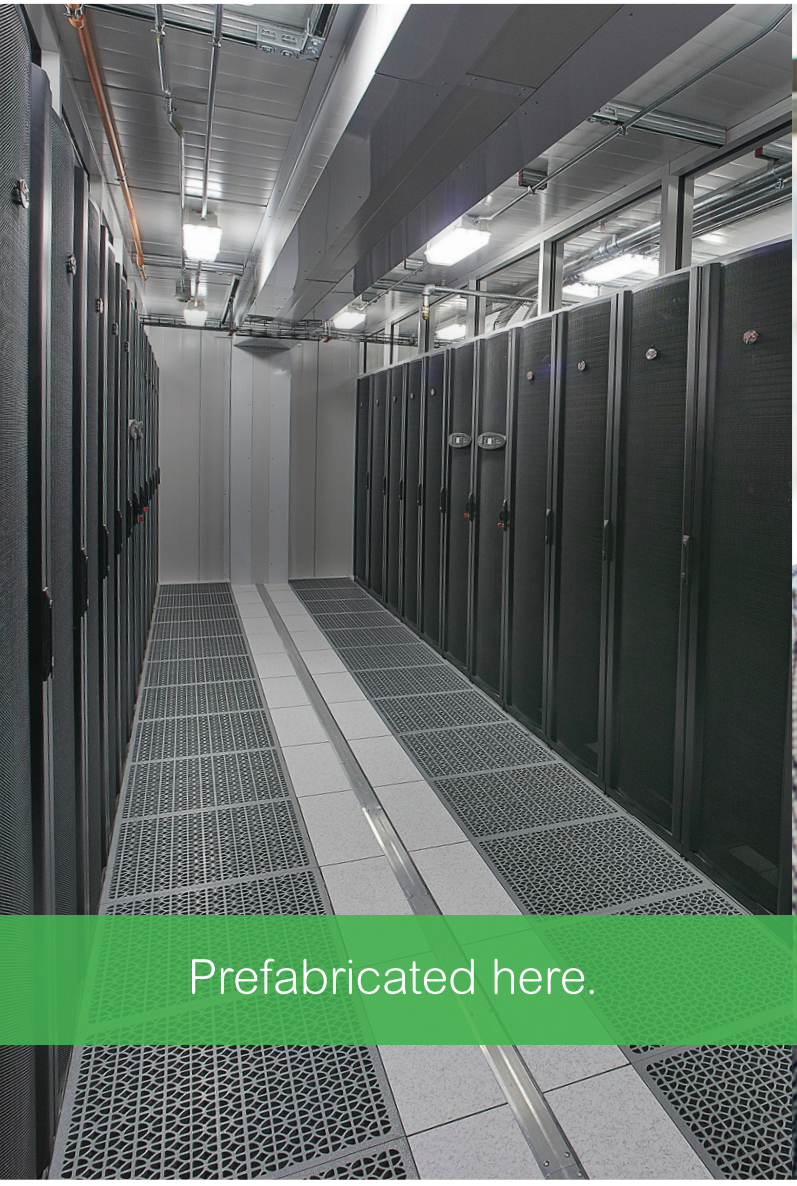

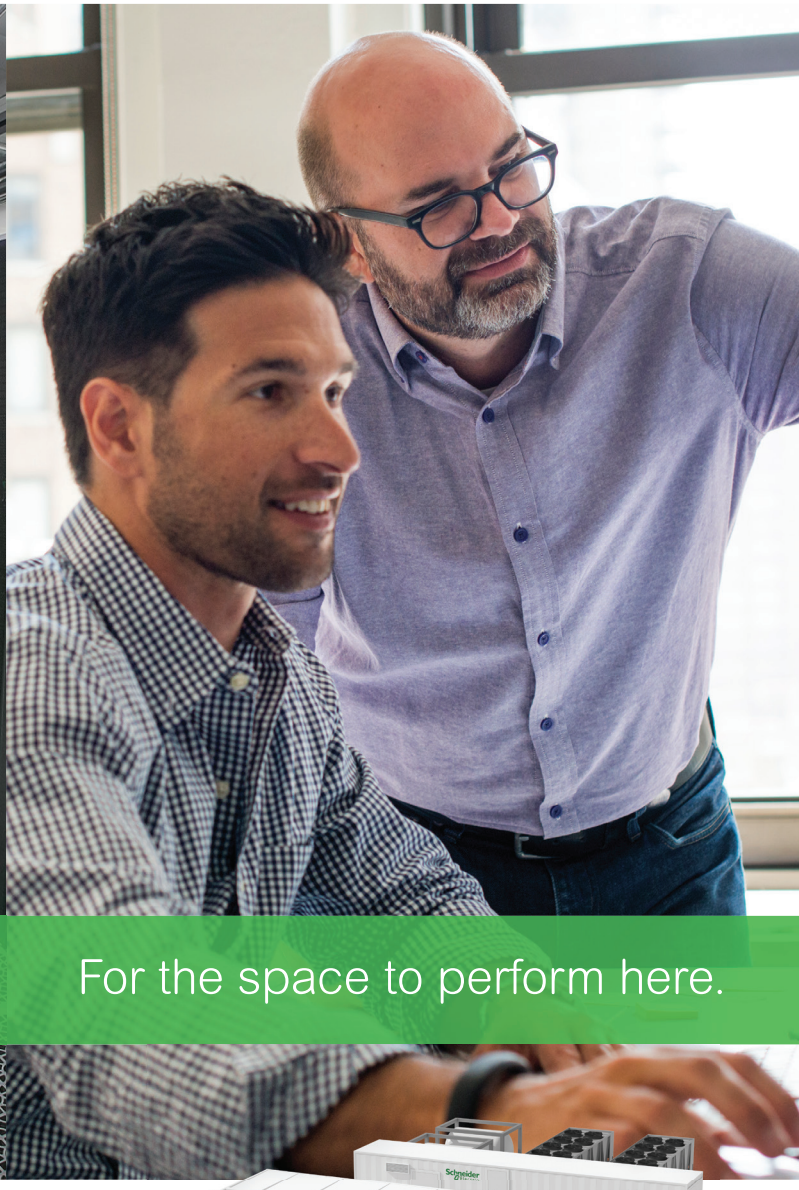

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