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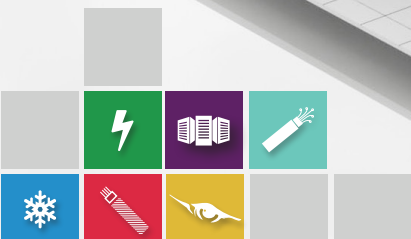
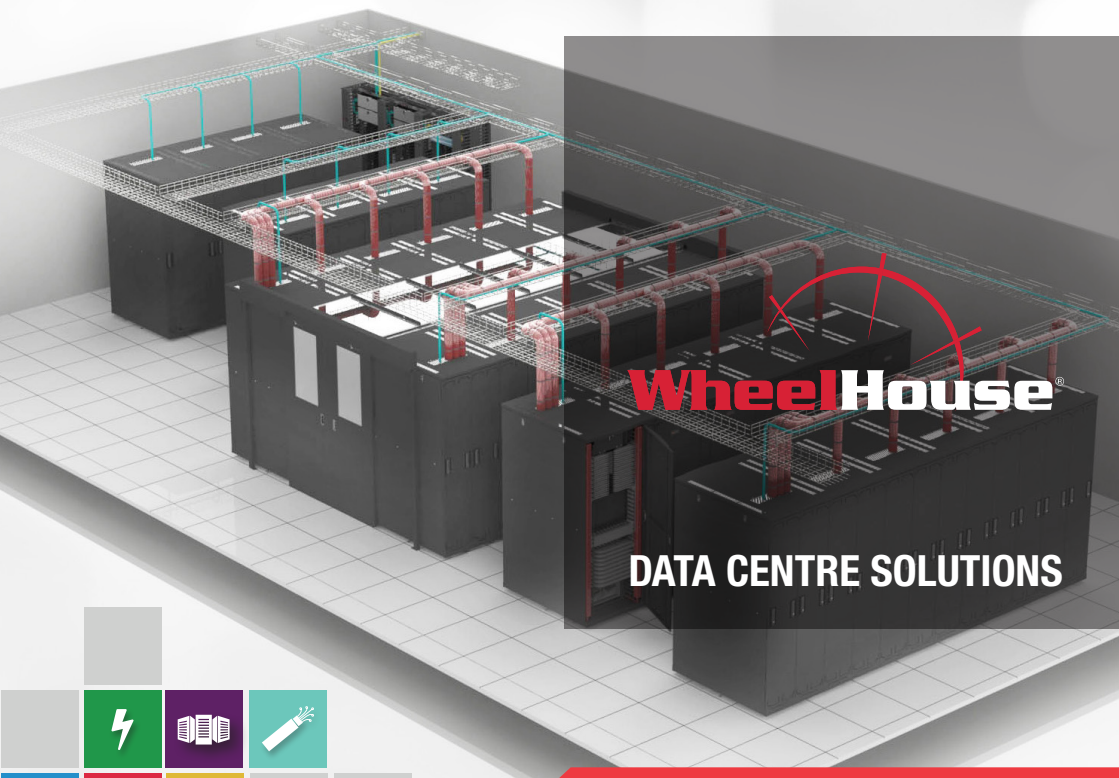
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Edging ahead

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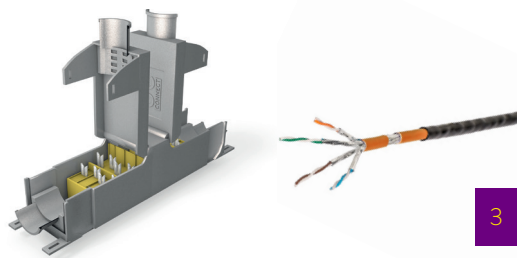


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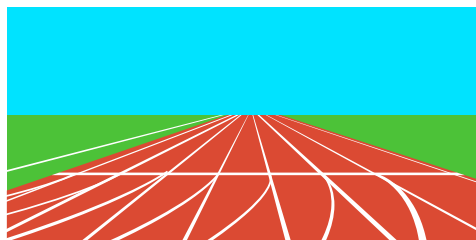
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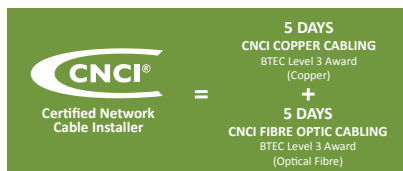
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2019 has got off to a flying start and there are clearly exciting times ahead. There's also a sense of change in the air on a number of fronts and no more is this evident than in colocation data centres. What used to be referred to a new sector is rapidly maturing and there have been various drivers for change over the past few years.

We live in an increasingly digitalised world and the ability for companies to adapt to this trend will be fundamental to their longevity. In this issue Russell Poole of Equinix examines the role of the colocation data centre in the rise of global data. Likewise, the move to edge data centres continues unabated and Jonathan Arnold of Volta Data Centres explains the driving forces behind decentralised facilities. [CLICK HERE](#) to read Russell's article and for Jonathan's [CLICK HERE](#).

With more types of cabling available than ever before, doing your homework is well worth the time and effort. Choosing optical fibre cabling for use in a data centre is far from straightforward, which is why we've asked a panel of experts to identify the key considerations and examine whether pre-terminated cabling is now the most efficient and reliable option. You can read this month's Question Time by [CLICKING HERE](#).

Optical fibre is not the only cabling solution where there is a high level of complexity – copper has similar issues. With Category 8 cable and connectivity now able to support IEEE 25GBASE-T and 40GBASE-T, Mark Dearing of Leviton Network Solutions explains why Category 7 and Category 7A no longer offer an advantage and you can read what he has to say by [CLICKING HERE](#).

With so much more besides, I hope you enjoy this issue of Inside_Networks. Don't forget that if you'd like to comment on any of these subjects, or anything else to do with enterprise and data centre network infrastructures, I'd be delighted to hear from you.

R. Shepherd

Rob Shepherd Editor



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Cisco predicts more IP traffic in the next five years than in the history of the internet

The new Visual Networking Index (VNI) by Cisco predicts that by 2022 more IP traffic will cross global networks than in all prior 'internet years' combined up to the end of 2016. In other words, more traffic will be created in 2022 than in the 32 years since the internet started. More than 28 billion devices and connections will be online and video will make up 82 per cent of all IP traffic.

'Since we first started the VNI Forecast in 2005, traffic has increased 56-fold, with more people,



devices and applications accessing IP networks,' said Jonathan Davidson, senior vice president and general manager, service provider business at Cisco. 'Global service providers are focused on transforming their networks to better manage and route traffic, while delivering premium experiences. Our ongoing research helps us gain and share valuable insights into technology and

architectural transitions our customers must make to succeed.'

60 per cent of organisations have not evaluated continuity risks across their cloud services in over a year

Despite sensitive data being increasingly moved to the cloud, research carried out by Databarracks has revealed that over 60 per cent of organisations have not evaluated the continuity risks for their cloud services over the past year.

Recently, McAfee published findings from its Cloud Adoption and Risk Report showing that 21 per cent of organisations regularly store files in the cloud containing sensitive data. This is a 17 per cent increase from over the past two years. The number of files with sensitive data shared in the cloud has also increased 53 per cent year-on-year.

From a survey of 400 IT professionals,



only 40 per cent of organisations have evaluated the continuity risks for their cloud services in the past 12 months. 17 per cent of businesses have no plans to address this over the next 12 months. Further to this, almost a quarter (23 per cent) of

organisations admit to not having back-up or recovery capabilities in place, beyond the standard default options offered by their cloud provider.

Peter Groucutt, managing director at Databarracks, commented, 'In many ways cloud computing is secure and resilient but it's worth noting that several issues do carry equal risk, regardless of whether systems are on-premises or in the cloud.'

More than 70 per cent of businesses moving to the cloud despite two thirds of IT leaders fearing security risks

Equinix has announced the findings of an independent survey of over 1,200 senior IT professionals from across Europe, Middle East and Africa (EMEA). Results show that 71 per cent of organisations are likely to move more of their business functions to the cloud in the coming years. 60 per cent of EMEA IT leaders cite proximity to cloud service providers (CSPs) as an integral factor when choosing a data centre in their local market.

Despite more business moving to the cloud, 70 per cent of respondents still perceive there to be cybersecurity risks around cloud adoption. Large public data breaches have caused uncertainty among companies, leading to 45 per cent of respondents focusing on improving their organisation's cybersecurity as their

biggest IT priority.

Cloud and cybersecurity considerations together are top of mind for IT executives across the region. For nearly half (48 per cent) of those surveyed, the adoption of cloud-based services represented one of the top two factors that will impact their business in the future – second only to cybersecurity risks and breaches (53 per cent).



Eric Schwartz

Eric Schwartz, president EMEA at Equinix, said, 'The results of this survey reveal the huge shift towards cloud as businesses across EMEA prepare to compete in the digital economy. Cybersecurity risks and breaches are of course a matter for close attention but must not prevent businesses from undergoing digital transformation.'

Wi-Fi users are being given a false sense of security

Unless more comprehensive security is built into the Wi-Fi infrastructure, users will be fooled into feeling safe with the new WPA3 encryption standard, while still being susceptible to attacks such as evil twin access points (AP). This is the warning from researchers at WatchGuard Technologies' Threat Lab, who predict that a WPA3 Wi-Fi network will be hacked in 2019.

WatchGuard believes that hackers could use any of the six known Wi-Fi

threat categories, as defined by its Trusted Wireless Environment Framework, to compromise a WPA3 Wi-Fi network.



Corey Nachreiner

'While WPA3 has undergone significant improvements over WPA2, it still does not provide protection from threat categories that operate primarily at Layer 2 and include rogue APs, rogue clients, evil twin APs, neighbour APs, ad-hoc networks and misconfigured APs,' commented Corey Nachreiner, CTO at WatchGuard Technologies. 'We think it is highly likely that we'll see at least one of these threat categories used to compromise a WPA3 network and our money is on the evil twin AP.'

Application performance visibility seen as key to boosting business processes and user experience

80 per cent of senior IT professionals in global companies think that visibility of business critical applications and network infrastructure performance is valuable in their role, according to a survey commissioned by Teneo. Researchers also found that an even higher proportion of senior IT professionals – 86 per cent – are likely to start designing business services from the user experience outwards over the next two years.

These findings from the study show the constant pressure that enterprise IT teams are under to ensure a better corporate IT experience for each individual employee, as well as delivering better performance from global level business critical applications running across complex cloud and hybrid network environments.

The research questioned 200 senior USA and UK IT and networking managers (100 in the US and 100 in the UK) at companies with worldwide operations. The survey found that, on average, network monitoring now absorbs 36 per cent of corporate IT budgets, while a majority (52 per cent) of respondents said that deploying networking infrastructure and monitoring solutions is time consuming.

Marc Sollars, CTO at Teneo, said, 'It's no surprise that networking teams face a continual dilemma of how to deliver this next level visibility – do they make a separate business case from capital expenditure or can they squeeze it out of operational expenditure?'

The Alan Turing Institute and the Hartree Centre sign collaboration agreement

A collaboration agreement signed between The Alan Turing Institute and the Science and Technology Facilities Council's (STFC) Hartree Centre will see the two organisations bridging their mutual interests in the areas of data analytics, machine

learning, modelling and simulation.

T Adrian Smith, director of The Alan Turing Institute, commented, 'Data science and artificial intelligence (AI) research

requires access to large computing facilities in order to enable intensive algorithms to

operate and learn.

As a national centre committed to driving impact in these sciences into real world applications, we want to partner with world class facilities like the Hartree Centre to ensure we build data science and AI tools

and software which match the needs of the UK's industrial future. We look forward to working with the team at STFC to further develop our collaborative plans.'



Small businesses left in the dark over edge computing

Small businesses in the UK are falling behind their larger counterparts when it comes to the adoption of new technologies according to a new report, with just 38 per cent of smaller companies making use of edge computing systems compared to 60 per cent of bigger businesses.

In total, 90 per cent of small business owners said their company is not utilising edge data centres, according to the independent commissioned by Volta Data Centres, with just 17 per cent saying they were likely to deploy the technology in the next five years compared to 51 per cent of larger companies.

Although 45 per cent of firms overall said they are using edge data centres, just 25 per cent of companies with less than 100 employees are utilising the technology – this rises to 68 per cent of 100-199 sized

companies, 59 per cent of 200-499 and 57 per cent of 500+. The report also highlights the reasons for edge data centre adoption, with security (68 per cent) being the primary factor ahead of faster delivery (57 per cent) and cost efficiency (56 per cent).

Jon Arnold, managing director at Volta Data Centres, said, 'Industry inequality is emerging that threatens to profit the biggest companies while leaving the rest far

behind. In the long-term, these small businesses might lose employees frustrated with what they perceive as inadequate data centre and IT resources, as well as customers equally frustrated with slow, unreliable access to information. Education on and the witnessing of benefits around edge computing will be essential to help plug this gap, helped by the smaller businesses that plan on adopting the technology in the future.'



NEWS IN BRIEF

66 per cent of organisations have plans to deploy 5G by 2020, according to a new 5G use case and adoption survey by Gartner.

Vertiv has completed the purchase of MEMS Power Generation (MEMS), a privately owned company headquartered in the UK that specialises in temporary power solutions.

Research commissioned by SoftwareONE has revealed that 62 per cent of organisations believe that the actual costs of maintaining cloud technologies are higher than they expected.

Maincubes has signed up two DAX-listed companies as well as another high-profile customer active within automotive and telecommunications for its data centre in Frankfurt, Germany.

Exponential-e has achieved the CAS(T) standard for telecoms providers – certified by the National Cyber Security Centre (NCSC) – for its smartwires, WAN, VPLS, internet and HSCN services.

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Hi Rob

At its 2017 Data Centre Conference, Gartner predicted that 40 per cent of enterprises are set to introduce edge computing into their projects by 2021. And no wonder, because the need for a better, faster customer experience is becoming ever more acute as our networks grow and become even more widely distributed.

Fulfilling this demand is now absolutely critical to an organisation's bottom line and even has a direct link to sales. Amazon discovered that every 100ms of latency cost it one per cent in sales. Similarly, Google found an extra 0.5 seconds in search page generation time dropped traffic by 20 per cent. Building an edge data centre clearly requires much planning and preparation, so what do service providers need to consider before moving to the edge?

• Location

Location in this case applies both geographically and also to the characteristics of the physical site. Think

about your target market – is it close enough to them to ensure little latency and an excellent customer experience? Regulatory compliance is also now an essential consideration given that data is going to be stored on-site – ensure you're compliant with and conscious of local data regulations and their impact.

• Power

Power planning is obvious yet critical for any data centre build, but the needs of an edge data centre are quite distinct. While power redundancy is usually a necessity for traditional data centres, at the edge this may not be available or be too expensive. Given that, in a best case scenario, power will enter the facility from different entrance points, businesses should consider whether multiple utility grids could service the building.

• Heating and cooling

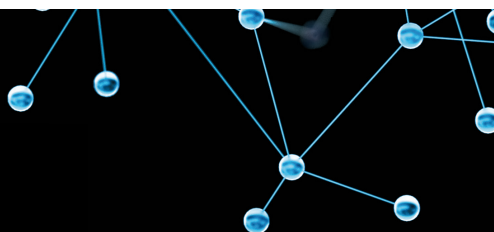
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success

(HVAC) is also crucial to operating a data centre successfully. 50 per cent of all power used by a data centre is due to HVAC, so service providers must ensure that this operation is efficient and cost effective.

• Design

Bearing in mind the value of the infrastructure and the data within it, most of the design concerns for edge data centres are regarding security and safety. This means physical security measures, not just the more obvious cyber security aspect. Perhaps consider biometrics as an additional layer of security on top of key cards and traditional identification.

• Physical layer infrastructure

Given that analysts predict huge growth in the volume of data going to the edge, the key here is future proofing. The physical layer infrastructure should be designed from the outset to support multiple upgrades – it would be prudent to put in

place a 3-5 year roadmap to consider all eventualities. Any service provider looking to truly harness cloud computing and SDN/ NFV needs to examine its physical layer infrastructure with both the present and the future in mind.

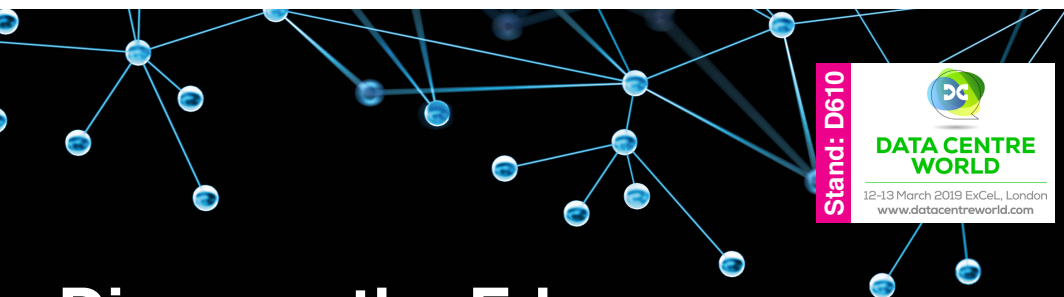
These five points are just scratching the surface, but hopefully they can serve as signposts for the move to the edge. Service providers need to consider both their present and future requirements when building an edge data centre to support such explosive projected growth in demand.

Craig Doyle
CommScope

Editor's comment

The edge will continue to be a major discussion point and Craig provides a useful overview of what needs to be considered. His points about future proofing physical layer infrastructure are particularly pertinent.

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A bit of light reading

Selecting the right optical fibre cabling system for use in a data centre requires careful thought. [Inside_Networks](#) has assembled a panel of industry experts to identify the key considerations and examine whether pre-terminated cabling is now the most efficient and reliable option.

 In an industry where faster equals better, it's no surprise that optical fibre is now extensively used within the data centres that feed the demand for Internet of Things (IoT), 5G, Industry 4.0 and intelligent transport systems. 200GBASE-DR4 and 400GBASE-SR16 have pushed the boundaries further still in what's possible with fibre. However,

has a typical length restriction of around 100m on OM4 for 100Gb/s, 200Gb/s and 400Gb/s.

Then there's the issue of whether to use a pre-terminated cabling solution, with ISO/IEC 14763-3 defining more accurate and stringent testing requirements for installed fibre networks. It is certainly the case that many large data centres

WHEN SELECTING AN OPTICAL FIBRE CABLING SYSTEM FOR A DATA CENTRE, WHAT ARE THE CRITICAL FACTORS TO CONSIDER? WITH STRINGENT TESTING REQUIREMENTS FOR FIELD TERMINATED OPTICAL FIBRE NETWORKS NOW IN PLACE, ARE WE REACHING A POINT WHERE PRE-TERMINATED CABLING IS THE MOST EFFICIENT AND RELIABLE OPTION?

17

selecting a fibre cabling system isn't always a straightforward choice and there are a number of factors to address, such as whether to use singlemode or multimode cabling.

Generally designed for systems of moderate to long distance, singlemode fibres have a small core size that permits only one mode or ray of light to be transmitted. This requires precision alignment to inject light from the transceiver into the core, significantly driving up transceiver costs. Conversely, multimode fibres have larger cores that guide many modes simultaneously, making it much easier to capture light from a transceiver, allowing source costs to be kept down. However, this type of cabling

are enjoying faster installs and smoother moves, adds and changes as a result of this technology, with high quality connections and high availability. This also means reduced focus on the need for highly advanced installation skills, now that pre-terminated systems enable fast, clean, and simple connections.

In order to shine a light on what installers, consultants and end users should be aware of when selecting a fibre optic cabling solution for a data centre, [Inside_Networks](#) has assembled a panel of experts to give us their thoughts and opinions.

Don't forget, if you have a question that you would like answered in [Inside_Networks](#), [CLICK HERE](#) and we'll do our best to feature it.

RICHARD EDNAY

TECHNICAL DIRECTOR AT OPTICAL TECHNOLOGY TRAINING

There are many inter-related factors to consider when selecting a fibre optic cabling system for a data centre environment.

Some of these relate to the passive cabling, but it is also important to have a good understanding of the systems that operate over the fibre. As data rates continue to climb, systems have become more complex and there is now a plethora of data rates, form factors and technologies to be considered.

Much will depend upon the scale of the data centre being considered. This affects maximum transmission distances and the volume of cabling that has to be managed. The March 18 Inside_Networks Question Time addressed the fundamental question of multimode versus singlemode fibre, with the general conclusion that multimode will provide the lowest cost solutions for distances up to 100-150m. This is certainly true for data rates up to 100Gb/s and most likely for 400Gb/s too.

The choice of transmission technology will also affect connector styles and fibre counts. Up to 100Gb/s can be achieved with a pair of fibres using wavelength division multiplexing (WDM) technology – hence the equipment connector interface may be duplex LC. However, at 400Gb/s, the most cost effective solutions will be using parallel

fibres. So how much future proofing do you want to build in? For parallel fibre solutions you'll also need to decide whether to go

with 12, 24, 16 or 32 fibre MPO connectivity.

Another set of decisions are around cable management and include using 800mm wide cabinets to provide adequate space at each side for cable management; use of fibre friendly pathway systems; space for, and management of, slack cable, especially for pre-terminated solutions; and space for fibre termination modules if pre-terminated solutions are not used.

So, is pre-terminated the most efficient and reliable option? Probably yes, for most sizeable data centres. But effective systems need to be in place to determine accurately the required cable lengths and provision needs to be made for the inevitable overlength of these cables. Also, it is important to be aware that factory terminated doesn't mean you can get away without inspecting and cleaning connectors if you want reliable and trouble free performance.



'So, is pre-terminated the most efficient and reliable option?

Probably yes, for most sizeable data centres.'

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ROBERT LUIJTEN

EMEA FIELD MARKETING MANAGER AT FLUKE NETWORKS

When certifying or troubleshooting an optical fibre system for a data centre it is critical to ensure fibre end faces are clean and that, given the fact that optical loss budgets are more stringent than ever, the correct loss limits are calculated or chosen. Users understand the importance of fibre inspection and cleaning, yet it does not appear to be common practice. This is also confirmed by the fact that when fibre test and measurement instruments are returned to the service lab for repair or calibration, almost 50 per cent of them have dirty ports.

The current standard test limits for fibre do not cover many application needs, mainly due to the deployment of ultra-low loss components. As a result, it is key to certify links that exceed the standards' performance requirements using custom limits. Some testers have these limits accessible through a built-in fibre performance calculator.

Details of calculated loss budget are then also transmitted with the test result. Keep in mind that a typical fibre link in a data centre will contain multiple sections of cable and, as a result, twice as many connectors. Duplex connectors – such as LC, ST or SC – can be field terminated using mechanical crimp methods or traditional epoxy polish. MPO field termination is achieved with fusion splicing with splice-on MPO pigtails or splice-on MPO connectors. In all cases testing to ensure losses are within custom limits is extremely important.

We may be reaching a point where pre-

terminated cabling is considered the most efficient option, but I do not think it is by definition the most reliable. Efficiency may be desirable when installation speed is driven by limited 'people on floor' and 'time on floor' requirements. On the other hand, pre-terminated links are made to order, resulting in possible undesirable lead times and there are cases where link lengths can't be predetermined.

Fibre remains challenging to deal with and training requirements continue to be high, also driven by staff attrition and the fact that it is difficult to find the right people. Typical data centre problems are caused by dirty fibre connections and troubleshooting initiatives that are too time consuming. With MPO/MTP pre-terminated fibres, one contaminated or misaligned connector could lead to issues in multiple fibres within the ferrule. On top of that they often get deployed 'straight out of the bag', which does not guarantee that they are clean. Pre-terminated cables are typically also re-used, making inspection and testing even more important.



'We may be reaching a point where pre-terminated cabling is considered the most efficient option, but I do not think it is by definition the most reliable.'

NICOLAS ROUSSEL

TECHNICAL MANAGER AT SIEMON

There are a great number of factors to consider when selecting an optical fibre cabling infrastructure for a data centre.

One of the most obvious is cost, which includes cabling, connectivity and active equipment.

Equally important is to ensure that the selected fibre system guarantees application assurance, supporting not only current but also future higher speed fibre applications.

Other considerations include the cabling distances

to be covered in the data centre, which impacts decisions over the deployment of a singlemode (OS1, OS2) or multimode (OM3, OM4) fibre. The number of connections in a cabling link also plays a critical role, as it affects insertion loss budgets and overall cabling performance, and requires a decision over standard or low loss fibre connectivity.

To help satisfy the ever-growing bandwidth needs, transmission speeds in the data centre are evolving fast and are now migrating from 10 to 40 and 100 Gigabit Ethernet. New fibre applications such as 200GBASE-DR4 and 400GBASE-SR16 have recently been approved and even faster Ethernet speeds, including 800Gb/s or 1Tb/s, are already emerging.

However, these higher speed fibre applications will only perform as intended if the optical budget – channel insertion loss – is achieved. Standards groups have

therefore defined more stringent testing procedures of the installed fibre network to ensure link losses stay within an application's 'optical budget'. Testing now also includes a thorough cleaning process and fibre end face inspections before the actual test with a power meter can be carried out, making the acceptance testing of installed links and channels increasingly time consuming.

Therefore, many network managers are turning to pre-terminated fibre cabling solutions. Compared to field terminated solutions, pre-terminated fibre systems are manufactured

and tested in a controlled and clean factory environment and deliver guaranteed performance levels. They also enable rapid deployment speeding up installation time by up to 75 per cent compared to field terminated solutions. In addition, MPO/MTP connectors that are required for 40Gb/s and beyond cannot easily be terminated in the field and also drive the case for pre-terminated fibre solutions.

'Testing now also includes a thorough cleaning process and fibre end face inspections before the actual test with a power meter can be carried out, making the acceptance testing of installed links and channels increasingly time consuming.'



KAI THEILE

BUSINESS DEVELOPMENT DATA CENTRES AT NEXANS

When selecting an optical fibre system for a data centre, I recommend a three-step approach.

The first step is to determine the networks and speeds required. What type of network should your fibre system support today and in the future?

In a data centre this is most likely to 40 or 100 Gigabit Ethernet, and 16Gb/s or 32Gb/s Fibre Channel in storage area networks (SAN). To support future protocols like 400 Gigabit Ethernet and 64Gb/s Fibre Channel, the migration options need to be considered, taking into account the fibre type (OM4, OM5, singlemode) and connectivity options (LC/MPO).

The second step is to consider the data centre layout. Here we are looking into the physical concerns like the space and distances involved. In a large hyperscale data centre with link lengths over 500m, singlemode fibre would be the smartest choice, whilst for smaller data centres multimode may be more economic due to lower cost of transceivers. Similarly, space available in racks and in cable runs will have an influence.

The third step is manageability. It's mainly a decision whether to connect each server and switch direct (with a single patch cord) or to use a structured cabling system. A structured cabling system with trunks and patch panels has many advantages over a direct link, especially where a high

density is needed.

With regard to pre-terminated cabling, this is more efficient and reliable in terms of optical performance compared with the higher risk of signal loss when using traditional field termination. What's more, as



data centres constantly have air conditioning systems running, field termination is not the most practical option, as the additional dust and dirt created will inevitably interfere with performance, and damage servers and switches. Pre-terminated cabling solutions don't have this issue.

Space is always at a premium in the data centre, especially as the need for higher density in racks and cabinets increases, so the handling benefits of pre-terminated cabling are most welcome. Of course, you'll need to make precise measurements and plan carefully, but the benefits outweigh the extra effort of a pre-terminated solution.

'As data centres constantly have air conditioning systems running, field termination is not the most practical option, as the additional dust and dirt created will inevitably interfere with performance, and damage servers and switches.'

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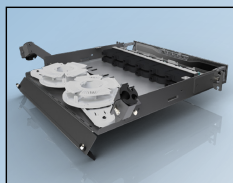
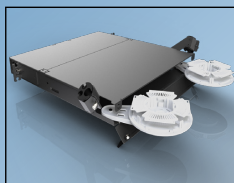
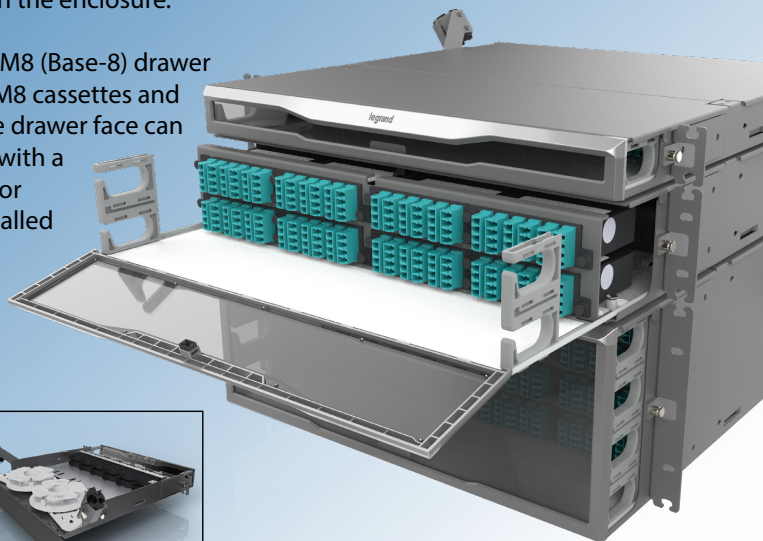


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ALAN BULLEN

MANAGING DIRECTOR AT LYNX NETWORKS

The critical factors are reliability, performance and lack of disruption during installation. Cost should not be much of a consideration because any short-term savings are likely to prove a false economy in the long-term.

Taking this into account, it's clear that pre-terminated cabling is likely to be the best choice. I say this even though Lynx Networks is an installer, not a manufacturer, and can make more profit by running cable off and terminating on-site. Although the risk of causing any downtime during cable installation can be reduced

to a minimum, the consequences can be catastrophic, so the less time cabling installers spend on site, the better. And, it's not practical to terminate high density multi-fibre push on (MPO) connectors on-site.

The biggest argument in favour of pre-terminated assemblies is that the highest quality can be achieved by building, labelling and testing in the factory. Speaking to my colleagues in the industry, it's clear that installers now do less work in data centres because most of the installations are with pre-terminated assemblies that take little time to install, and the work is often carried out by a facility's own engineers.

Returning to the question of the critical factors, you will want the installation to last as long as reasonably possible, so it will need

to support the speed of any equipment that could be installed in the foreseeable future.

So what fibre type should you choose?

You need to investigate all of the options

of fibre types and the speeds and distances you can achieve. For example, if the link length is no more than 150m you can use OM4 or OM5 multimode cable and save some cost on the active hardware when compared to singlemode. OM4 or OM5 will enable you, with the right equipment, to transmit at up to 100Gb/s using 10 pairs of fibre cores.

For longer distances in large data centres, it will be necessary to have singlemode fibre installed.

I'll finish by emphasising that a good cabling engineer is the best person to install pre-terminated cable assemblies.

'It's clear that installers now do less work in data centres because most of the installations are with pre-terminated assemblies that take little time to install, and the work is often carried out by a facility's own engineers.'



COLIN PARKER

MARKETING MANAGER AT EDP EUROPE

Critical selection criteria when deciding on the design of optical fibre cabling to use are relatively simple. They comprise the number of optical channels to support, optical glass type required to support applications, connector interface type, expected upgrade path, performance under fire conditions, etc.

However, what isn't quite so straightforward is how that cabling will be installed, as there are now many options including field termination, splicing, pre-connectorising ceramic, array connectors or a combination of two or more. This gives a designer an option for all occasions.

When comparing different installation methods though, the one common element is that the final testing regime is likely to be as stringent for field terminated as it is for pre-terminated optical fibre cabling, as the governing test standards do not differentiate between them. Optical splice loss, the only additional loss of the splice method over pre-termination, is now so small as to be mostly insignificant.

Another factor to take into account is the ability to accurately measure required length of cabling or, conversely, if there is space to store cable overlength. If neither is possible a mixed approach would make sense, as it is then possible to gain time by using a single ended pre-terminated assembly, which is then spliced at the far end to the ideal length, saving the time and cost associated with splicing at both ends.

Time and cost, killers of installer profitability, must also be considered. The cost of skilled labour varies enormously

across the world and whilst in some regions it may be economical to employ a high labour content – usually developing countries – in others the opposite is

the case. Purely pulling a raw cable in place versus pre-terminated costs are comparable, whereas plugging-in versus splicing are quite different.

An added safety factor in favour of pre-termination its use of factory processes in the termination, which adds consistency performance and suitable testing. This ensures full compliance prior to shipping and, providing the subsequent installation

is carried out in a suitable manner, performance should be unchanged.

The final aspect is that, irrespective of the method chosen, if the installation cable is required to comply to BS 6701, its reaction to fire should, as a minimum, meet Euroclass Cca-s1b,d2,a2 in accordance with BS EN 13501-6. This may be a limiting factor, as not all manufacturers have a comprehensive range of cables – pre-terminated or otherwise.

'The cost of skilled labour varies enormously across the world and whilst in some regions it may be economical to employ a high labour content – usually developing countries – in others the opposite is the case.'



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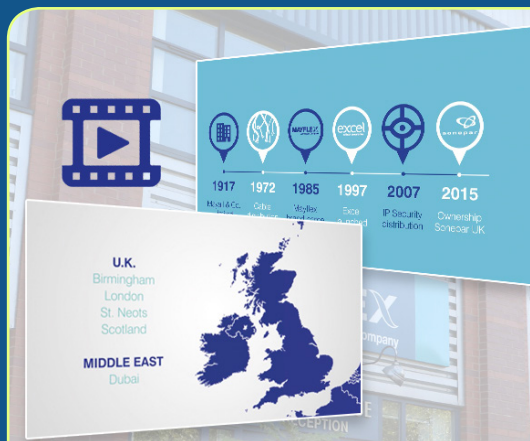
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Pieces of eight

Matthias Gerber of Reichle & De Massari (R&M) looks at the impact of Cat.8.1 on LAN design

▶ Anyone considering installing a LAN for long-term usage needs to take two important factors into account – the continuously increasing bandwidth requirement of the active components, and the possibility to power devices remotely via data cable using power over Ethernet (PoE).

SOLUTION PROVIDER

The new cabling standard for Cat.8.1 could be the solution for both challenges.

Current trends are putting pressure on the LAN and challenging planners and installers. 10GBASE-T, 25GBASE-T and 40GBASE-T are increasing data throughput in copper cables, but makes them more susceptible to internal and external electromagnetic influences. Installers have to work with the utmost precision, as there is no concealed headroom left in LAN cabling.

TECHNICAL BACKGROUND

Transmission performance in twisted pair copper cabling is increasing from 10Gb/s to 25Gb/s and 40Gb/s. Standardisation committees have agreed on a quantum leap in transmission frequency, which is increased from 500MHz to 2000MHz.

To handle the resulting increase in

attenuation, permanent links will need to be shorter. In the case of 40GBASE-T, this distance is limited to 24m. Recent research indicates that a distance of 50m may be feasible with 25GBASE-T. For 10GBASE-T the distance remains at the known 90m. Use cases and possible applications need take these shorter distances into consideration.

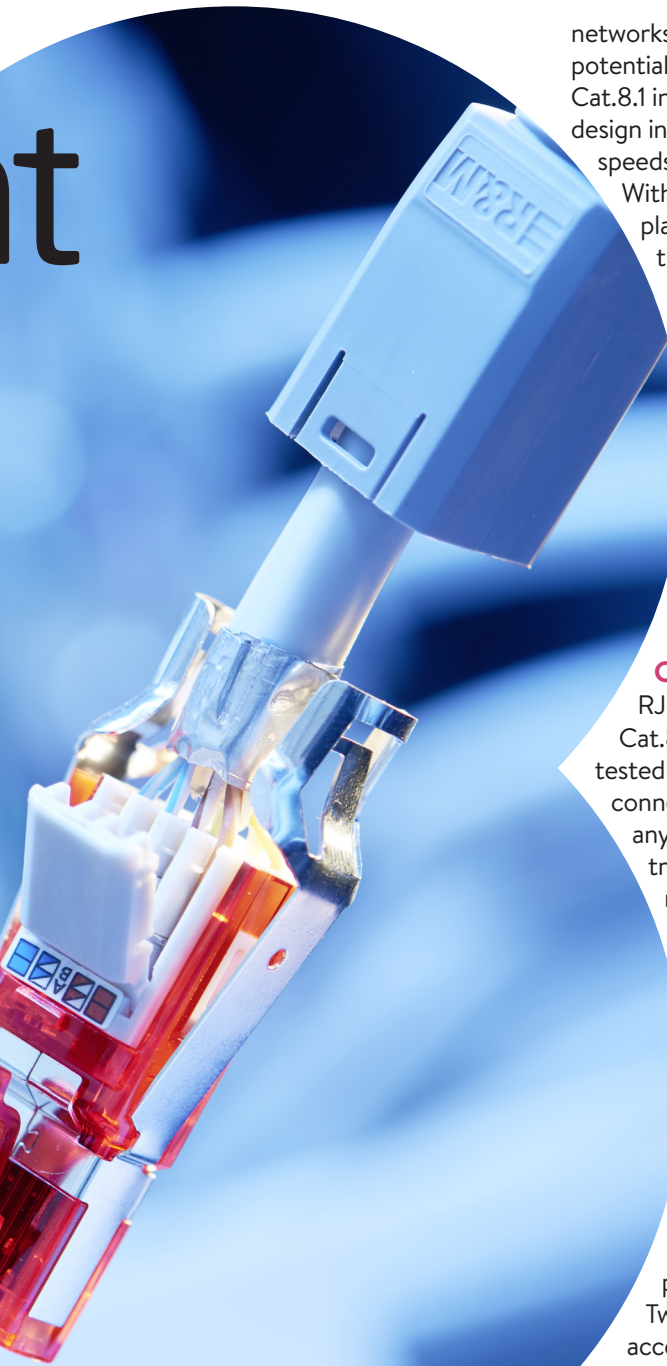
EXTENDED SCOPE

To date, 40GBASE-T was primarily intended for short distance applications in data centres. But an extended reach for 25GBASE-T could make it interesting for the LAN sector. Possible applications for 25Gb/s in structured office and building cabling are already becoming apparent.

For example, WLAN access points of coming generations will require bandwidths higher than 10Gb/s. 25GBASE-T with a 50m permanent link range could cover two-thirds of all typical LAN



t



networks. This makes Cat.8.1 systems potentially interesting for LAN usage, as a Cat.8.1 installation would result in a LAN design in which achievable transmission speeds are directly related to length.

With a well thought out utilisation planning, the most challenging transmission requirements can be met.

Since Cat.8.1 cabling usually uses AWG22 cables, heating issues with PoE applications are not a problem. In normal installation environments, the bigger copper diameter and shielded cable construction of Cat.8.1 will prevent problems resulting from overheating.

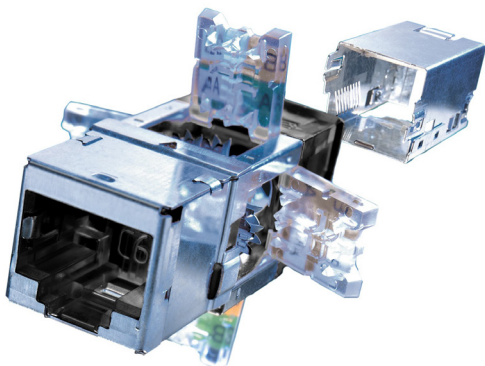
PRACTICAL CONSIDERATIONS

RJ-45 format connectors of Cat.8.1 systems offer a tried and tested solution. Alternative Cat.8.2 connector systems don't bring any advantages in the area of transmission speed and require relatively costly and cumbersome adaptor cables.

When evaluating products, planners should make sure that Cat.8.1 components are backward compatible. Therefore, if the user would like to keep using Cat.6A patch cords, at least 10GBASE-T transmission should be possible. However, this is not the case with some products currently on the market!

Two measurements for formal acceptance should take place after installation, one for Cat.8.1 and one for Cat.6A.

‘Since Cat.8.1 cabling usually uses AWG22 cables, heating issues with PoE applications are not a problem. In normal installation environments, the bigger copper diameter and shielded cable construction of Cat.8.1 will prevent problems resulting from overheating.’



MATTHIAS GERBER

Matthias Gerber, market manager LAN cabling with R&M, has worked in the cabling business in various positions within R&M for over 20 years. He has ample experience in the development and marketing of cabling systems and RJ-45 connectors. In addition, Gerber is a participating or past member of various standardisation bodies (IEC, ISO/IEC and TIA) as well as chairman of the Swiss National MirrorCommittee for TC48.

MARK OF QUALITY

Of course, no matter how well technical specifications are documented or how excellent the quality of the used materials is, a copper installation might still end in failure because a number of essentially simple procedures and considerations have been overlooked.

To make sure copper networks deliver on the promised performance, cabling suppliers, planners and installers have to work very closely together.

PLAN OF ACTION

Knowing the intended use and smart planning for future bandwidth requirements are crucial. This allows the planner to calculate requirements and give guidance for implementation lengths depending on environments. This is essential when making the most of the different length/speed options that are now possible with Cat.8.1 in the LAN environment. ■

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The CPR defines a clear process and requirements for proof of compliance to

a specific Euroclass. Excel has adopted a transparent approach to providing the market with relevant information, with a cable's Euroclass clearly available

on individual specification sheets as well as on its **declaration of performance** certificate. In addition to this, a series of **CPR related webinars**, a label stating a product's compliance and printing on the outer sheath of the cable demonstrates



Excel's commitment to meeting the requirements of the industry regulations.

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Nexans

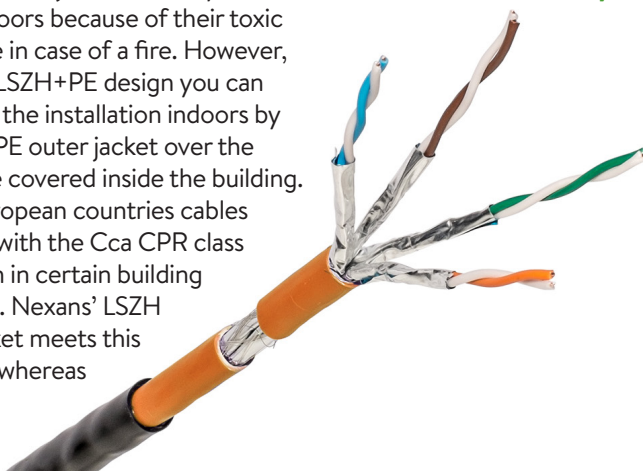
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In some European countries cables must comply with the Cca CPR class for installation in certain building environments. Nexans' LSZH Cca inner jacket meets this requirement, whereas the outer PE

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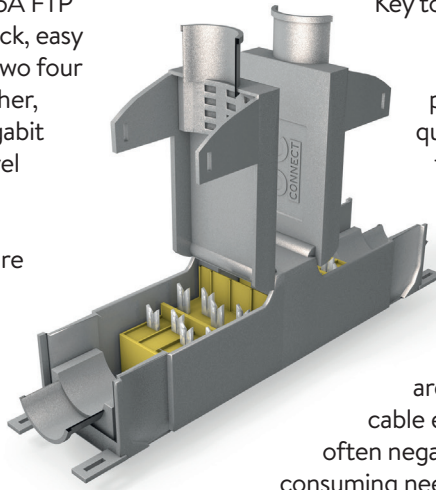
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and the cabling is fed and managed within the columns. Covers over the columns then conceal the cable to provide a more aesthetically pleasing appearance.

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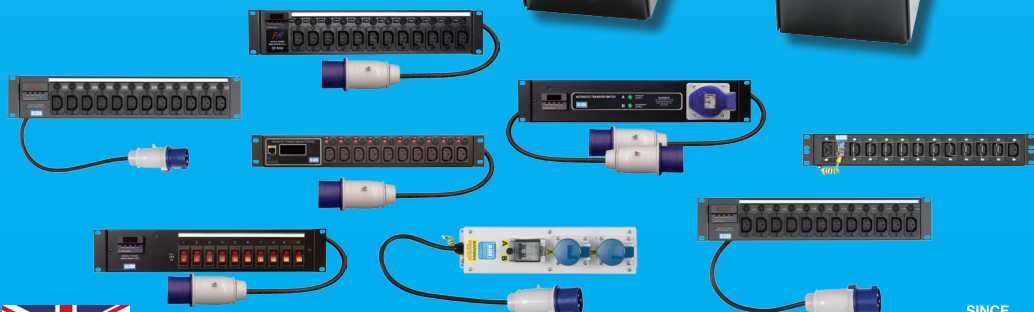
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What's the use?

Mark Dearing of Leviton Network Solutions explains why Category 7 and Category 7A no longer offer an advantage

 In 2016 and 2017 ANSI/TIA and ISO/IEC approved Category 8 cable and connectivity, with the ability to support IEEE 25GBASE-T and 40GBASE-T Ethernet. The introduction of Category 8 calls into question the usefulness of Category 7 and Category 7A cabling systems, as the benefits of Category 6A and now Category 8 have industry

professionals asking, 'where do Category 7 and Category 7A fit?'

HISTORY LESSON

Introduced in 2002, Category 7 cable and connectivity was established by ISO to offer a higher frequency and greater performance than Category 6, with the ability to transmit 10Gb/s. Similarly, Category 7A – introduced in 2010 – offers a higher frequency and greater performance margin than Category 6A, but it does not increase the bandwidth beyond 10Gb/s.

As Category 7 and Category 7A have never been widely adopted, and as Category 8 now extends the performance and bandwidth of category cable, it appears that Category 7 and

Component Performance Rating	Performance Rating	Max Data Rate	Max Distance
Cat 6A	Class E _A	10 Gb/s	100 m
Cat 7 (not recognised by TIA)	Class F	10 Gb/s	100 m
Cat 7A (not recognised by TIA)	Class F _A	10 Gb/s	100 m
Cat 8.1	Class I	40 Gb/s	30 m
Cat 8.2 (not recognised by TIA)	Class II	40 Gb/s	30 m

Category 7A will likely see even lower adoption moving forward.

SIX OF THE BEST

There are six key reasons why BASE-T solutions like Category 6A and Category 8 make more sense than Category 7 and Category 7A.

- Active equipment uses an RJ-45 connection interface. Both Category 6A and Cat 8.1 use RJ-45 jacks, whereas Category 7 and Category 7A have three different types of non-RJ connectors – TERA, ARJ and GG45. RJ-45 connections are constructed with pins aligned along the top, whereas the non-RJ options spread the pins to the four corners of the plug/jack. In turn, the non-RJ connections require a hybrid patch cord to connect to ports on servers and switches. There is no equipment today that uses connections supporting Category 7 or Category 7A channels.

GG45. RJ-45 connections are constructed with pins aligned along the top, whereas the non-RJ options spread the pins to the four corners of the plug/jack. In turn, the non-RJ connections require a hybrid patch cord to connect to ports on servers and switches. There is no equipment today that uses connections supporting Category 7 or Category 7A channels.

The ISO/IEC 11801-1 standard specifies both Cat 8.1 (Class I) and Cat 8.2 (Class II) options. While Cat 8.2 cable option is backwards compatible with Category 7 and Category 7A components, it still requires a similar hybrid solution to interface

with servers and switches, and will see very limited adoption. While Cat 8.2 is recognised by ISO/IEC standards, it is not recognised by ANSI/TIA.

- Category 8 is the only option for testing standards at data rates greater than 10Gb/s for cabling using RJ-45 jacks. And Category 7 and Category 7A testing is not compatible with RJ-45 connections – this

means that a Cat 8.1 RJ-45 jack cannot be installed on a Category 7A cable and then tested to the Class FA standard.

The reason for the compatibility issue is based on how the standards bodies established the limit line for the near end



crosstalk (NEXT) parameter. For Category 8 (Class I) the standards extended the NEXT limit for Category 6A (Class EA) from 500MHz to 2GHz. For Category 7 and Category 7A (Class F and FA), the limit line for NEXT was shifted up. For this reason, RJ-45 will not support the Class F and FA channels.

- If you are basing your cabling system choice on the highest frequency, Category 8 is by far the best option. Category 8 operates at 2000MHz – nearly double that of Category 7A (1000MHz), providing much better performance margins.

‘As Category 7 and Category 7A have never been widely adopted, and as Category 8 now extends the performance and bandwidth of category cable, it appears that Category 7 and Category 7A will likely see even lower adoption moving forward.’

- Category 8 components can be used as a substitute for Category 7A. If there is a specification to use Category 7A connectivity on a project, Category 8 will work in place of the specification.
- All four categories – Category 6A, Category 7, Category 7A, and Category 8 – are available in a ‘highly shielded’ construction. Some cabling system customers have been attracted to Category 7 and Category 7A for their S/FTP design (overall braid shield with foiled twisted pairs) with dual shielding protection against electromagnetic

Category 6A S/FTP cable runs from 5.8-7.5mm, where Category 7 and Category 7A will typically run close to 7.5mm and larger – Category 8 outer diameter can range from 8.0-9.9mm. This allows for more flexibility in network designs.

Also, unlike Category 7 and Category 7A, Category 6A cable is available in other shielded types including U/FTP (unshielded overall with foiled twisted pairs) or F/UTP (overall foil with unshielded twisted pairs), allowing for more flexibility based on network needs.

- Category 7 and Category 7A cabling have

no true IEEE application. Category 6A supports the IEEE 10GBASE-T applications, while Category 8 supports both 25GBASE-T and 40GBASE-T.

PERFORMANCE		
Category Rating	Frequency	Max Data Rate
Cat 6A	500 MHz	10 Gb/s
Cat 7	600 MHz	10 Gb/s
Cat 7A	1,000 MHz (1,200 MHz in some cases)	10 Gb/s
Cat 8	2,000 MHz	40 Gb/s

interference (EMI) and alien crosstalk (AXT). However, this shielding is also available with Category 8 and Category 6A. And with Category 6A, you can get the same shielded benefits as Category 7 or Category 7A, but with a smaller outside diameter. The outside diameter of

Again, the maximum data rate supported by Category 7 and Category 7A is 10Gb/s, just like Category 6A.

PERFORMANCE ART

In essence, for the highest performance available in a copper cabling system,

Category 8 is now your best choice. If you don't intend to build a migration path to 25GBASE-T or higher, the cost effective and flexible Category 6A option is the clear choice, leaving no place for Category 7 and Category 7A.

It should be noted that Category 8 is limited to 30m or less, shorter than previous category ratings of 100m. However, according to IEEE, links of 30m or less make up 80 per cent of data centre connections in the industry. If you require longer distances at bandwidth beyond 10Gb/s, optical fibre is the only option. And for distances longer than 30m at 10Gb/s or less, Category 6A has you covered.

FEATURE PRESENTATION

Twisted pair cabling with RJ-45 connectivity is recognised and adopted as the de facto infrastructure choice throughout commercial networks worldwide. It is the highest volume port type in servers today, with close to a billion ports of RJ-45 jacks sold every year. The features in RJ-45 that made it appealing in the past are still true today, giving network managers more flexibility throughout deployment and operation in terms of timing, disruption, and cost for upgrading their networks. ■



MARK DEARING

Mark Dearing is senior product manager for copper at Leviton Network Solutions and has been with the company since 2006. He manages a diverse portfolio of products including shielded systems, modular patch panels, cable management products, power solutions, and software managed intelligent solutions. He is certified as a BICSI Registered Communication Distribution Designer (RCDD), is a Certified Data Centre Designer (CDCD), and is an active participant in standards development with the Telecommunications Industry Association (TIA). Dearing is also a co-inventor of several patented products and design features.

R&M launches its Better Connected initiative

R&M has launched its Better Connected initiative, which focuses on the entire lifecycle of data networks.

‘It is all about taking more into account than just the material and installation costs, and the common standards when planning data networks. A top quality installation with higher initial costs is always the less expensive solution over the long-term,’ said Hermann Christen, market development manager at R&M.

R&M experts worldwide will be providing



consulting services to the markets as part of the initiative. At the same time new training programs are being offered by the R&M Academy, which awards places to interested planners, project leads, installers and distributors. Graduates become qualified R&M partners. They

receive exclusive certificates as well as comprehensive specialist, technical and logistical support in network projects.

Siemens and Aruba form strategic partnership for integrated networks

Siemens and Aruba, a Hewlett Packard Enterprise, have announced a strategic partnership focused on bridging the operational technology and information technology worlds. Based on the complementary portfolios, Siemens and Aruba are able to support customers with highly reliable, secure and insightful data networks, enabling high plant and network availability.

Customers benefit from integrated networks with proven interoperability from factory floors to corporate offices based on

Siemens' expertise as a leading provider of Industrial Ethernet network components and Aruba's as a leader in wired and wireless LAN infrastructure.

Klaus Helmrich, member of the management board at Siemens, said, ‘The cooperation between Siemens and Aruba is an important step to complement our industrial networks offering, which is one of the pillars of the digital enterprise, with the additional IT offering from Aruba.

Customers will benefit from future proof, integrated communication networks ensuring availability and security.’



Boston Networks acquires 2020 Vision Systems as it steps up growth plans

Boston Networks has completed the acquisition of 2020 Vision Systems, as it accelerates its ambitious plans for UK growth. The purchase is the latest step in an overall strategy to establish Boston Networks as the UK mid-market leader in network enabled smart integrated technologies to improve the performance safety and security of buildings, campuses and cities.

The management team at 2020 Vision Systems, which has grown over the last 25 years into a security provider of choice for public and private sector organisations in many sectors including education, health, local government, utilities and transportation,



will continue to manage the business, working closely with Boston Networks' CEO, Scott McEwan, and his executive management team.

McEwan said, 'We look forward to leveraging 2020 Vision Systems' many years of experience of working in key areas of critical physical security, which will help us to drive towards the next phase of our growth as we continue to focus on applying technology to improve the performance, safety and

security of people, buildings and assets. This acquisition further deepens our services in the further education sector, enhances our existing security offering through the cloud platform and significantly spreads our geographic coverage.'

CHANNEL UPDATE IN BRIEF

Leviton has opened a new sales office in London, at 72 Cannon Street. In addition to providing a workplace for more Leviton staff, the office includes a customer solution suite that showcases the latest Leviton network infrastructure products.

Kedington has become part of ExcelRedstone. Kedington is the largest IT network infrastructure solutions company in Ireland, operating from offices in Dublin, Cork, Limerick, Derry and Belfast, as well as Copenhagen.

France-IX and BICS have announced an extension of their partnership, as BICS joins the France-IX marketplace as a seller. BICS will offer a range of value added IP-centric services to France-IX peering members, including access to remote peering to other Internet Exchange Points (IXPs), carrier Ethernet, direct inward dialling (DID) cloud numbers, internetwork packet exchanges (IPX) transport and its SIM for Things global IoT connectivity solutions.

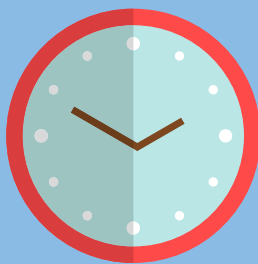
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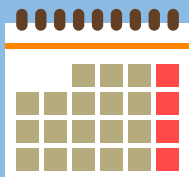
Your one click guide to the very best industry events, webinars, electronic literature, white papers, blogs and videos

The **Ivanti** Women in Tech Survey 2018 is available to download by **CLICKING HERE**.

From Niche to Mainstream: Can Direct Liquid Cooling Make the Jump? is the question posed in a blog from **Future-tech**. **CLICK HERE** to find out the answer.

According to a new white paper by **IDC**, sponsored by Seagate, titled The Digitization of the World – From Edge to Core, assesses data readiness of the four critical industries that encompass nearly half of the global enterprise datasphere – manufacturing, financial services, healthcare, and media and entertainment. **CLICK HERE** to obtain a copy.





The Future of Fibre Optics in the Data Centre Networks is a white paper by **Panduit**.

CLICK HERE to obtain a copy.

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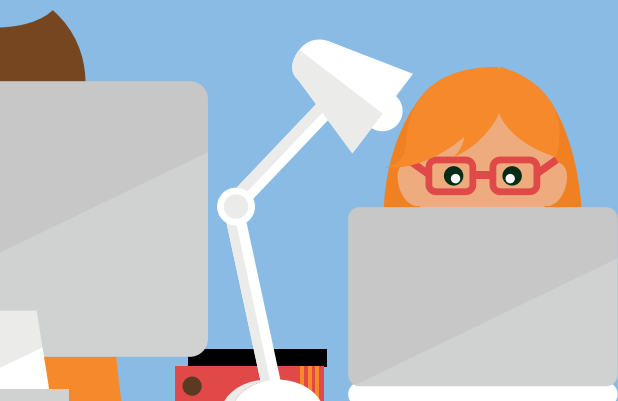
Lengthonomics and the Benefits of Reach is a blog from **Paige Datacom Solutions**.
CLICK HERE to read it.

The Rapid Evolution of Modern Data Centres is a blog from **Sudlows**.

CLICK HERE to read it.



Common Misconceptions About Fibre Cable is a blog from **Networks Centre**.
CLICK HERE to read it.



Onwards and upwards

Russell Poole of Equinix examines the role of the colocation data centre in the rise of global data

▶ Digitalisation of the modern world continues to accelerate, impacting every industry. Companies no longer have an option – they must become digital to stay competitive. Indeed, by 2022, IDC predicts that over 60 per cent of global gross domestic product will be driven by digitally enhanced offerings, operations, and relationships.

SUPPLY AND DEMAND

As enterprises navigate their way towards greater digitalisation, they seek solutions that avoid the instability generated by the growing complexity of integrating various digital services. New architectures anchored by interconnection smooth this complexity and, increasingly, enterprises are finding that they also yield improvements in security, performance and capacity.

Equinix recently published the second volume of its Global Interconnection Index, a market study that analyses traffic exchange globally. The GXI found that interconnection bandwidth is forecasted to grow by 2021 to 8200Tb/s of capacity, or the equivalent of 33ZB of data exchange per year. This is 10 times the projected capacity of internet traffic.

A FACTOR OF THREE

Interconnection bandwidth is defined as the total capacity provisioned to privately and directly exchange traffic with a diverse set of participants at distributed IT exchange points, allowing businesses to exchange away from the public internet. There are three main causes that are driving interconnection bandwidth's growth:

• The rise in digital technology

Digital business ecosystems require real time interactions between people, things, locations, clouds and data to increase value capture. To achieve this, many enterprises are turning to 'as a service' solutions across multiple cloud providers to seamlessly and quickly move workloads between clouds, platforms, partners, and providers across the globe.

• Urban expansion

Urbanisation is transforming global demographics and demand origins, creating a need for proximity between digital services and users. According to the United Nations, two-thirds of the global population will live in cities by 2050. Supporting this urban density requires

the interconnection of applications, data, content and networking in locations where there is a concentration of users.

- **Security considerations**

It is clear that today's cybersecurity threats are rapidly expanding and the public internet often offers no refuge from the dangers presented. Firms are increasingly looking to shift to private data traffic exchange, bypassing the public internet to address digital threats and changing data protection laws. Increased vulnerability

points with data distributed across multiple sources and consumers heightens the risk of a breach. Managing this risk involves distributing security controls across locations and privately interconnecting them at business points of presence.

The GXI also forecasts interconnection bandwidth growth by counterparty categories, estimating the interconnection behaviour of each. Surpassing all other categories, interconnection between enterprises and cloud IT providers is projected to grow 98 per cent per annum



through 2021, supporting businesses building out new digital services and migrating existing workloads to third party cloud platforms.

THE GROWTH IN GLOBAL DATA

The lightning quick pace of disruption is being felt across every industry sector. We have witnessed entire industries transformed in the space of a few short years by rapidly evolving, data-led technologies. Some have embraced this change as an opportunity to continuously improve, but others have been slow to respond and we have seen high profile players faltering or failing altogether because of their inability to adapt.

With the market at an inflection point, where the right digital strategies become the differentiator and source of competitive advantages for organisations, the trends driving interconnection demand are set to endure. Evolving technology and data trends such as 5G, artificial intelligence, blockchain, data privacy and cloud will increase data usage exponentially, paving the way for significant IT and network architecture changes in 2019.

‘The demand for interconnection bandwidth reflects fundamental changes in the way in which business is being done in the digital age, and the ability to directly and securely interconnect companies is the way forward for all businesses hoping to compete and survive in the digital economy.’

ROLE PLAY

At the heart of this digital transformation is the colocation centre. For the first time in history, the technology to fully enable digital business is available to everyone. The demand for interconnection bandwidth reflects fundamental changes in the way in which business is being done in the digital age. The ability to directly and securely interconnect companies is the way forward for all businesses

hoping to compete and survive in the digital economy.

A major architectural shift of migrating enterprise IT to third party data centres is expected to drive the data colocation market, as it provides multiple opportunities for colocation providers. With interconnection becoming paramount for the success, growth, and security businesses in the digital age, the data centre sector is responding to the surplus of demand.





COME TOGETHER

According to the GXI interconnection, or direct and private traffic exchange between key business partners, is becoming the de facto method for companies to operate in today's digital world, leaving internet traffic lagging far behind.

With cloud becoming increasingly critical to digital business success and interconnection critical to cloud success, an interconnected cloud brings enterprises and providers together to directly and securely interconnect across many locations in a variety of ways, opening the

door to greater business agility, intelligence and innovation.

REAPING THE BENEFITS

The ability to adapt to digital disruption will be vital to the long-term success of companies. Enterprises that can scale their IT infrastructure appropriately and quickly will find themselves ahead of their competitors and ready for whatever the future holds. And in the end, it will be them who undoubtedly reap the benefits. ■

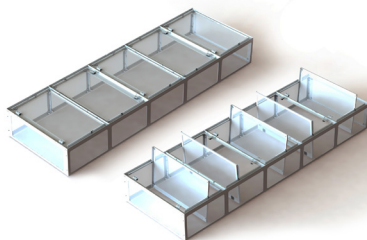


RUSSELL POOLE

Russell Poole is managing director UK at Equinix.

Siemon

Siemon has launched an active cold aisle containment solution, featuring roof panels that open automatically during an alarm event to facilitate access to sprinkler systems and other fire suppression systems.



As an expansion to Siemon's WheelHouse advanced data centre portfolio, this new containment solution improves efficiency and expands the capacity of a data centre without the need for supplemental cooling, while leveraging existing fire suppression systems.

Active aisle containment panels form a

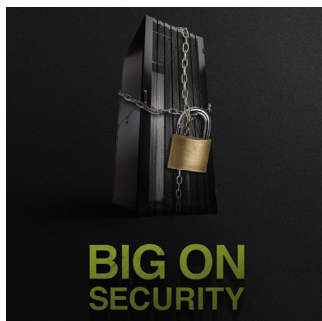
horizontal roof across the cold aisle and, when used in conjunction with self-closing or manual doors that close off the end of the aisle, the cold air is contained in the aisle to provide targeted cooling to active equipment. Electromagnets hold the active roof panels in place during normal operation and, in the event of an alarm, release the panels allowing them to swing open.

The active cold aisle containment solution is compatible with all Siemon data centre cabinets deployed in a pod configuration.

To find out more **CLICK HERE.**
www.siemon.com/wheelhouse

Mayflex

Mayflex offers a set of strategically aligned enterprise products from leading vendors that creates a perfect offering for companies installing in the colocation data centre market.



Three key current offerings that have excellent synergy are the Environ server range of racks, digital networkable locks and intelligent power distribution units (PDUs) that, when used together, create a highly compelling solution.

Colocation facilities rent the services they offer to customers and charge for those services. The intelligent PDUs offered by Excel Networking Solutions

can be configured as a set of virtual PDUs. They allow for power usage to be managed down to the socket level for each customer or IT device within a shared rack, whilst offering Class II quality – this offers the facility the tools to monitor power usage at billing quality. The PDU can be configured to a set of and agreed cost parameters, helping to make the process of creating bill information easy and straightforward.

These PDUs can also drive the digital networkable locks, allowing for remotely and centrally managed access into each individual rack through the network controlled by the network operations centre.

CLICK HERE to find out more.
www.mayflex.com

EDP Europe

Maintaining visibility and control of activity in racks housed in third party colocation data centres can be challenging, with many operators simply offering key or combination lock management.

EDP Europe offers a better solution through its iAccess modular cabinet door access control system, which can be easily installed into new or existing cabinets to provide access control of front and rear doors, and even side panels.

iAccess can be used as a standalone system or can be linked into BMS, DCIM, NMS and other systems, facilitating centralised management of multiple



cabinets across multiple sites. iAccess provides full visibility and an audit trail of access to cabinets, with notification of activity, door lock status and door access being provided via email or SNMP.

Doors are accessed via built-in card or separate readers and can be remotely triggered

through SNMP or via the on-board web interface. iAccess can also provide temperature/humidity monitoring and, if required, CCTV cameras can be attached.

CLICK HERE to find out more, call our sales team on 01376 501337 or **CLICK HERE** to send an email.
www.edpeurope.com

NGD

At 750,000ft² NGD is Europe's largest data centre. An out of town location, abundant power and dense high speed connectivity make NGD a compelling future proof solution for customers of all sizes – from global organisations to growing small to medium sized enterprises (SMEs).

This world class energy efficient Tier 3+ facility caters for requirements from a few racks to hundreds of racks, all in highly secure and resilient environments. It also hosts very demanding high density cloud or high performance computing environments.

NGD's commitment to compliance,



design innovation, exacting build and plant specification, and the provision of experienced engineering personnel are testimony to the facility's 100 per cent uptime record since operations commenced almost 10 years ago.

Services include server migration and installation, remote hands, 24/7 engineering support and availability of high quality meeting facilities. Furthermore, NGD's rapid build programme enables the cost effective delivery of bespoke data halls within an industry leading 16-week timescale.

To find out more **CLICK HERE**.
www.ngd.co.uk

At the cutting edge

Jonathan Arnold of Volta Data Centres explains the driving forces behind the current explosion of interest in the edge

▶ The move to edge data centres – optimising data transfer by physically moving services closer to the end user – is changing business as we know it. The edge computing market will grow from £1.1bn in 2017 to £5bn by 2022 according to a MarketsandMarkets report – a compound annual growth rate (CAGR) of 35.4 per cent. But why now?

CALL FOR INTEREST

There are two main reasons behind the move towards the edge – the need to ensure that content delivery networks (CDN) meet rising consumer expectations, and the Internet of Things (IoT) with millions of distributed sensors that all receive, generate and share data that needs to be processed and actioned.

As content delivery speeds and quality

of service have risen over the years, so have expectations. One in four customers will simply abandon a web page if it takes more than four seconds to load, according

‘While 57 per cent of IT decision makers cite faster delivery as a reason for edge adoption – which would be expected in line with the IoT and content delivery networks models – the top reason for edge adoption is, in fact, security (68 per cent).’

to a GlobalDots white paper. In an increasingly competitive, digital world, if your organisation is not investing in some kind of an edge infrastructure to optimise content location and bring large files/content closer to the end user, the chances are that one of your competitors will be.

There are several advantages to optimising content location, such as faster and more reliable delivery, a higher quality of service, and a more balanced network load, as there is less traffic going into and out from one main data centre. The scattered infrastructure inherent in a content delivery network, leveraging regional and





edge resources, is also more secure when it comes to dealing with distributed denial of service (DDoS) and other cyber-attacks, as more distributed resources are less likely to become saturated by an attack.

THE SWEET SPOT

If the argument for the edge being crucial to content delivery networks is a powerful one, it's fair to say that, without the edge, the IoT simply doesn't work. The billions of remote sensors that make up the IoT, attached to all manner of products, assets and buildings, will be generating data in real time.

Take autonomous vehicles (AVs) as an example. Some of this generated data will require a real time, localised response, such as reporting accident information to a nearby data centre, while some of it will need to be analysed at a more regional level, such as sharing data with thousands of other AVs to create a near real time traffic map across an entire city. Some data will also be needed at a centralised level, allowing more long-term, strategic decisions to be taken, such as when to do maintenance work or raise the road tariff during rush hour.

For IoT, localised data logistics – creating,



processing, moving and storing of data – is perhaps the major sweet spot for the edge. However, there is clearly going to be a significant amount of data traffic from the edge to more centralised locations and vice-versa.

As with content delivery networks, the data centre and IT infrastructure required to provision an end-to-end IoT solution is unlikely to be available in its entirety, either in-house or in one location. An IoT solution is almost certainly going to feature a mix of in-house, colocation and managed services resources, and at the local, regional and national or international level.

CONTRIBUTING FACTOR

One of the biggest contributors to the evolution of data centre strategies for businesses is the growth of edge computing and being able to handle computing applications, data, and services away from centralised nodes to the logical

extremes of a network. Fuelled initially by the need to support the mass of data created by IoT devices, the importance of ensuring that content delivery networks provide users with the expected quality of service is now contributing to a forecast edge computing market value of \$19.4bn by the end of 2023.

A recent Volta market research report revealed that edge is already well established in the data centre market – especially with larger companies. While 45 per cent of firms overall are already using edge data centres, this rises to 68 per cent of 100-199 sized companies, 59 per cent of 200-499 and 57 per cent of 500+.

However, it also reveals increasing polarisation between the IT infrastructure strategies adopted by small and large companies – while 60 per cent of companies with more than 100 employees are already using edge computing, over a third (38 per cent) of IT decision makers



in companies sized 1-19 people have never even heard the term. Indeed, of those that do not currently deploy an edge data centre, just a quarter (25 per cent) believe they are likely to do so over the next five years.

TECHNOLOGY GAP

The findings suggest that the technology gap between large and small companies is growing. As hybrid models continue to dominate the majority of data centre strategies, the divergence in sophistication between small and large companies suggests the need for a better understanding of an increasingly diverse IT infrastructure marketplace.

It is also interesting to note that while 57 per cent of IT decision makers cite faster delivery as a reason for edge adoption – which would be expected in line with the IoT and content delivery networks models – the top reason for edge adoption is, in fact, security (68 per cent). Security will always remain a top business priority for organisations – but if businesses are to implement a hybrid infrastructure that effectively supports those priorities, a far more rigorous approach to due diligence is required and that includes a guarantee of 100 per cent uptime.

With 69 per cent of IT decision makers not currently using hybrid solutions, and 25 per cent looking to deploy edge data centres in the next five years, there's still much work to be done on the infrastructure front.

EMBRACE THE EDGE

Today's digital consumer has high

expectations. Whatever the industry sector, businesses wishing to meet or even exceed the demands of their customers need to ensure that they have the necessary data centre and IT infrastructure in place to optimise content delivery networks and IoT devices. The edge joins virtualisation, cloud and big data as an essential element of the required dynamic, resilient, fast, intelligent and automated solution for the digital age. ■



JONATHAN ARNOLD

Jonathan Arnold is managing director at Volta Data Centres. He has been in IT and business communications solutions since 1996. Throughout the years, he primarily focused on sales and account management, gaining experience in companies such as Siemens, WorldCom, Sirocom, Azzurri Communications and Daisy Group, signing multimillion pound deals and delivering business growth.

Nexans and Emtelle join forces to supply optical fibre solutions for Swedish government rail projects

Nexans has been awarded a €65m contract by Trafikverket, the Swedish government's transport administration, for the supply of optical fibre solutions. The Nexans cabling solutions, allied with Emtelle's microducts and microduct bundles, will be used in rail projects as the Swedish government continues to develop FTTX networks throughout the country.

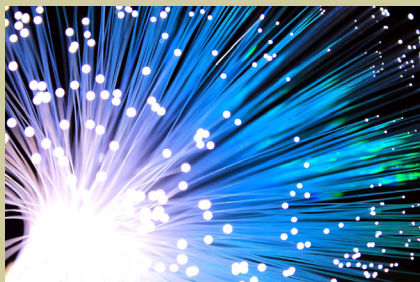
Today's rail infrastructures rely on high speed and scalable communication networks. As part of the European Rail Traffic Management System (ERTMS), these networks carry data between remote locations and control centres, making it

possible to monitor and optimise traffic, while improving user safety. Furthermore, the highway and rail telecommunication network in Sweden serves as a foundation of

trunk capacity that provides additional data transmission capacity for local telecom operators.

Nexans and Emtelle will supply Trafikverket with a complete fibre optic solution, fully compatible with

existing rail networks, which also meets the customer's strict requirements for the exceptional blowing performance of fibre cables into the microducts.



IP House uses Schneider Electric EcoStruxure architecture at its newest colocation data centre

Schneider Electric and its UK Elite Partner, Comtec Power, have installed the former's EcoStruxure architecture at IP House's newest colocation data centre in the City of London.

Located close to the financial sector, IP House provides high performance colocation data centre services to customers for whom uptime, availability and service excellence are essential. It has designed and built the communications,

power and cooling infrastructure at its

London facility to provide a competitive and customer focused colocation service.

The data centre contains industry leading infrastructure solutions including Schneider Electric's Symmetra UPS, deployed in an N+1 configuration, with 4x500kVA to deliver rapidly scalable and resilient power

options. In addition, IP House selected Schneider Electric's EcoStruxure IT platform for 24/7 advanced monitoring, management and data driven insights.



EvoBits IT helps ensure energy efficient crypto-mining

Critics say crypto-mining is a hugely wasteful activity and with thousands of transactions across a single chain, that eats up energy. The crypto-currency industry is using up more energy than the entire state of Ecuador, according to a recent article in the New Scientist.

In order to use data centre resources in the best way possible, the biggest energy obstacle is

keeping equipment cool. EvoBits, a start-up crypto-mining company in eastern Europe, has built an IT facility that focuses on

indirect evaporative cooling. It's a relatively new concept but reduces costs in energy intensive environments where equipment is working at full capacity and constantly under stress.

Evaporative cooling works on the principle that when the water evaporates it absorbs heat. Wetting an air/air heat exchanger in order to cool the external air then has a cooling effect on the data centre air.



The data centre operates with external temperatures of 35°C and high humidity, yet has achieved a PUE of 1.15.

PROJECTS & CONTRACTS IN BRIEF

Migsolv is now an approved supplier of the UK government's G-Cloud 10 framework.

Kao Data is working with euNetworks to enable the delivery of high density fibre and duct to its Harlow based data centre campus. The new infrastructure provides unique routing opportunities, taking advantage of Harlow's strategic location between core hyperscale campuses in Dublin and Amsterdam. It also offers fast connection to Slough, to the west of London, and Docklands in the east of London.

Next Generation Data's (NGD) hyperscale data centre is now connected to the Global Cloud Xchange (GCX) network, a privately owned next generation network carrying around a fifth of global Internet traffic with extensive reach throughout Asia and the Middle East.

Mellanox Technologies has had its RDMA over Ethernet (RoCE) 25Gb/s ConnectX network adapters successfully deployed in Alibaba Infrastructure Services' production network.

Speaking up

As chief executive officer (CEO) and founder of the Data Centre Alliance (DCA), **Steve Hone** plays a vital role in supporting its members and promoting the sector. Rob Shepherd recently caught up with him to find out more about his life and career, and his views on the direction the sector is heading in

RS: How and why did you decide to embark on a career in the data centre industry?

SH: With a background in electrical/mechanical engineering in the Ministry of Defence (MOD), and having spent many years in technical sales, I was first introduced to the mystical world of the data centre whilst working for a subsidiary of EDS in 2005. At the time

‘No, not enough is being done to encourage women into our sector, however, I feel this needs to form part of a much larger issue, which is whether enough being done to encourage anyone to join the data centre sector full stop.’

outsourcing of IT was not commonplace for most businesses, however, with an ever increasing number of bids requiring collaboration with third party hosting providers, we set about researching the market and creating a growing partnership programme with the data centre provider



community.

A colleague and I decided to break away and start up on our own search and selection consultancy called Colofinder. Colofinder acted as a sort of ‘dating agency’ – matching clients hosting requirements with best fit providers to meet their business needs on a global basis. Colofinder quickly built a strong trusted reputation of always being independent and neutral – as a result of this, we were

approached in 2009 to set up a trade association to represent the interests of the entire data centre sector. This led to the formation of the DCA in 2010.

RS: What challenges are facing the sector globally at present and how can they be addressed?

SH: The data centre sector has several challenges, which all stem from an unprecedented growth in the use of digital services both by business and individuals. The amount of data business generates alone is doubling every year and, as private citizens, it's estimated that 1.7Mb of data will be created every second for every person on earth by 2020.

From a processing and storage perspective this mindboggling growth is clearly good news for the data centre sector. It also creates some serious challenges for data centre owners, operators and suppliers, as we attempt to keep pace with demand, issues such as energy supply, increased power density demands, security concerns both physical and down the wire, business agility, service availability and skills shortages. These all represent serious challenges we need to address.

These challenges, many of which are interrelated can only be solved by the sector working together. Collaboration is key and, as with other industries going through the same growing pains, it was the formation of a trade association that provided both the catalyst and glue to make this happen.

RS: What differentiates a good data centre from a not so good one?

SH: I really don't want to get bogged down with Tiers, uptime, N+N or Power

Usage Effectiveness (PUE) to answer this question. However, I would say that as long as it meets your business requirements there is no such thing as a bad data centre, as every single business will have slightly different needs and priorities. So, my definition of a good data centre is one that meets the required needs of the business, runs in the most energy effective way possible and, if it does, claim some form or accreditation that it can back this up with.

RS: Do you think trade associations have an important role to play and how effective are they?

SH: Naturally, as the CEO of a trade association I would have to say yes to this question – if they back up words with actions.

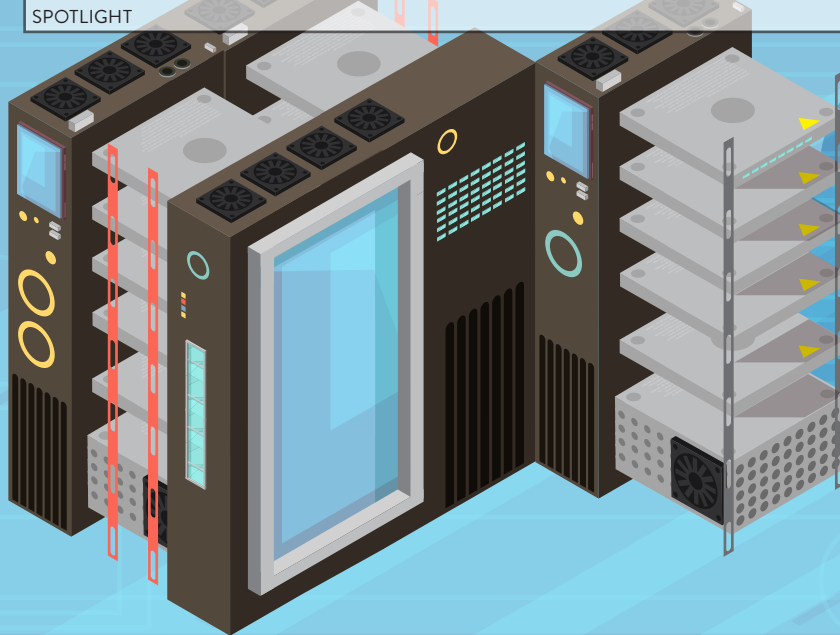
If you are already a member of the DCA, for example, you have probably already realised that there is so much more to it than you had originally believed, however, it is important to get the most out of your trade association and to unlock all the benefits on offer.

As a private data centre owner, being a member of the DCA provides access to a wealth of peer reviewed content, support services and vendor neutral advice and guidance. For suppliers, the trade association represents a trusted environment for both collaboration and networking, offering an independent platform from which members can educate the market and stay informed of the latest developments and policy changes affecting the sector.

RS: What is the most common question you're asked by DCA members?

SH: The question we hear the most from our members is 'how do we get more involved?'

The DCA is always delighted to hear this question. Members vary, we have a



number of passive members and then we have those that are very active – these members contribute articles for our publications, news stories, product updates, white papers, press releases and keep their member profiles updated. They might chair or participate in special interest groups (SIGs), speak at industry events, take part in panel discussions or deliver keynotes at major events throughout the year. In summary, the members who are the most active are the ones that get the most from their trade association.

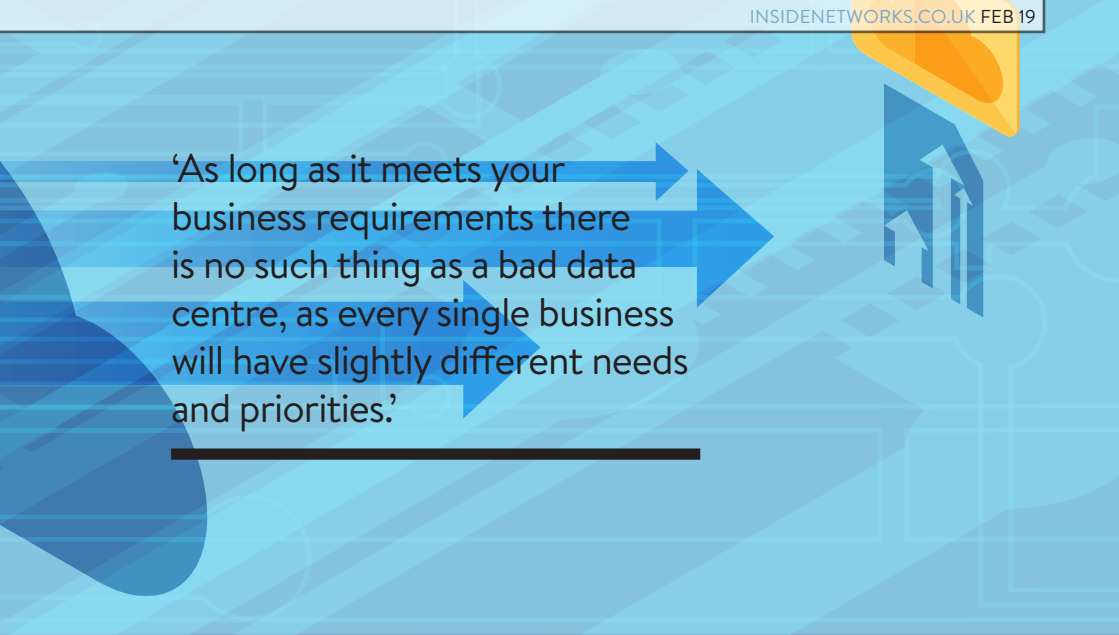
RS: Is enough being done to encourage more women to join the data centre sector?

SH: No, not enough is being done to encourage women into our sector, however, I feel this needs to form part of a much larger issue, which is whether enough being done to encourage anyone to join the data centre sector full stop. The answer to this is also, sadly, no. With the massive explosion in the use of digital services both in business and

in our own daily lives we need to get far better at promoting our sector as a career destination of choice, irrespective of gender, otherwise we won't be able to service this demand.

Current focus does seem to be on training those already in the sector and attracting graduates in, even though not every role in a data centre requires you to have a degree. As a sector with very broad needs we also need to be doing a lot more to attract, increase and provide awareness in schools and colleges, so we can fill all the skill sets required.

With this in mind, the DCA has recently collaborated with STEM Learning. The plan is to encourage DCA members to volunteer to become data centre STEM ambassadors. As a result of various workshops with our members it is clear they are equally keen to mobilise and talk to their local school and colleges to spread the word about data centres. So I think progress is being made on this front – although, even if successful, it will still take 10 years for this to filter through and we



‘As long as it meets your business requirements there is no such thing as a bad data centre, as every single business will have slightly different needs and priorities.’

are already playing catch up.

To summarise – yes, we do need more women in the industry and a better balance with respect to gender diversification in the workforce, however, we equally all need to play our part in promoting the data centre sector more effectively as a choice of career across the board.

RS: What is your greatest business related achievement?

SH: Certainly, one of my greatest business related achievements is to have built the DCA from scratch into an organisation which is trusted, valued and respected within the sector.

This is an ongoing task and was not achieved alone, so thanks and credit need to go to everyone who supports the DCA be that as members or volunteers. For me, it has been a privilege to play a role in the creation of a truly independent and effective trade association that continues to deliver support and value to the entire data centre community.

RS: If you could change one thing about the industry that you work in,

what would it be?

SH: Over the years I have noticed an increasing tendency by procurers to focus on the cost of something rather than the value it delivers. Be it a matter of time, risk or simply going for the easy option, we are all guilty of it from time to time. After all, how many of us have chosen a hotel based on cost only to have to spend more on taxis rather than opting for the more expensive hotel right around the corner from the right location. The same goes for many business decisions.

So, I could change one thing it would be the mindset of customers, so they focus on the value of why something is important rather than just monetary cost.

RS: What's the most useful piece of advice you've been given and how has it helped you during your career?

Recognise you can't be good at everything and don't be too proud to ask or to accept help. How has this advice helped during your career? Quite simply, I would not have succeeded without taking it. ■

R&M

The R&MinteliPhy automation system for data centres is now reaching the ports of active devices such as servers and switches. This brings end-to-end management of the cabling in the LAN, as well as in the area of fibre optic or data centre interconnect infrastructures.

New active port cables are extending the monitoring range of automated infrastructure management (AIM) with fibre optic connections that lead directly from the patch panel to the port of an active device.



The active port cable system consists of two elements – port markers and cables.

Port markers fixed on the ports of the active devices contain RFID tags that identify every port uniquely worldwide. Special cables read out the RFID tags and transmit the status information to the R&MinteliPhy Analyzer in the network cabinet.

This means the connection between the patch panel and the active device can be monitored without interruption.

To find out more [CLICK HERE](https://rdm.com).
rdm.com

Rittal

Rittal has five key predictions for the data centre sector:

- **Trend 1: Data Centres will acquire greater AI-based monitoring capabilities**

IT data centre specialists will require assistance systems featuring artificial intelligence (AI), or they will soon find it impossible to operate large and complex IT systems in a fail-safe way.

- **Trend 2: Processing the flood of data in real time with edge computing**

5G will increase the amount of data that network operators and other companies have to process. Decentralising IT infrastructure through edge data centres means data can be processed at source, leading to low latency and enabling real time applications for the control of industrial robots or autonomous vehicle systems.

- **Trend 3: The cloud market will benefit from hyperscale data centres**

IT managers should consider how to balance their on-site edge (or core) data centre and cloud resources, to optimally

support application hosting and high availability in line with their corporate strategy.

- **Trend 4: Optimised technologies will increase energy efficiency**

Optimising the energy usage of an entire data centre should be the number one priority in the coming year. Hybrid cooling units that integrate free cooling with refrigerant based cooling are one example of new approaches to cost optimisation.

- **Trend 5: Nordic countries' locations will help to cut costs**

Countries such as Denmark, Finland, Iceland, Norway and Sweden offer renewable energy sources, a climate favourable to data centres, very good internet connections and a high level of political and economic stability. One example is Norway's Lefdal Mine Datacenter (LMD), with whom Rittal is a strategic and technological partner.

For further information [CLICK HERE](https://www.rittal.co.uk).
www.rittal.co.uk

Ideal Networks

LanTEK III data cable certifiers from Ideal Networks now feature a Partner Finder feature to save time, reduce guesswork and simplify cable installation and troubleshooting.

The LanTEK III certifier will now emit an audible alert to let users know when both the display and the remote handset are connected to the same port, such as when one technician is based in a server or switch room and the other is at the outlet. The installer with the display handset can then simply press the 'test' button to test the copper or

fibre cable.

With Partner Finder, communication between technicians is improved, as there is no longer a need to contact one another by phone, or to shout across the site, to verify that both handsets are connected to the same port. This also reduces guesswork and also enables installers to move around the building to conduct tests more simply, increasing productivity.

To find out more or purchase the latest LanTEK III cable certifier [CLICK HERE](#). Those that purchase a new LanTEK III before 31st January 2019 will receive a SignalTEK NT network

transmission tester worth £1,615.

www.idealnetworks.net



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2019 CHARITY GOLF DAY 22ND MAY

An opportunity to compete and entertain clients and colleagues at the superb Marriott Hanbury Manor Hotel & Country Club.

www.marriottgolf.co.uk/club/hanbury-manor

Indoor Simulator Competition

The cost of a 4-ball team will be £575 (+VAT).

There will also be discounted accommodation at Hanbury Manor Hotel & Country Club, which will include breakfast and use of the extensive leisure facilities. Price to be confirmed.

As in previous years – teams will be asked to provide a raffle/auction prize on the day in support of the charity.

Organised by:

Promoted & Supported by:



Playing the Hanbury Manor PGA Championship Course:

This prestigious golf course was the first to be designed by Jack Nicklaus II and still incorporates features from an earlier 9-hole course designed by the great Harry Vardon. The course is now widely recognised as one of the best in England.

The event will ask for 4-ball teams to compete in a 'best 2 from 4' full handicap Stableford competition over 18 holes (with a 2-tee start from 10:30am).

Live Scoring sponsorship available.

Golf will be preceded by tea, coffee and bacon rolls at registration and will be followed by a 3-course private dinner and prize giving with charity raffle.

There will also be opportunities for sponsorship of all aspects of the day – all raising money for Macmillan Cancer Support – since 2005 this industry event has raised over £65,000 through our charity golf events!

Supporting:

**WE ARE
MACMILLAN.
CANCER SUPPORT**

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Let the games begin



Jackson Lee of Colt Data Centre Services examines whether the Tokyo 2020 Olympic and Paralympic Games could be the catalyst for cloud adoption in Japan

▶ Playing host to the Olympic Games is a privilege and an incredible burden of responsibility in equal measures. On the plus side it increases valuable tourism, which can help boost local economy. It also increases the host country's global trade and stature and creates a sense of national pride.

HOST WITH THE MOST

Tokyo is in the process of preparing for the 2020 Olympic and Paralympic Games and it is facing a multitude of new challenges since the country last played host in 1964. The biggest change is the reliance on digital technologies, data driven communications and cloud dependency to ensure the Olympic Games experience lives up to expectations.

We are likely to see more on-demand video streaming footage, more online

searches for news, information and location mapping, to name a few. All of these require a stable internet connection and fast data transfer that is reliable and able to put up with huge demand. There is certainly an appetite for digital services amongst consumers, but demand for cloud services is also on the rise for enterprise and financial services.

As more consumer and business services migrate to the cloud, demands for data centre capacity and reliable internet exchanges are only set to grow. However, for a country like Japan that is traditionally self-sufficient, turning to external solutions is increasingly becoming an attractive approach.

ON THE RISE

A new wave of digital innovation is reshaping Asia and Japan is at the heart of

it all. Digital farming, e-commerce, fintech and mobile payment have seen rapid adoption in recent years, thanks to advancement in artificial intelligence, robotics and cryptography – all of which rely on data.

Big data enables companies to innovate more creatively and at a much faster pace. In turn, organisations are creating high volume of data traffic on a minute by minute basis. More data means greater insights, new revelations and even more exciting innovations. It's a circular process that is driving new ideas and creations every day.

The type of data services required is changing because of this. The data traffic is less static than a traditional infrastructure and the conventional cloud model is no longer fit for purpose. Instead, organisations are turning to edge and hyperscale computing to achieve ultra-low latency. These agile data services are also highly scalable for any sudden peaks in demand.

REACHING ITS PEAK

If you look back over the last 20 years, the Japanese economy is mostly flat or declining because of its aged population. However, we have seen an uplift in recent years as local businesses invest in digital technologies to compete with global players traditionally headquartered in the US and Europe.

International companies are piling more investment in the country to attract local talents who seem to be naturally adept at digital innovations. Cloud companies are also investing in key cities. But with more global businesses and cloud service providers expanding into Japan, it presents

'A new wave of digital innovation is reshaping and Japan is at the heart of it all. Digital farming, e-commerce, fintech and mobile payment have seen rapid adoption in recent years, thanks to advancement in artificial intelligence, robotics and cryptography – all of which rely on data.'

a supply versus demand challenge.

Data centres in Japan are mostly older infrastructures that have been well-maintained but lack significant upgrades. They are designed to serve small, local customers, and not built to scale for the larger global cloud service providers like AWS, Alibaba, Google and Baidu, to name a few.

THE BIG CLOUD BOOST

Before we rush into building bigger data centres, it's important we understand the cloud consumption landscape and how customers are expected to use it. In other words, knowing what kind of traffic will be computed in the cloud will help us understand what level of data centres services are fit for purpose.

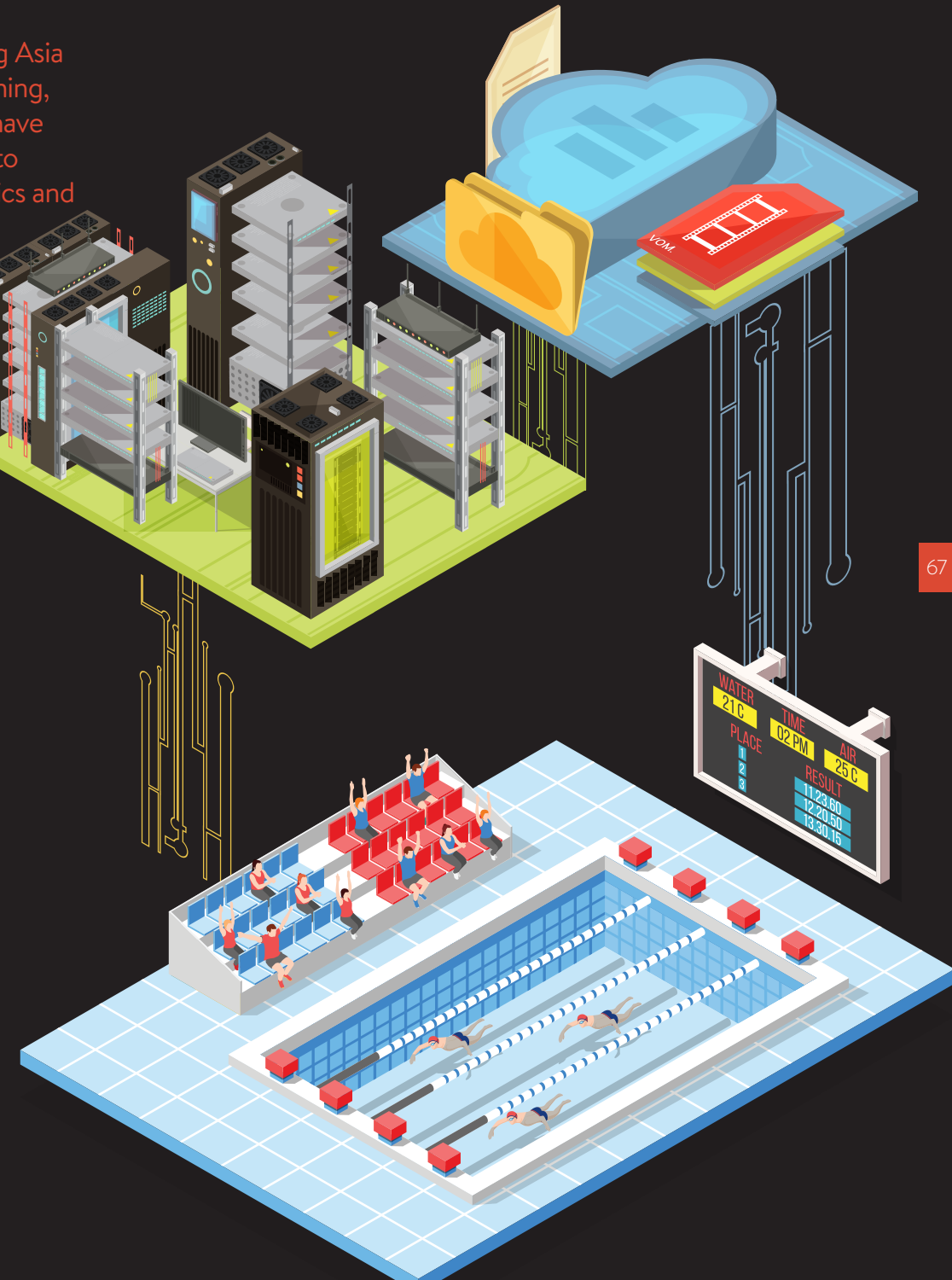
With Japan booming as a hub for digital innovation, it becomes evident that advancement in artificial intelligence, machine learning, and algorithmic decision making are dictating a lot of the data traffic. Video streaming and social media network traffic are only a proportion of the overall cloud usage.

ON THE MOVE

Mobile payment is also creating new demands for edge computing, with reliable and fast connectivity. In fact, most of Japan uses mobile payment as the



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first choice of transaction as it swiftly moves towards becoming a cashless society. This trend also brings with it the critical need for secure and reliable data processing – calling for business and service providers that demonstrate high tenacity and assurance in handling personal data.

It is clear that there is a high consumer appetite, but the real power users are enterprise companies that are moving their computing and data assets to the cloud. With SAP, Oracle and Microsoft moving away from licensing model to cloud based software platform services, data traffic is ramping up thick and fast. The more complex the systems, the more data and content it generates, therefore the higher the data density and storage capacity.

CATALYST FOR GROWTH

Edge and hyperscale data centres offer low latency and high performance – a critical factor to today's businesses that operate in near real time and cannot afford slow or poor quality connectivity. They are also highly scalable to provide for the sudden peaks in demand.

Locations like Inzai, Shiohama, Osaka and Otemachi are ideal. They are stable geographic locations that are moderate in seismic activity but offer low latency traffic to key cities and financial districts. Partnering with a data centre that has good seismic design is also important, because these buildings are better equipped to handle earthquakes. It is able to sustain big compute cloud traffic with no outages.

SUPPORT STRUCTURE

Japan is a growing market with lots of opportunities in the years to come – that

said, it has a much more traditional mindset. While local businesses have not jumped as fast as the Americans on the cloud train, we are seeing significant growth potential for the cloud in recent years. The Tokyo 2020 Olympic and Paralympic Games could be the catalyst for rapid growth. It certainly has the ability to lift the country's global trade and stature – as long as the infrastructure is ready to support it. ■



JACKSON LEE

Jackson Lee is vice president corporate development at Colt DCS. He provides recommendations into market expansion in Europe and Asia through mergers and acquisitions, new builds and partnership opportunities, competitive positioning and product differentiation. Previously, Lee was a director within Fidelity Investments private equity group, providing portfolio management oversight, acquisition and divestiture capabilities, and financial restructuring expertise.

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