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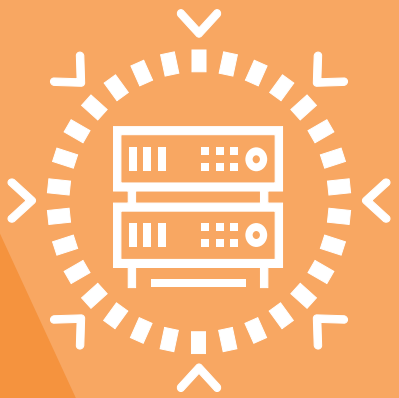

Scaling with confidence

INSIDE

Lights-out facilities

> How data centers are learning to work even better with limited visitors

Keeping networks up

> Virtualizing the meet-me room could be the way to deal with a surge in demand

Servers find a new life

> Enterprises can take advantage of hyperscale efficiency, and help the planet

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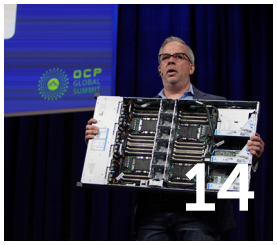

Speaking in confidence...

How confident are you that you can meet the challenges that will come your way? If the first half of 2020 hasn't shaken your confidence somewhat, you haven't been paying attention.

In this supplement, we look at long-running issues in the industry, that have perhaps come into sharper focus due to the twin threats the world is facing - the climate crisis and the Covid-19 pandemic.

Lights out
Remote management has always been an ideal. Short of physical hardware replacement, most IT maintenance tasks can be done remotely - so why have colocation customers always wanted to visit and do work on-site?

When nations began restricting travel, and workers had to keep their distance from each other, the realization dawned that modern data center equipment is already configured to be controlled remotely and facilities can be operated with minimal human presence. It took a health crisis to make us see it (p4).

Finance
As we write this, data center finances are still good. Mergers and acquisitions are steaming along, with Digital's purchase of Interxion the latest mega-deal to go through. Data centers are still upgrading and investing in capital equipment,

But big clients in aviation and oil may collapse, and supply chains for replacement hardware may be strained (p10).

Networks
In the weeks following the imposition of lockdown, network traffic changed radically, routing away from offices, towards homes, and shifting to conferencing and streaming.

Everyone was surprised how well things ran - except the network engineers, who'd built with resilience in mind (p6).

Meanwhile, inside the data center, virtual meet-me rooms have been proving their worth. Allowing flexible connections, they've joined up the links to allow traffic to switch from business to domestic networks, and alter to encompass more videoconferencing (p11).

Community service
The issues facing the world have required people to work together, and maybe it will bring new attention to the ways in which data centers support their local communities (p12).

These can range from not making the place look ugly, to sharing electrical energy to ease the local utility.

Circular Economy
Finally, the long term survival of mankind depends on using resources more intelligently, and data centers can be a big part of moves towards a circular economy (p14)

Servers, racks, and even the concrete that encases the building all embody energy and valuable materials. Reducing this drain on the planet can only help.

When we emerge from lockdown, we will be in a new normal. Or as people now say, "the next normal".

REMOTE management comes into its own

Peter Judge
Global Editor

For years, remote management has been a good idea for data centers. Now it has become a necessity

Managing a data center remotely has always made sense. Facilities are often in out-of-the-way locations, and it is quicker and cheaper to fix problems remotely instead of getting an engineer on site.

At the extreme, it is possible to run a data center with virtually no staff activity - the so-called "lights out" facility. But the reality has often not lived up to the promise. On the one hand, the tools to provide remote control have often been hard to integrate. On the other hand, colocation providers and their customers have been reluctant to trust the remote systems, preferring to touch servers and other equipment directly.

In 2020 all that changed - of necessity. As we go to press, large parts of the world are going in and out of lockdown, with travel restrictions still in place. Getting into a data center is awkward, even though data center staff are generally categorized as "essential" and exempt from the restrictions, because digital infrastructure is essential to the economy. But data center reliability experts at the Uptime Institute have advised that visits to a facility should be minimized.

In colocation facilities, customers must visit the site less, says Uptime SVP Fred Dickerman, and staff access should be restricted too, and handled very carefully: "When teams come on and off site, they should do handovers from a distance or by phone."

In March, colocation giant Equinix responded to the lockdowns that were being applied, and severely restricted customer access to its data centers. Visitors, customers, contractors, and non-critical Equinix staff were banned from Equinix IBX facilities in France, Germany, Italy, and Spain, with other countries moving to an appointment-only regime.

This move placed a heavy requirement on remote functionality, which may have been used rarely in the past, or been incompletely implemented. Products for data center infrastructure management (DCIM) or service management (SM) present themselves as a complete solution, but most betray their origins in one sector or another, or need careful implementation to deliver fully.

When the crisis hit, those who had fully functional systems, and a culture of using the tools available, had a head start in dealing with the crisis.

Brent Bensten, CTO at QTS Data Centers, counts himself lucky. The data center firm deals with a range of companies from small to large, but it has a service delivery platform (SDP) developed from that of Carpathia Hosting, a 2015 acquisition.

The lockdown created a significant change in customer behavior, he said. The number of logins to SDP went up by 30 percent in the first three weeks of restrictions, and the top users nearly doubled the amount of time they spent on the system - going up from 36 minutes to 62 minutes.

Over the same period, customers were still welcome onsite, but visits went down by a similar proportion to the increased traffic on the SDP. "We want them to come if they need to," Bensten told us in April. "But Covid-19 is a perfect case to use the tools, so they can do remotely what used to be done on site."

Statistics are granular, as different sites have a widely varying number of visitors, depending on the profile of the customers and their stage of deployment. QTS's largest site in Atlanta could have anywhere from 400 to 700 visitors in a month, but normalizing the period with a previous one, he reckons this went down about 40 percent: "The curves mirrored each other."

If customers are realizing that unnecessary visits are a risk, new procedures may be contributing to this. "We haven't had to put in place a hard rejection at any site. We require disclosure of where visitors have been, we use biometrics, and sanitizing wipes when they touch things."

The reduction in customer visits is even more striking against a background of data center hardware which is working harder to meet greater traffic demands: "By every statistic we have, power consumption is up, bandwidth is up significantly. With all those indicators going up, you would normally see visitor profiles go up."

QTS was fortunate in having a full-featured SDP, said Bensten: "It's high-touch, high-need, for people to get what they need in the data center without going in there. It's the single way to integrate with QTS, all the way from buying the service. It's available for the iPhone, through a portal, or with an API so you can do everything programmatically."

Our employees are considered essential workers. When we need physical things our 'smart hands' can do the physical work, so the customer doesn't need to.

That range is important. Smaller firms like cloud startups just need a quick check on an app, while big hyperscalers have the resources to get the most out of programmatic access: "How they get used is wildly different. A one-to-two cabinet guy will use his iPhone app. But a large hyperscaler customer with 1MW of capacity will move loads around to consume less energy and keep the service up reliably, based on the data we share through the API. In the old world, they would have needed to go to the site to do that."

You might expect the tech-savvy big players to adapt to remote use more easily, but that's not what Bensten found: "The reduction in visits is across the board for every size of customer, including enterprise, and government business."

A remote check with the SDP can actually be more effective than a site visit, as it has access to more data, he said: "We have a massive data lake built over the years, based on data we collect from the millions of sensors in our customer space."

It also includes wider world data such as weather patterns, and effectively looks at the "weather" inside the data center: "We have a team of data scientists using advanced analytics, so we can project our power consumption in seven day intervals to predict future patterns - and the data lake can be mined by our customers as well as by us."

If remote control is good for customers, it's also good for staff, so QTS implemented home working where possible - using a different view of the same tools: "Our NOC support center is now working remotely, using a mapper with a 3D view of all our buildings down to customers' cabinets."

Of course the tools can't do everything, but when something physical has to happen, it's best for operator staff to go in and do it for the customer, directed by the support center, said Bensten: "Our employees are considered essential workers. When we need physical things our 'smart hands' can do the physical work, so the customer doesn't need to."

The work is directed by the SDP, but staff physically open the cabinets: "We don't have robots yet." The staff also operate a slightly different shift pattern, but there's no dramatic change, said Bensten: "The number of our folks on site at a time hasn't changed."

QTS also shares its building security, giving customers access to CCTV feeds for their enclosures, said Bensten: "It's Nest for your cages, you can see who came in and who left." The operator has the same ability extended to the shared areas, so it can track staff and customers from the entrance through the mantrap to the data halls.

Remote management brings up issues of demarcation for colocation vendors and their customers. The customers want to know about the building facilities, such as cooling and power, but those are under the control of the operator. Meanwhile, the operator draws a line at looking inside the IT at operating systems and workloads, leaving those for the customer to manage.

"We capture the IT as assets, like servers and storage controllers, so the customers can

load in IP configurations and VLANs. Our technology doesn't interrogate their guest OSs."

Both groups see a different view: "Our employees need to see a macro picture, while customers need to see a more drilled-in micro view."

Smaller facilities also got a head start on remote working, simply because of the overhead involved in covering multiple small locations.

"Our whole business premise was based on lights out data centers," said Lance Devin CIO of EdgeConnex, a colocation provider specializing in built-to-order facilities for smaller cities round the world. "We have 2MW sites, not 100MW behemoths. I can't afford to put three engineers and 17 security people and two maintenance people in a site like that."

With 600 of these facilities, the company had an incentive to enable remote control from the start. "The business justification was already there - it's more cost effective and cheaper." And moving further to the edge, with the possibility of 100kW or 200kW sites made remote management more important.

But the Covid-19 crisis provided a workout for the company's EdgeOS data center infrastructure management (DCIM), EdgeOS, Devin told *DCD* in April. "This is the way we run our business. This was not a change."

The systems manage EdgeConnex's equipment and the customer equipment in the racks - but the data views have to be managed. Despite the size of its facilities, EdgeConnex is a wholesale vendor, dealing with cloud players, "Our customers don't want us to know what is in their stuff or vice versa."

So EdgeConnex's system remotely manages equipment like Liebert cooling systems, which have computerized predictive maintenance, showing the equipment's details, when it was certified and tested, and its history, said Devin.

SCADA monitors everything every 100ms, spots when something is out of line, and then checks the root cause - for instance finding the faulty remote patch panel (RPP) upstream of the PDUs that suddenly show errors. The system them talks to the vendors of the hardware: "Our ops people don't have to get in the middle, the system automatically sends a ticket directly to the vendors"

The system also communicates to the customer. It knows the location and status of PDUs and other kit, what racks they serve, who will be impacted - and whether it will affect their service level agreement (SLA). "The ticketing system tells our customers the vendor is working on it, automatically."

EdgeConnex also lets customers monitor their equipment visually, but by integrating their own CCTV cameras into the system. "When you think about everything you've seen from automation and remote working. You do have everything you need at your fingertips," said Devin.

Views and data are carefully controlled: "One tenant may only see Denver, and within that their real time load and their tickets. They see their cabinets."

Actual visits are an issue in a lightly-staffed facility, pandemic or no pandemic. "We built a mantrap, and a callbox system that worked with the security system, so we can let people in remotely," said Devin. "We take a picture of them in the mantrap, and then ask a challenge system for dual authentication or a remote biometric read."

Their pass has photo ID, but has to be issued securely, and the biometric recognition has to be low-maintenance for a lights-out site: "We tried an iris scanner," said Devin, but it was too complex, with visitors having to repeat the scan at different distances. "You've gotta be kidding, people aren't that good at following instructions."

Fingerprints were rejected as the scanners get greasy. EdgeConnex uses a vascular image of the back of the visitor's hand - "they don't touch the lens."

It's a complex system which EdgeConnex put together from partial solutions. "I looked at four off the shelf DCIM products," said Devin. "I would guarantee you, any single system, did two things really well. But the reality is there isn't one system that does it all from ticketing to management to reporting,"

Back at QTS, Bentsen agreed that customers need more than DCIM. "We are a big believer in DCIM - we need it to run our building. But it is a small piece of our platform. We love our DCIM, but without our data lake on top of it, using it in ways DCIM was never intended to be used, our service delivery platform would not be able to do what it does."

Bensten thinks the pandemic has changed behavior. "We think our toolset is better for the customer - and the pandemic has pushed people to adopt that."

But what happens after the lockdown? "I guess I hope things won't go back to the way they were," said Bensten. "I've worked a lot for my career in managed services, and one of my goals is the cloudification of the data center. I want to see the data center working the way the cloud works.

"A few months from now, when this is over, the last thing anyone is going to do is hop on a plane to visit a data center."

THE NEW NORMAL

As we settle in for the long haul, here's what networks can expect from the pandemic age

Sebastian Moss
Deputy Editor

The Internet is going to be alright.

The past few months have been difficult, the next few likely more so, but the challenge of global lockdowns has been eased by our ability to communicate, work from home, and unwind with games and video streaming services. So it's good news that the net was built to handle unprecedented demand.

It's also quite remarkable. "Imagine another utility scaling like this," Cloudflare CTO John Graham-Cumming told *DCD*. "Imagine if everyone was like, 'I need 40 percent more water. All of this. Right now.' It couldn't happen."

Networks were built with redundancy in mind, designed to handle the peaks in traffic caused by events such as sports game streams (although, ironically sports is one of the things which is now less likely to be streamed). As a whole, networks should be able to weather the current surge.

Traffic began to rise, as one would expect, as lockdowns began to be enacted around the world. "There was a huge increase of traffic, somewhere between something like 20 and 70 percent, depending on the geography," Graham-Cumming said. "Now they've come up to kind of a new normal level," And it's becoming clear that the new normal is likely to extend, as lockdowns will ease gradually and people are likely to continue to stay at home.

Usage has changed. Previously there was one big peak as people came home from work and streamed videos, or accessed things that were blocked at work. "Now you're seeing a double peak, you're seeing a peak around eight to nine o'clock in the morning. And then again in the evening. So a big, big change has definitely happened."

Equally, for obvious reasons, where people access the Internet from has changed: Commercial districts have gone dark, while residential areas are permanently digitally connected.

This shift to diffused last mile connectivity has caused some issues, albeit isolated ones, that expose areas of network underfunding or low fiber deployment. Like most crises, it is something that disproportionately impacts the poor. "Mostly, though, the network is very, very flexible," Graham-Cummings said.

In an effort to improve its flexibility, in the weeks after the lockdown, network operators rushed to upgrade their systems and do essential maintenance. This had the unfortunate side effect of adding further planned and unplanned outages, network monitoring company ThousandEyes found.

"What we've noticed is that overall we've seen a gradual increase in the number of outages globally, from February 17," product marketing manager Archana Kesavan said. But from April 5 that figure began to drop, as the upgrades were finished and the networks were able to handle increased load.

With traffic plateauing and vital upgrades out the way, it is clear that Covid-19 will not overwhelm network operators. However, there is still a risk of isolated outages. While data center and networking staff are counted as essential, teams are likely to be stretched thin, kept in smaller, isolated teams, and could be understandably tired and distracted due to the current situation.

"There will be effects that are caused by people being sick, or people having to care for others or people having less ability to concentrate," Graham-Cumming said. "The environment has changed, there are additional stresses. So you might see things you didn't expect. I think that's a real thing to worry about."

As we head into yet another record hot summer, it's also likely we will experience outages that could have happened even without the current pandemic. Outages happen.

Except this time, as the entire global economy is propped up by the thin fiber cords connecting us all, large outages would be felt ever more keenly.

"We just need it more than we ever did," Graham-Cumming said. "The Internet has become a vital part of our lives." Data connectivity is now becoming as essential as electricity and (in the developed world at least) is expected to always work.

What happens when it doesn't? "A blackout is a big deal," he said.

Scaling With Confidence From Core To Edge

Amid ongoing uncertainty – of which the current crisis is an example – the ability to deploy agile infrastructure is increasingly important. This includes the ability to deploy capacity as needed and avoid overprovisioning for uncertain future needs. One solution, increasingly embraced at all levels of today's networks, is scalability through prefabricated modular (PFM) designs. These are IT whitespace and/or power and cooling systems, factory-built and tested, that can enable fast and effective capacity increases to meet immediate needs.

PFM designs support a range of data center facilities, from consolidated enterprises to cloud and colo providers.

Colos, in particular, are a potential match for self-contained, modular solutions. The multi-tenant data center (MTDC) business model is built on delivering the data center space, power and connectivity customers need in a timely and cost-effective manner, and PFM makes that easier. PFM designs provide value to a variety of colo uses, from whole site builds to containerized micro builds at the edge to augmentation of conventional facilities to add power or cooling capacity.

BUILD AS YOU GROW

Modular expansion theoretically aligns with the core colo business model, and as more and more colos introduce on-demand edge solutions, the opportunity for PFM in the colo space is growing.

From core to edge, colocation providers want to be able to scale with confidence and build as demand grows. PFM solutions will be an increasingly important part of their growth strategies. This includes colocation providers with ambitions not only to deploy and scale specific sites but also scale their whole business internationally.

Standardized, repeatable units of PFM capacity can speed up global expansion and also ensure resiliency, cost control and built quality across multiple regions.

T-Systems, one of the largest European IT service companies with global delivery capabilities, needed to achieve rapid availability and high scalability during its data center expansion. For T-Systems, PFM designs met that need, easily allowing for future phases of expansion as well as a staged investment.

CAPACITY ON DEMAND

Colocation providers want to avoid stranded capacity and overprovisioning at all costs. PFM designs can be tightly integrated and add only the capacity needed, reducing space demands and real estate costs.

This smaller footprint also makes them ideal for population-dense urban environments where computing demands are skyrocketing. And, modular solutions give colos the ability to free up white space by

putting power outside the data center.

A healthcare system in the U.S. knew these space constraints first-hand, leading them to move their data center operations from on-premise to two colocation facilities. This allowed them to use space within the hospital for revenue-generating purposes, while reducing personnel costs. The colo provider used Vertiv SmartCabinet solutions to quickly and efficiently update and relocate the hospital's IT infrastructure within a 12-month timeframe.

SPEED OF DEPLOYMENT

PFM designs leverage repeatable manufacturing practices to reduce time to build and deploy.

That does not mean these are cookie-cutter, one-size-fits-all solutions. The foundational elements may be consistent, but factory manufacturing actually enables more efficient, cost-effective customization.

A colo provider can select a prefab solution to meet specifications, and those specs can be repeated as additional capacity is added. Similarly, a provider can select the base model, but repeat and tweak requirements based on individual site requirements.

Factory construction allows that work to be completed while the site is being prepared. Once built, prefabricated units can be deployed quickly, and many units are considered "plug and play." This can cut start-up time to days or weeks instead of months with more traditional builds. That extra time allows organizations to be more agile and nimble, add capacity only as it's needed, and to quickly react to changes as they arise.

According to a 2020 report from Omdia (previously IHS Markit Technology), PFM mechanical modules often arrive in two to four months, to provide critical power capacity. In South Africa, a telecommunications provider used prefabricated modular units for a data center system, and the units were packed, shipped, reassembled, and ready for testing in less than six weeks.

ENGINEERING QUALITY

PFM solutions can provide predictability for projects that face uncertainty. In some regions, the skilled workforce required for on-site construction may not be available.

PFM solutions are built in a factory by trained specialists who can control the environment to ensure consistent quality. The finished system can be tested under load conditions in a factory setting to help ensure reliability.

Looking specifically at the edge, those sites can be located in harsh environments that require rugged enclosures to protect sensitive electronics and ensure availability.

PFM units – whitespace or power/thermal – can be built specifically with such environments in mind.

The speed enabled by PFM doesn't mean sacrificing resiliency or availability. For example, some PFM designs, such as Vertiv™ SmartMod™, are pre-tier design certified by the Uptime Institute. This pre-certification speeds up the required certification process for sites, opening up the potential for cost savings and compressing deployment times even further.

Targeted capacity deployment and management is critical to the success of colocation providers, and PFM solutions deliver on-demand capacity better than traditional builds.

These solutions can simplify deployment for colo providers, whether at the core or at the edge, with factory-built and tested performance and reliability. Regardless of the location of the deployment, PFM solutions can provide easy scalability, rapid deployment, and reliable predictability.

About Vertiv

Vertiv designs, builds and services critical infrastructure that enables vital applications for data centers, communication networks, and commercial and industrial facilities.

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Matt Weil is the Director of Offering Management for Vertiv Integrated Modular Solutions. His expertise includes prefabricated modular solutions at the edge.

Several companies are pushing the boundaries of traditional colocation using prefabricated and modular solutions. Their innovations are helping to deliver a more customer-centric edge infrastructure.

EdgeConneX

Vertiv has collaborated with EdgeConneX on dozens of projects across three continents (North America, South America and Europe) since 2014.

EdgeConneX is moving away from the traditional colocation model. They work with large cloud providers, and they'll build a facility in a matter of weeks using PFM solutions. They are focused on one-way delivery of traffic, catered toward content distribution in growing markets.

EdgeInfra

EdgeInfra, based in the Netherlands, is another new type of PFM edge colocation provider. EdgeInfra is adopting a colo model within a container – they are deploying shipping containers as edge data centers in urban areas, acting as a colo provider. They'll use PFM solutions to build out those small edge sites.

EdgeInfra is focused on bidirectional, IOT-driven compute. When we look ahead to smart vehicles and other innovations that will require more capacity, these types of compute will be critical.

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Financial security

The Covid-19 pandemic may trigger a recession, but data centers don't look likely to suffer, reports *Peter Judge*

Peter Judge
Global Editor

Remember the start of 2020? Data center investors were looking forward to another year of uninterrupted growth. Six months in, Covid-19 has changed almost everything... except for that expectation of data center growth.

Surging demand for online services during lockdown has boosted the growth projections of the industry. Subject to restrictions on movement, data center investments, openings and expansions have continued unabated.

The first four months of the year saw a total of $15 billion in merger deals according to data from Synergy Research - although most of these were set up before the year began, and way before the pandemic introduced restrictions to travel.

That bumper figure is largely due to one huge merger. Digital Realty bought Interxion for $8.4 billion, the largest deal since Digital's $7.6 billion purchase of DuPont Fabros in 2017. Digital's purchases provide peaks within the overall growth curve, but there have been plenty of other deals worth more than a billion.

Macquarie Infrastructure Real Assets (MIRA) bought 88 percent of Australia-based AirTrunk in a deal which valued the hyperscale provider at around $1.8 billion.

Other large deals have included the acquisition of Global Switch by Chinese investors, and operators including CyrusOne and Iron Mountain have also been buying up and consolidating their rivals.

However, later in the year, things may slow down as these deals require due diligence - which means actually visiting a potential acquisition.

"Due diligence requires travel - and travel has been restricted by the shelter-in-place rules," Rob Plowden, head of the US Data Center practice at legal firm Eversheds Sutherland, told *DCD* in March.

"I am still in a period where we're just getting used to the new normal, but I have definitely seen the brakes have been pumped on due diligence. Deals haven't been terminated, but they have been slowed."

For general investors, data center operators that are constituted as real estate investment trusts (REITs) still look good. At least compared with other REITs, in sectors like retail and hospitality, they have an obvious advantage: they remain open and continue to expand - so investors are likely to keep their stakes or increase them.

However, lockdown restrictions may cause some practical issues for the data centers themselves, although their own staff are generally classed as essential to keep national infrastructure running.

One window into these concerns came in an earnings call by operator QTS, which took place in April. Although the company is in the digital sphere, many of its customers are not immune to the inevitable recession which will follow the lockdown and some - like those in the oil and gas and hospitality sectors - are staring real hardship in the face.

Some of QTS' customers have warned they may have difficulty in paying: the company reported "a modest increase in customer requests for payment relief," and has extended payment terms to some. CFO Jeff Berson said that exposure was comparatively small, as companies in such risk only represent "less than 10 percent of in place recurring revenue," and any losses might be offset by increased demands from digital companies delivering online services to people stuck at home.

Physical infrastructure expenditure may be hit in future too. At the end of 2019, Synergy reported that capital expenditure in hyperscale data centers was running at $32 billion per quarter.

In the rest of 2020, data centers may have some trouble keeping this up. For one thing, construction may be impeded by restrictions. Facebook had to temporarily pause building at two major sites, in Ireland and Alabama, due to Covid-19.

For its part, QTS reported "modest delays in construction activity in a few markets - primarily as a result of availability of contractors and slower permitting."

The other major expenditure in data centers - the equipment inside it, could also be a problem. Factories in Asia experienced breaks in production. This, and possible stockpiling, may cause small gaps in the supply chain.

So far, *DCD* hasn't heard of serious trouble. QTS, for instance, claims it has "already secured" the vast majority of equipment it needs for the year, and is moving orders forward.

A global recession will ultimately hit every business somehow, but digital infrastructure looks to be insulated from all the worst of the pain.

Virtual CAPACITY

Peter Judge
Global Editor

As network demands increase, can data centers use virtual meet-me rooms to squeeze more capacity and flexibility from their networks?

Nation by nation, most of the world went into lockdown to reduce the spread of the Covid-19 virus in early 2020. This changed people's work and private lives, accelerating a move to digital working and relaxing.

It may also have accelerated a change within the data center. Different demands on network traffic made it more necessary than ever to have flexible connections between resources within the building and outside it - and will most likely push facilities to adopt a more flexible network topology: the virtual meet-me room.

The meet-me room is a physical space in a colocation data center, where telecoms providers and colo tenants connect their equipment together to exchange traffic, without having to go through an expensive local loop. Internet exchange points can also be located inside the meet-me room.

Colocation providers will connect their clients together by physical cables "cross-connects," either directly or via the meet-me room. However, as data centers have evolved, this has led to large numbers of cables running between different parts of the building - setting up connections virtually over the building network has become a preferred option, virtualizing the meet-me room.

"Vendors are building platforms which empower folks to not need the physical meet-me room as much as they did before," said Sagi Brody of disaster recovery provider Webair in a session at DCD's Virtual New York event in March 2020. "They're changing the landscape."

As a new technique, this goes under many different names. It's referred to as interconnection fabric, software-defined interconnect or data center interconnection (DCI). It also extends beyond a single data centers, with network-as-a-service companies like Megaport and PacketFabric offering flexible connectivity between popular locations across wide geographies.

Equinix is a colocation provider that makes significant revenue from cross-connects, and styles itself as an interconnection provider as much as a colocation player, branding its sites Internet Business Exchanges. Unsurprisingly, Equinix has adopted virtual connections inside its facilities, under the name Equinix Cloud Exchange Fabric (ECX).

"In some ways that's a global large meet-me room," Jon Lin, president Americas at Equinix told *DCD*.

Equinix solutions architect Sanjeevan Srikrishnan describes it as "consuming infrastructure as a service with the capabilities of the cloud," Digital Realty has a similar offering called Service Exchange, which it put together in partnership with Megaport.

These services extend outside the meet-me room of the home data center, said Okey Keke, solutions architect at Digital Realty: "We try to provide customers with end-to-end connectivity between the infrastructure they have within our facilities, and data sets in another Digital Realty facility or at a third party."

There are interesting results of this. Data is being carried over connections that may bypass the Internet, and use direct physical connections, and because those connections are virtualized, they can be made available more quickly. "We're virtualizing the physical connection, just like we virtualized physical servers," said Brody. Just as virtual servers can be deployed at will in the cloud, so can virtual connections.

This has been useful for services such as back up and disaster recovery which only need to be turned on when needed, but it also came into its own in the pandemic, he said. When business traffic flowed away from traditional business districts to residential areas, it needed a flexible response: "I don't think there's a better use case of that capability than Covid."

With this kind of service, "you have the ability to not only connect the cloud service providers to anyone else that's in the data center, but the ability to turn up services to the ISP - the eyeball network," said Jezzibell Gilmore, SVP of business development at PacketFabric.

According to Equinix, virtual connections within a single data center can actually meet those shifts at the Edge which are demanded by the pandemic response, speeding up and rerouting traffic to away from offices and towards homes: "It enables customers to exchange traffic with each other, and we've been able to use that with a lot of service providers if they are seeing congestions in areas," said Lin.

"We host a lot of the eyeball networks, we host a lot of the core backbone networks, we host a lot of the content providers and the communication providers, as well as the enterprise customers. So if you're talking about the Zooms and the WebExes of this world, we are the ones helping them scale their Edge presence to handle this load," said Srikrishnan.

Virtual connections don't replace physical cross-connects, said Keke: "In addition to customers increasing cross-connects they are looking at virtual cross-connects because they offer a lot more elasticity and access to a larger ecosystem than a cross-connect to a single business partner or carrier."

The use of direct connections means that organizations are sending less of their data across the public Internet, according to Christian Koch, head of product at PacketFabric. Some of this goes across physical fibers within a colocation site, some goes across services like Megaport, between sites.

One thing virtual meet-me rooms won't do, is change one of the oft-cited gripes of the data center world: the price of Equinix's cross-connects. Rivals often complain that for the price of Equinix running a cable from one side of its building to the other, a telecoms provider could offer a link across a country, but Jon Lin says virtual links won't change this.

ECX links themselves may be cheaper, but they are a different use case, he says. "If you have a cross-connect, you can scale from 10G to 100G on a dedicated circuit that's inherently under your control.

"There's a lot of value in this, and ECX is about being agile and having a dynamic software-defined experience. We are pricing based off of the value."

Becoming a part of the COMMUNITY

To build in cities, data centers need to become a part of cities. That means looking nicer, and helping out the grid, *Sebastian Moss* reports

Sebastian Moss
Deputy Editor

Let's be honest: For local communities, data centers can often be a tough sell. Sure they bring jobs, but not many. There's some revenue, but it's usually offset by tax breaks. But beyond that?

It's this perception that has led to some areas turning against data centers, most notably Amsterdam, which in the summer of 2019 placed a moratorium on new builds. "I think one of the biggest problems they have is that Amsterdam does have a lot of data centers and they do produce these dead areas in the city," Chad McCarthy, Equinix's global head of engineering development and master planning, told *DCD*.

Some of the criticisms against data centers are based on unfair presumptions, McCarthy believes, but others are grounded in truths - ones that data centers need to learn from. "You've got these large, cubic, plain grey buildings, and big gates outside - no one's really walking around," McCarthy said. "They don't really see that as how they want Amsterdam to be. Amsterdam is a lively place and they don't really want it to look like that."

This is not just an issue with picky Dutch architects, but a wider sentiment shared by many. "I've seen a lot of these data centers in Santa Clara and they're just big, blank boxes; they're disgusting, they're just so ugly and when I look at the picture of this one, it's just one big white plane that's not interesting," Planning Commissioner Suds Jain said of a RagingWire facility when discussing whether to approve the construction.

"I don't understand how we allow this to happen in our city."

Even outside mass conurbations, there are those calling for more care in data center design, with Loudoun County officials last year begging for data centers to be better looking, lamenting the hundreds of identical rectangles dotting the landscape.

"We're starting to provide green areas, cafes, and scenic walkways through the campus like universities do," Equinix's McCarthy said.

"If data centers are in the city center, they have to be integrated and have to be part of the city infrastructure."

That does not mean blindly following planning officials' every whim, however, with McCarthy sharing his distaste for "the number one request" - vertical green walls.

"I mean, that is one of the most pointless things you can do from an environmental perspective, it's not easy for plants to grow on a vertical surface, you need to use a lot of water to keep it alive, you have to pump the water up to a great height because these things are typically about 30 meters tall. And it's a complete waste of energy. It is an illusion, we need to move away from things which just don't count, and start looking at what really counts."

An area that could have a far greater impact would be shared heating systems, where the waste heat from a power plant is used in adsorption chillers in a data center, and then the waste heat from the data center is given to the district heating system to warm homes and schools.

"Once it gets to that point, then you can imagine you're sitting in your apartment at home and you've got your feet on the sofa and you're watching Netflix," McCarthy said. "Yes, you're causing heat in a data center when you watch Netflix, but you're using that to heat your house - and by the way, it's heat which is

"I've seen a lot of these data centers in Santa Clara and they're just big, blank boxes; they're disgusting, they're just so ugly and when I look at the picture of this one, it's just one big white plane"

a necessary byproduct from the power that's generated to run your television."

But an integrated community energy scheme has yet to be rolled out en masse outside of some Nordic nations. "I tried to do adsorption cooling in Frankfurt using waste heat from a coal-fired power station," McCarthy said. "And it was just impossible to negotiate terms."

The company would have had to pay for additional heat rejection, the region didn't have an appropriate district heating network to pass on the remaining heat, and the power station wanted to charge exorbitant fees for the heat because they had a sweetheart deal to use river water for free.

"And so this is what we're up against - we're after a complete modernization and a recalibration of the energy market."

As we shift away from fossil fuel power plants that create waste heat for steam turbines, and move to wind farms and solar plants that don't create excess heat, data center waste heat could become even more important to communities.

Renewables could also give data centers another vital role in society - as grid stabilizers. Using UPS systems for demand response is already being trialed, but could roll out further as data center operators and customers get used to the concept. "It's just one of those inertia factors that has to be overcome for that to work," McCarthy said.

"But from a technology perspective, batteries in data centers can be dual purpose. They can cover grid outages for the data center, but they could also stabilize the grid as well."

That's not to say further technological advances won't make the transition easier, with UPS battery improvements allowing for fundamental data center changes, including allowing companies to drop diesel generators - another community bugbear.

"Currently you've got a five-minute battery supply and diesel generator," McCarthy said. "It isn't easy to use a fuel cell as a backup source, it takes too long to start." So, in that scenario, you'd likely use the fuel cell as your main source of power, and fail over to the grid. "But the grid is not under your control, so failing over to something which is outside your control is not really acceptable at this point in time, and so that would point you would need very long battery periods, which only really makes sense if you're dual purposing for grid stability.

"So if you were stabilizing the grid and you had something like a four-hour battery then the fuel cell without the diesel generator, I think is something which is very realistic."

But, McCarthy cautioned, "you can see that we're moving this specification a long way from where it is now."

Much of this will rely on new technologies, government incentives, and regulations - and Equinix notes that it is in talks with the EU on the latter two points. But until then, data centers should focus on a simple task: Being better neighbors.

"We need to completely change the way we think about how we live in the community," McCarthy said. He's hopeful such moves will nix "a perception which has grown over time and it's been left unchecked" that data centers are bad for communities.

"The data center is the platform of that digital economy. That interchange of data, the storage of data, and the availability of data is really largely responsible for our standards of living today, even more so right now."

What goes AROUND comes around

Why build a whole new server when Google's about to chuck one away?

Sebastian Moss
Deputy Editor

As much as the data center industry prides itself on the vast efficiency improvements it has made over the past few decades, and the climate-positive effects of businesses moving to modern facilities, there remains an uncomfortable truth: Electronics are dirty.

Whether it's the chips using rare-earth metal extracted from horrific mines, or trawled from deep sea beds; whether it's the hard drives with neodymium magnets primarily found in China; or whether it's the copious quantities of steel used to make racks, smelted in a highly carbon intensive process, the sheer act of setting up a data center is a wildly environmentally damaging one.

And then, when the hardware is upgraded, all those servers and all those racks are simply thrown away.

"We did a full lifecycle analysis of a standard Open Compute Project (OCP) rack to find out what portion of the total CO2 impact is attributable to pre-use phase, such as mining, manufacturing, system assembly, and so forth, which portion of the CO2 impact is tied to its use, and then which part is attributable to end of life processes," Ali Fenn, president of ITRenew, told *DCD*.

"And it turns out that in a pretty common use case - where components are manufactured in Asia, systems are assembled in Eastern Europe, and then data center deployment is in the north, and end of life stuff is done locally - then it turns out that 76 percent of the net CO2 impact is attributable to that pre-use phase."

Her company is one of several springing up to try to minimize the impact of server construction, by making data centers a more effective part of a circular economy.

The idea is simple: Hyperscale companies like Google, Facebook, and Microsoft buy staggering numbers of OCP servers with life expectancies of around nine years, but because of their need to always have the latest hardware, usually decommission the servers after just three years. Previously, this would mean that the servers were destined for an early scrapyard, but instead ITRenew buys the servers, wipes them, and resells them to less demanding organizations that then run them for another five or six years.

Of course, it still doesn't stop the servers being environmentally damaging, and eventually they too will likely end up in a landfill somewhere, Fenn admitted. "It's a deferral of new manufacturing as opposed to avoidance. But it buys us time, right?

"In a truly circular world, the system would be regenerative by design and those end-of-lifetime things would magically become something else with zero sort of byproduct waste. Unfortunately, electronic components are kind of the hardest things to do in that regard."

> *"The ODMs are only set up to serve like a hundred thousand servers at a time. They're two percent margin businesses, taking orders from the hyperscalers at massive scale"*

Another challenge is that ITRenew does most of its work with more-or-less anonymous "white label" servers from manufacturers like Wiwynn or Quanta. These are based closely on open design standards from the Open Compute Project (OCP) and are often referred to as ODM (original design manufacturer) kit.

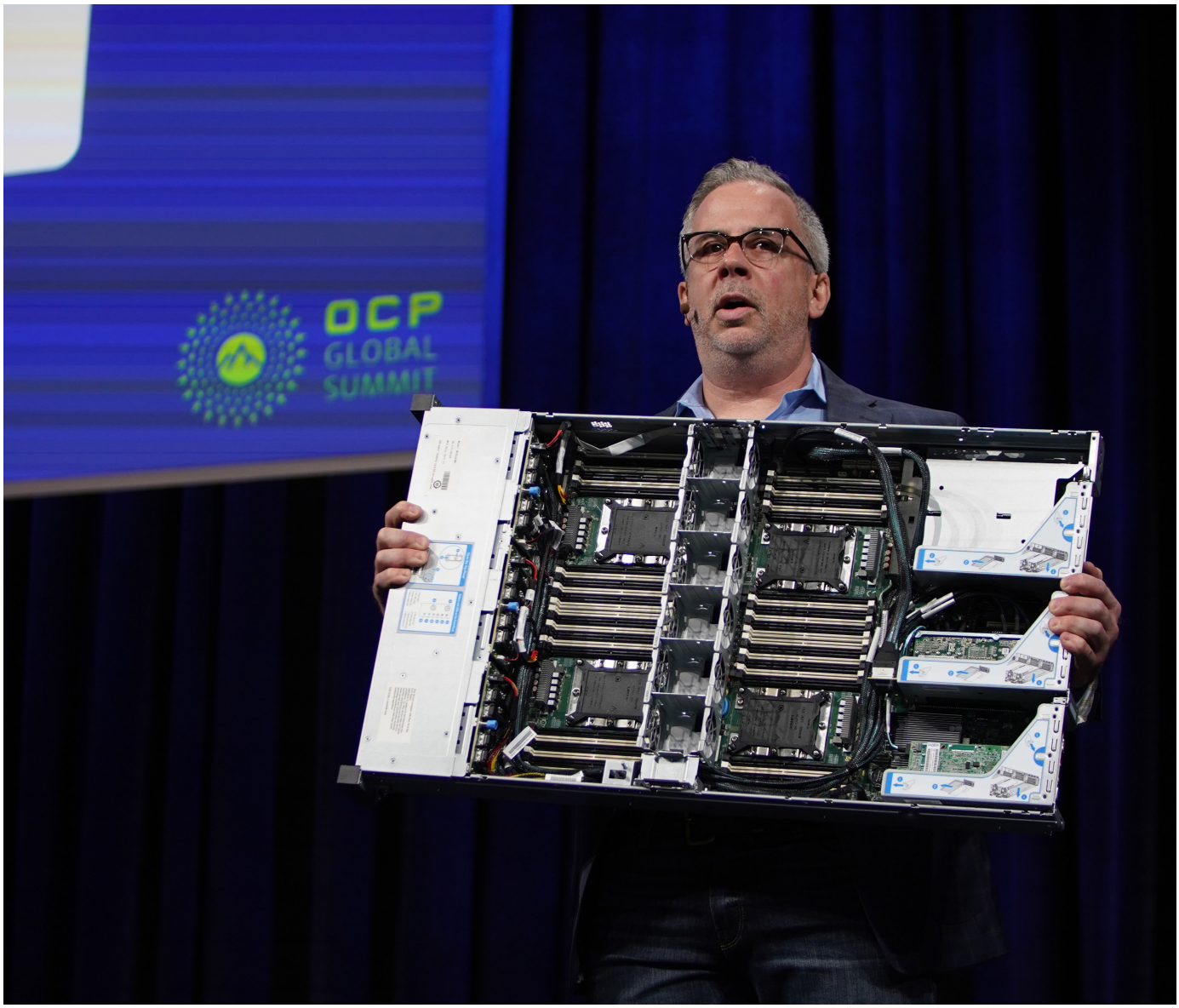
It's harder to work with branded servers, from the likes of HPE or Dell, which are often referred to as OEM (original equipment manufacturer) kit, because OEMs use proprietary firmware, and bundle support packages and agreements which can restrict what ITRenew can do.

"We've sold a lot of OEM equipment. But you can't warranty it or support it. What's different now is that, because things are open, we can actually stand behind it and say, 'we've tested it, we've certified it, with warranty' - that's the key shift from proprietary OEM systems to open ODM systems."

OCP and the ODM model has been a huge success with hyperscale companies, but it has struggled to make a dent elsewhere in the data center industry, amongst the everyday businesses where ITRenew finds its customers. "Frankly, ODM hardware has not been as widely adopted as it could be," Fenn said. "A lot of it is that the ODMs are only set up to serve like a hundred thousand servers at a time. They're two percent margin businesses, taking orders from the hyperscalers at massive scale."

With low margins, and often not offering warranties, the ODMs have small sales footprints and channel support, with little desire to chase comparatively tiny enterprise deals. Servers built to OCP specifications therefore represent "a fraction of the total server market and even a fraction of the ODM market," Fenn said. "But that's actually one of the things we're trying to solve."

The circular economy is increasingly becoming a focus of governments looking to minimize the impacts of the coming climate catastrophe, and to reduce their reliance on foreign-owned natural resources, with the



EU in particular promising to push a radical circular agenda.

But the circular economy, like the normal economy, is currently facing the challenge of the Covid-19 pandemic. For ITRenew, the impact has been a mixed bag.

On the positive side, businesses with suddenly constrained cash flow may be more likely to turn to cheaper second hand equipment, while the pandemic has threatened to hit the supply of some components needed for new equipment.

While factories across Asia have mostly got back into business, the amount of components in the supply chain has been affected by fear. There's been an uptick in purchases of usually slow moving memory, and very specific spares, ITRenew's chief strategy officer, Andrew Perlmutter, told *DCD*.

So, it would seem that general enterprises might be more receptive to the idea of cast-offs from the hyperscale world right now. But, unfortunately, the effects of the pandemic are also reducing the supply of second-hand equipment from the giants, who are changing their habits.

Hyperscalers are facing unprecedented demand for their services, and can find themselves understaffed and cautious about unnecessary maintenance.

One response is to extend the life of their servers, reducing the number available second hand. "It's not exactly business as usual," Perlmutter said. "We have seen a dip, but not so substantial that it's caused major challenges."

Once the crisis is over, however, Perlmutter expects the reverse: "I do think you'll see something of a spike in decommissioning and deployments."

Longer term, Perlmutter believes it's unlikely that this experience will lead to hyperscalers operating servers for longer. At the moment it remains true that this year's servers are vastly more powerful than those of three years ago, so there's an incentive to swap them out.

However, Moore's Law is starting to sputter, and the exponential performance curve is nearing its end, so the need to refresh systems so rapidly may go away.

Organizations like ITRenew hope that the current pandemic does not blind businesses to the larger coming one - climate change - which makes it imperative to find ways to reduce the waste of resources.

"For the first time ever in history, we are all fighting a common battle and maybe people will pull together after this, and things will become less polarized globally," Fenn said.

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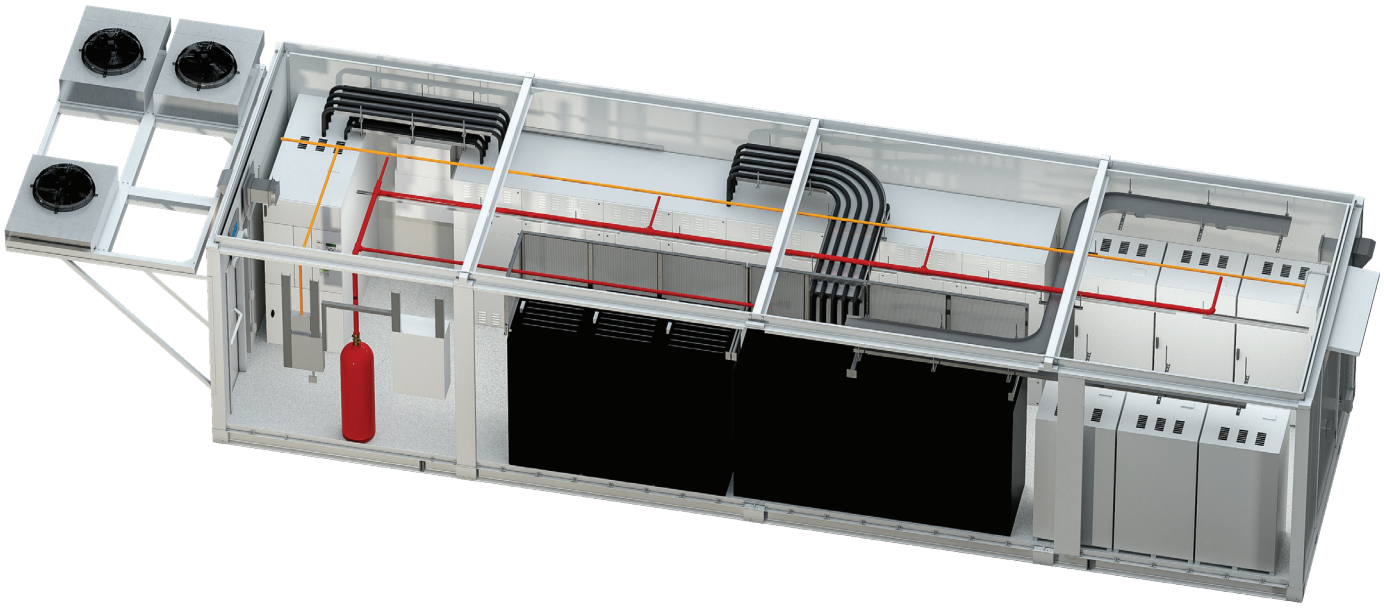

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