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VIEWPOINT

By Phil Alsop, Editor

Time for a sustainability revolution

I SUSPECT that I've covered this topic on more than one occasion in the past across the various titles I edit (DW, DCS and SDC Channel Insights), but I am not sure that the case for a revolution, rather than evolution, has ever been stronger. Sadly, in the UK at least, the green agenda appears in danger of being derailed by politics, following a recent by-election where the winning candidate seemed to gain support for rubbishing, to be fair not the concept of, but the cost to the consumer involved in expanding London's Ultra Low Emission Zone. Many more people are going to be charged money to commute to work each day because their vehicles are deemed to be too polluting.

In a nutshell, this example encapsulates the issues surrounding the road to sustainability. Everyone seems to accept that lifestyles will have to change – although by how much there is less agreement; but not everybody thinks that the financial and personal sacrifices demanded by the environment are acceptable. Big business demands to continue making large profits; individuals still expect to fly around the world to enjoy their holidays abroad.

Guess what, big business can still make money in a sustainable world – it just might not be quite as much as they once did, or, God forbid, they might have to change their businesses model to do so! As for individuals, abandoning a flight for a train ride might just be a good place to start (and, yes, I know that getting the train/boat from Europe to Australia is time consuming and expensive – all but impractical).

The bottom line is, how much corporate and personal sacrifice/realignment are companies and private citizens prepared to make to ensure a truly sustainable future? Not enough seems to be the simple answer as of now. And that despite the current high temperatures across much of Europe – where folks who flew on holiday to Rhodes, for example, are not getting great value for money!

Whether or not the sustainability revolution ever occurs, or folks will still be arguing about the 'injustice' of having to install heat pumps as London disappears under water, I know not. But I think there are more than enough warnings of the future we face if we do not act quickly and radically. The evidence is compelling. Indeed were it not climate evidence, but, say evidence as to how consumers were changing their buying habits, then the business world would have acted a long time ago.

For those who want to hear an eloquent and informed opinion on the subject, I recommend the video interview with James Rix of Arcadis, to be found on the DCS and DW websites. He has a brilliant perspective on how and why the tech sector needs to embrace change now.

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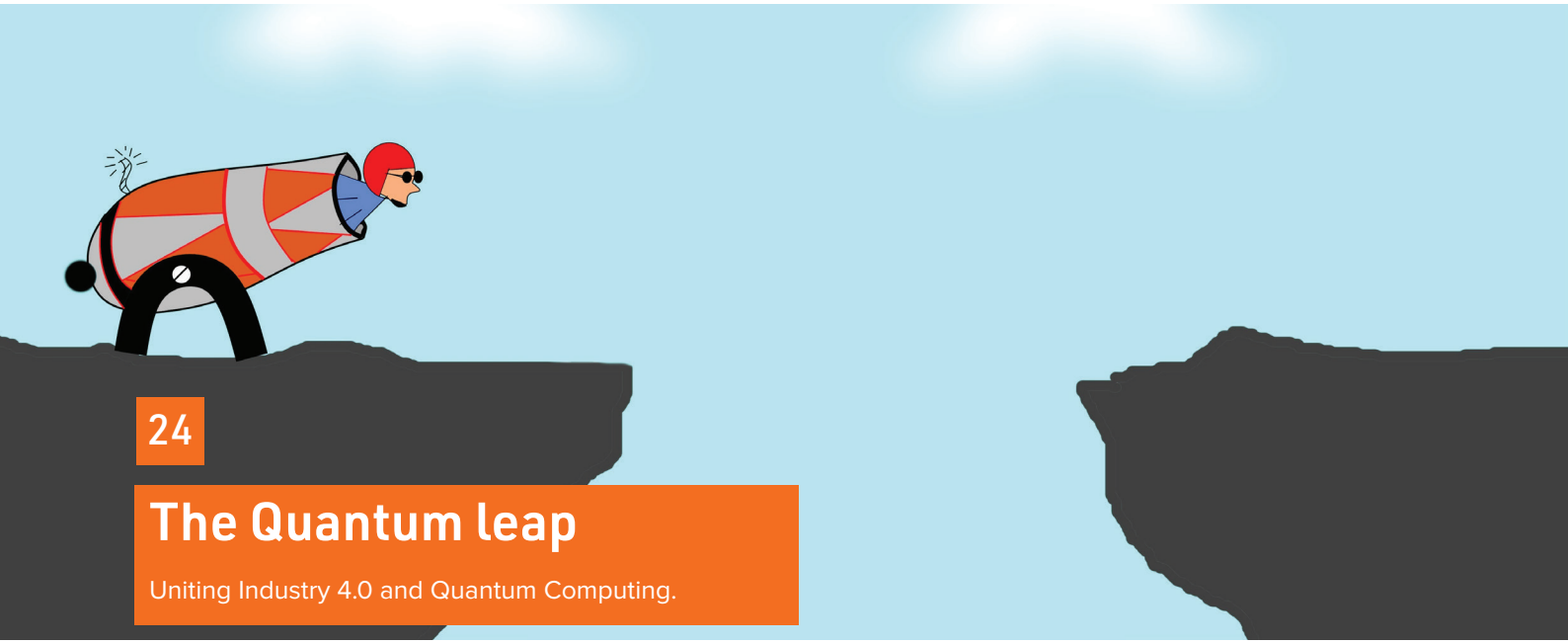

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Chief Technology Officers are critical for companies' Net-Zero targets

Eighty-four percent of CEOs and chief sustainability officers agree the CTO has the potential to become the greatest driver of sustainability in an organization

THE SUSTAINABLE CTO, a new global research report from Intel, finds that chief technology officers (CTOs) play a critical role in aligning business strategies with technology demands to meet sustainability targets.

"Enterprise leaders are approaching the interconnected challenges of sustainability and radical digital transformation. Technology has a critical role to play in sustainable transformation," said Greg Lavender, senior vice president, chief technology officer and general manager of the Software and Advanced Technology Group at Intel. "If the C-suite, including CTOs and CIOs, rally in support of a tech-positive approach, technological transformation can propel us toward a future that is greener, fairer and smarter."

Information technology (IT) leaders have both the appetite to take on the challenge and the support from the rest of the C-suite: 79% of senior IT leaders aspire to become sustainability leaders and 82% of CEOs and chief sustainability officers (CSOs) believe the CTO role is pivotal to successful sustainability transitions. This new model of CTO is tasked with achieving "tech zero," defined as reducing the carbon footprint of an organization's IT function. Further, they must also use technology as a lever for their whole organizations to reach their net-zero goals, also known as "tech positive." Ultimately, these efforts can drive business growth and accelerate innovation, affecting the sustainable transformation of their entire organizations

Stepping into the Role of a Sustainable CTO

To support the initiative, Intel has established an advisory board consisting of tech and sustainability leaders across various sectors. The board will collaborate to identify best practices to help organizations determine the best path toward becoming tech positive, given real-world business demands.

"The new role of the sustainable CTO will play a crucial part in an organization's transition to net zero, but CTOs can't navigate the challenges they will face alone," said Motti Finkelstein, Intel corporate vice president and digital transformation officer. "We aim to help CTOs on their sustainability journey and outline the roadmap for organizations to achieve their sustainability goals."

The research found that 70% of senior IT leaders believe their organizations require a significant change or complete transformation to become net-zero businesses. And while CTOs need to drive this transformation, a tech trilemma is preventing them from taking on this role: a lack of knowledge, investment and innovation.

Intel's global research also found that: 82% of senior IT leaders say that technology strategy and sustainability strategy must become increasingly aligned if their organizations are to reach net zero and become more sustainable businesses.

80% of senior IT leaders believe organizations are heavily reliant on technology and their CTOs to make their businesses more sustainable. 70% of senior IT leaders believe their organizations will not be able to reach net zero without the support and action of their IT functions.

Roadmap for Sustainable CTOs

Respondents agree that the top four success factors for the CTO's Sustainability Roadmap to achieve tech zero are:

- Build skills to understand where to optimize.
- Get buy-in from the wider business.
- Understand the data and optimize existing infrastructure.
- Plan for solution and software innovation.

CEOs see sustainability as their organizations' top growth driver between now and 2030, with digitization a close second. With 82% of CEOs and CSOs believing that the CTO role has more influence on the organization's sustainability strategy than before, now is the time for CTOs to assume the mantle of the Sustainable CTO and step up to the challenge.

One in three employees blame lack of reliable tech for poor productivity

Despite a shortfall in the right workplace tools, over a quarter of CIOs believe home distractions are at fault for insufficient worker output.

OVER A THIRD (35%) of employees are having their productivity stunted by insufficient, slow and unreliable technology – yet over a quarter (27%) of CIOs say home distractions are the culprit. These are among the findings of new research by managed workplace services (MWS) provider, Apogee Corporation.

The research, which surveyed over 200 chief information security officers (CIOs) and 200 employees across SMB organisations and the public sector, highlights the impact unreliable workplace technology is having on employee performance and collaboration. A further 21% of employees say that a lack of team connection and collaboration opportunities when working from home is hindering their productivity.

This contrast in perception is threatening to isolate employees from their organisation and colleagues. For 46% of employees, access to the right technology is key to feeling connected across hybrid work environments – yet over half (56%) say technology is unreliable or completely non-existent when working from home. Almost one-in-three (28%) employees also say they are unable to do their job properly as a direct consequence of poor digital collaboration with technology.

As a result, over three-quarters (79%) of employees don't feel optimistic about the future of work – with almost half (46%) saying that a lack of access to the right technology is fuelling this negativity. Most CIOs share this outlook, with just 5% claiming they are optimistic about the future of work.

The research also uncovers a strong disconnect between CIOs' and employees' workplace ideals. A quarter of CIOs believe that training and career development is the most important feature of an 'ideal' workplace, yet other factors rank higher on employees' priority list. Over half (52%) of workers say that access to the latest technology that enhances teamwork and collaboration is the workplace feature they value the most.

Despite clear employee demand, employers admit to difficulties connecting with the new technology expectations and needs of a younger generation of workers, with over a fifth (21%) of CIOs admitting the generational divide is preventing them from feeling more connected to their employees. The disconnect is being further fuelled by nearly eight-in-ten (79%) CIOs stating that some employee expectations around flexibility are simply incompatible with the needs of the business. But budget restrictions are also playing a role, with 22% of CIOs saying this prevents them from providing the required technology to support flexible and collaborative working. This shortfall in suitable tech, compounded by the growing employer-employee divide, is leaving over a quarter (27%) of workers feeling frustrated, leading to far-reaching engagement and productivity challenges.

Julian Broster, VP of Strategic Business Development at Apogee, commented: "Home distractions are something of a red herring when it comes to employee unproductivity, as workers really are lacking the technology and collaborative digital tools to support them as they navigate the new hybrid workplace."

"If employers fail to understand and prioritise this growing demand, they risk disengaged staff and poor business performance. Budget constraints should not be a barrier; there are cost-effective collaborative solutions that CIOs can now tap into to better enable staff to connect with each other and the wider organisation."

As a result, over three-quarters (79%) of employees don't feel optimistic about the future of work – with almost half (46%) saying that a lack of access to the right technology is fuelling this negativity

Humans should be involved in AI decision-making

Workday has published the results of its latest study, which examines the state of artificial intelligence (AI) in the enterprise, including the current perception among business leaders about the technology's benefits, challenges, and opportunities

- 93% of business leaders believe humans should be involved in artificial intelligence decision-making.
- 77% of respondents are concerned about the timeliness or reliability of the underlying data.
- 29% said they are very confident that AI and machine learning (ML) are being applied ethically in business.
- 73% of business leaders are feeling pressure to implement AI at their organizations.
- 80% agree AI and ML helps employees work more efficiently and make better decisions.
- 72% of respondents said their organization lacks the skills to fully implement AI and ML.

Nearly three-quarters (73%) of business leaders are feeling pressure to implement AI at their organizations, but the vast majority are wary of giving up too much decision-making power. In the survey of 1,000 business decision-makers from around the globe, 93% said it's important for humans to have oversight of AI or ML when making significant decisions.

"Business leaders understand that AI and ML are critical to success in the future of work," said Jim Stratton, chief technology officer, Workday. "But enterprise organizations continue to lack the skills needed to implement the technology, and concerns around data integrity, ethics, and role elimination persist. Successful adoption of AI and ML require a commitment to keeping humans in the decision-making loop and working with partners who are committed to responsible AI and maintaining data integrity."

Despite the case for ai adoption, concerns about ethics and data accuracy remain

More than 90% said they currently use AI within their operations for managing people, money, or both, and 80% agree AI and ML helps employees work more efficiently and make better decisions. The need for investment in this area is clear – 80% of respondents agree that AI and ML are required to keep their business competitive.

But despite wide-spread adoption and broad agreement around the case for AI and ML in the enterprise, concerns remain about its accuracy, ethics, and security. In fact, 77% of respondents are concerned about the timeliness or reliability of the underlying data, 39% consider potential bias to be a top risk when considering AI, and 48% cite security and privacy concerns as the main barriers to implementation. Only 29% said they are very confident that AI and ML are being applied ethically in business right now, but they are more optimistic about the future – with more than half (52%) saying they are very confident it will be applied ethically in five years' time.

Outlook for workers is optimistic, but new skills will be required

Business leaders are considering AI's impact on the workforce of today and tomorrow. Nearly half (45%) believe AI and ML will benefit workers, augmenting workloads and creating new career paths. 43% are more cautious, warning that AI and ML will replace some tasks, causing some unemployment among workers.

12% are more doubtful, saying that AI and ML will replace humans completely and have a negative impact on workers.

While leaders agree it is critical for humans to be involved in AI decision making, the survey also found a critical skills gap to successful AI implementation. Nearly three-quarters (72%) of respondents said their organization lacks the skills to fully implement AI and ML, and an even slightly higher percentage (76%) said their own knowledge of AI and ML applications needs improvement.

The full findings from the study identify widespread recognition of the potential for AI to transform enterprise business processes – along with significant gaps in how to get there.

Almost all organisations are lagging on digital transformation

F5's Inaugural Digital Maturity Index: Only 4% rank at the highest level of digital maturity, compared to 31% classed as 'dawdlers'.

AFTER DECADES of investment in digital transformation, only a minority of organisations can claim to have reached an advanced level of digital maturity, analysis from F5 suggests. For F5's inaugural Digital Maturity Index1, 300 responses from the 2023 State of Application Strategy Report were assessed against a set of six technical capabilities2: infrastructure, app delivery, data, Site Reliability Engineering (SRE) operations, observability and automation, and security.

Based on the research, a mere 4% can be classified as digital "doers". In other words, organisations that have adopted and integrated technology to the point where it is core to business delivery – leveraging data and analytics to make decisions, providing digital services, and harnessing emerging technologies to enter new markets and gain competitive advantage.
In some key sectors, including financial services, healthcare, education and energy/utilities, no organisation surveyed ranked in this category.

By contrast, the vast majority (65%) are in the middle ground: digital 'dabblers' who scored strongly in some areas but not consistently across the six key capabilities assessed – IT infrastructure, data, app and app delivery, observability, and automation, SRE practices and security.
The remaining 31% are the "dawdlers", who lagged in all of the twelve measures used, which included the distributedness of infrastructure, app delivery and security, observability strategy, deployment of automation in key areas, and the use of telemetry to harness data insights.

"At a time when there is more focus than ever on the power of disruptive technologies, this analysis measures the readiness of organisations to take advantage," said Lori MacVittie, F5 Distinguished Engineer, speaking at Infosecurity Europe conference in London "That so few organisations are digitally mature may come as a surprise, but it underlines the complexity of this transition and the sheer breadth and depth of technical capabilities required to succeed. Even after long journeys of digital transformation, there remains a great deal of work for most organisations to do."

Automation and public cloud tell a story

The adoption curve of key technologies paints a clear picture about what differentiates the digital doers from the dawdlers. Whereas 100% of the former described their organisations as automated, just 30% of dabblers and 6% of dawdlers said the same. Over half of the latter said they had not made any progress on their automation journey.
When it comes to the use of AI and machine learning (ML), there was strong convergence between the doers and dabblers: in both cases 35% said they are using or planning to use their technologies in security and 29% each in line of business. The dawdlers stood out, with almost a quarter (24%) not making any use of them, although 27% of them were doing so in operations and security.

Public cloud is another key indicator of digital maturity. While at least a fifth of organisations across all categories are using it in business continuity and development, there was a notable group of dawdlers (39%) making no use of public cloud, compared to only 7% of dabblers and none of the doers.
The approach to security is also telling: while the vast majority of doers are using a platform approach to secure their business (91%), infrastructure (82%) and applications/APIs (74%),

those numbers are progressively lower among dabblers and dawdlers – 13% of whom are not using a platform approach at all.

Even the mature may struggle

While the most digitally mature organisations stand out from their peers in use of technology, that does not mean their digital transformation journeys are proceeding untroubled.

F5's research found that even the most advanced are still struggling in some areas, especially when it comes to generating actionable insights from data. The doers were most likely to cite either a lack of visibility when it comes to obtaining insight (75% compared to 54% of dabblers and 50% of dawdlers), or siloed data (66% against 55% and 43%). For the majority – the dabblers – the biggest problem was a lack of observability, highlighted by 53% compared to only a quarter of doers.
"Digital transformation is a marathon and not a sprint, and our research says more about the scale of the challenge than whether companies are succeeding or failing," said MacVittie. "Even those classified as dawdlers are showing signs of maturity in one or two domains: what they lack is a consistency in adopting and integrating digital approaches across business, infrastructure and applications."

Investment in employee experience, cloud and AI drives improved customer experience

91% of organizations agree better EX will directly affect their net profit; 92% say the same about CX.

NTT has launched its 2023 Global Customer Experience Report, which reveals that customer experience (CX) remains a top C-suite priority, with 95% of organizations now having a named C-suite executive responsible for this business area. At the same time, employee experience (EX) has risen in importance to become a top-3 priority for CEOs.

The report found that the majority of CEOs agree that improvements in CX (92%) and EX (91%) will directly affect their net profit. However, there is room for improvement, as over 80% of organizations agree that CX and EX are currently a weak link for them, leading to a negative impact on their business.

The data reveals that top-performing organizations are almost twice as likely as others to be in an advanced state of digitalization. Cloud-based technologies and AI, automation and machine learning feature prominently in these top performers' CX and EX strategies. Other key findings from the report include:

- Cloud technology tops the list of solutions that will reshape future CX capabilities, ranked ahead of AI (in second place) and predictive analytics.
- Top performers are already prioritizing AI, whereas it remains part of a three-year plan for most other organizations.
- Only 60% of organizations say their CX strategy is fully aligned with their business strategy, and 44% report full alignment for their EX strategy (compared with 74% and 58% of top performers, respectively).
- Over two-thirds (69%) of CX interactions will still require some form of human support in the near future, reemphasizing the importance of EX in enabling employees with the right tools and knowledge no matter where they work.
- 96% of organizations agree – 45% strongly – that evolving work and employee engagement models are driving new technology demands.

Top performers are nearly three times more likely than underperformers to fully involve their cybersecurity teams in CX and EX technology decisions.

"Over the last few years, we have witnessed an increasing link between CX and EX, and the need for them to be addressed through this technology.

Our data shows that companies that invest in technologies to improve CX and EX are significantly more likely to stay ahead of the curve, not just in financials but also in customer and employee satisfaction," said Amit Dhingra, Executive Vice President, Managed Network and Collaboration Services at NTT Ltd.

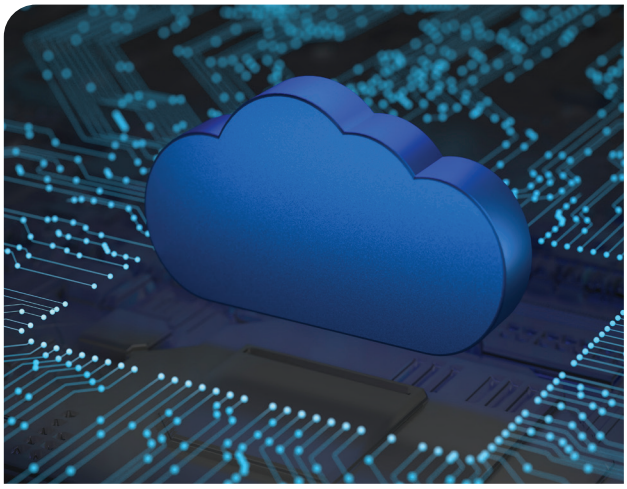
Failure to modernise limits AI benefits

Organizations are lagging in modernizing legacy apps and data; the study also finds that modernization initiatives lack clear leadership.

RACKSPACE TECHNOLOGY has published a new Cloud Modernization Survey commissioned by Rackspace Technology and supported by AWS. Coleman Parkes Research conducted the survey between April 27, 2023 – May 25, 2023. The survey finds that global IT organizations have been slow to modernize key applications, including customer resource management (CRM), enterprise resource planning (ERP), and human resources (HR) systems. Moreover, the study suggests that failure to modernize key apps and data will limit organizations' ability to deploy and benefit from cutting-edge technologies such as artificial intelligence (AI).

According to the survey of 1,420 global IT leaders across industries, 80% of respondents agree they will only benefit from AI if they modernize legacy apps and data. Although survey respondents identify increased security (58%), improved efficiency (54%), and cost reduction (49%) as the leading motivators of modernization – and ERP, CRM, and HR as the apps that most need upgrading – organizations are still dragging their feet on updating legacy infrastructure. Of legacy infrastructure that has not yet been modernized, only 22% of workloads are considered noncritical, but 25% of legacy infrastructure has "not yet been assessed." 89% of those surveyed say they have been in the cloud between 1-10 years.

"It is telling that even well into their cloud journey, the three most critical apps organizations say they need to upgrade are truly at the heart of the business because they are at once the most important things to modernize and the most challenging," said Jeff DeVerter, Chief Technology Evangelist, Rackspace Technology. "At the same time, it is encouraging to see leaders understand that app modernization is key to getting the most out of cutting-edge technologies. It could be that the prospect of losing out on AI will motivate organizations to finally get off the sidelines when it comes to modernization of core systems."



Who Is Leading Modernization?

The survey also points to gaps in the leadership of modernization efforts. Only 25% of those polled say they deploy cross-functional teams as part of modernization, while just 38% use tech vendors and only 30% deploy external consultants. Overwhelmingly, modernization initiatives are led by IT departments (68%) and executive leadership/C-suite (50%).

The Benefits & Challenges of Modernization

When survey respondents were asked to identify the top expected outcomes of modernizing, efficiency led the way (30%), followed by security (28%), cost savings (20%), and the ability to adopt advanced technologies (27%). Respondents also noted that modernization has resulted in better data management, integration, and quality and lowered data costs.

The most critical apps and data to modernize are enterprise (86%), CRM (87%), HR (75%), bespoke apps (72%), business intelligence (71%), data storage (60%), content management (60%), data analytics (54%), governance and security (51%) and data integration (50%).

However, many organizations still face unforeseen challenges to modernization, including limited resources (28%), cultures resistant to change (21%), integration challenges (16%), lack of senior buy-in (12%), lack of a clear roadmap (9%) and communication between stakeholders (8%).

If organizations fail to modernize legacy apps and data systems, respondents believe it will result in increased costs (32%), poor security (27%), lack of innovation (26%), and the probability to miss out on the ability to adopt advanced technologies (25%)."Companies cite costs and security issues as two of the main reasons why they have not modernized their apps and data," said Jeff DeVerter, Chief Technology Evangelist at Rackspace Technology. "However, they also state two of the key benefits of modernization are lower costs and greater security, indicating that many organizations are stuck in a Catch-22."

Coinciding with the results of the Rackspace Cloud Modernization survey Rackspace Technology recently announced Foundry by Generative AI by Rackspace (FAIR), a global practice dedicated to accelerating the secure, responsible, and sustainable adoption of generative AI solutions across industries. FAIR aims to aid in many of the problems respondents shared, including accelerating the pragmatic and secure adoption of generative AI.

Technology investment to fast track global growth

Research reveals 35% of CIOs believe global growth ambitions are constrained by legacy systems and fast growth economies are lower priority due to perceived complexity.

NEW RESEARCH of global CIOs launched by Expereo reveals that large global enterprises are moving 'Faster to the Future' with an increased focus on technology investment to fuel growth through global expansion.

The research of over 650 CIOs in global enterprises across Europe, US and APAC shows that half of global CIOs (51%) have secured increased technology budgets specifically to deliver growth and overcome existing challenges. Positive news for over a third (35%) who claim that their global business ambitions are constrained by legacy connectivity and management systems. It also identifies that organisations may be missing growth opportunities by failing to prioritise regions with some of the world's fastest growing economies, due to perceived complexity and challenges to market entry.

Ben Elms, Chief Revenue Officer at Expereo comments; "As organisations focus on driving growth through global expansion, there are clearly complexities and challenges to overcome. The business-critical nature of connectivity in today's world combined with an increasingly complex landscape – from security, regulation, skills and often challenging physical and geo-political infrastructure - mean it's no easy task. However, it is achievable. Those that find a way to simplify, automate and scale their operations will be in the best position to reap the rewards and growth that this can deliver."

The future is bright

According to the research, global CIOs describe their organisations' attitudes to growth as optimistic (34%) and nearly a third (30%) as ambitious for the next 12 months. Over half (51%) of respondents claim global boards have already increased technology budgets to help drive this.

Security (61%), automation and analytics (59%), and 5G (58%) were identified as the top three areas set for increased tech investments globally in the next four months, closely followed by public/hybrid cloud (55%), Edge computing and IoT (both 54%), SD-WAN (45%) and SASE (51%). CIOs claim that this investment will drive global growth by ensuring prioritisation of increased innovation (50%), increased automation (47%) and expansion into new markets (45%).

More markets, more problems...

Almost half (46%) of CIOs claimed that establishing and managing connectivity in new markets is the single most critical factor in ensuring successful global expansion, and 42% said that their board views global connectivity as a business asset critical to growth, but there are challenges that need to be overcome.

In fact, when asked specifically about the biggest challenge to delivering global growth in new regions, 37% said that effectively establishing connectivity in new regions is one of the major challenges in their role, 37% a major challenge for their organisation and 35% that their organisations' business ambitions are constrained by legacy connectivity. Additional challenges identified were security environments (35%), skills and resource retention (35%), complicated physical and geopolitical infrastructure (33%), regulation and compliance (32%), and legacy systems and local knowledge (both 31%).

Perceived complexity an obstacle to global growth

Responses indicated that global enterprises may be failing to prioritise the fastest growing economies due to perceived complexities.
When asked about where their organisation saw the biggest opportunity for growth, North America and Europe dominated the top five. North America (37%) took the throne, followed by Western Europe (32%), Eastern Europe (26%), Northern Europe (25%) and South America (25%). Although South America appears in the top five, it also ranks as the most technologically challenging region to do business in regarding the local knowledge of providers (29%), agility (28%), robust connectivity (28%), scalability (27%), and performance visibility (28%). Interestingly it is also seen as a more challenging security environment than China - 27% compared to China's 26%.

Given that the IMF's most recent World Economic Outlook Report showed that growth projections in advanced economies was 1.4% for 2024, while emerging and developing markets was 4.2%, it is surprising that neither the Greater China Area or Central & South Asia appear in the top five priority regions for growth. Each includes two of the fastest growing economies in the world - China and India. Perhaps this is due to both appearing consistently in the top five most challenging regions in terms of local technology provider knowledge (25% and 22% respectively), agility (26% and 24%), robust connectivity (25% and 23%), security (26% and 25%) and performance visibility (both 25%).

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The 13th Managed Services Summit London is the premier managed services event for the UK IT channel. 2023 will feature presentations by leading independent industry speakers, a range of sessions exploring technical, sales and business issues by specialists in the sector, and extensive networking time to meet with potential business partners. This is an executive-level event, exploring the latest trends and developments, evolving customer requirements and how to create value through managed services – both for your own organisation and your customers.

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European ICT spending to expand through 2027

European ICT spending is expected to post a compound annual growth rate (CAGR) of 5.4% over the 2022–2027 period, according to International Data Corporation (IDC). In a clear indication of the resiliency of the European ICT market, IDC's Worldwide Black Book: Live Edition reports the market will grow 3% in constant currency terms in 2023, rising to $1,046.8 billion.

IDC says software and services growth will propel the market upward; however, some hardware categories are forecast to decline, slowing overall growth.

Europe's economic slowdown, inflation, and high interest rates continue to weigh on consumers and businesses, impacting ICT spending. Customer cautiousness is expected to impact the devices market, which is projected to decline 9.4% year on year in 2023. Nevertheless, as inflation recedes, a modest rebound is anticipated in last quarter of 2023 for some products, including consumer PCs. European businesses will move forward with digital transformation initiatives to improve their market performance and build resiliency. Cloud deployments are projected to increase in support of business continuity and disaster recovery plans. Investments in security solutions will remain a priority as companies act to protect themselves from cyberattacks and comply with new regulations. Software and IaaS adoption will be major spending drivers as organizations pursue innovation and cost reductions.

"There is a clear sign that the European ICT market remains resilient even amidst periods of volatility and economic uncertainty," says Lubomir Dimitrov, software research manager with IDC. "The performance of the overall ICT market could be even better this year, as technology areas like software and services are expected to maintain a strong positive trajectory, while the poor performance of certain hardware categories will impede overall growth."

Worldwide Public Cloud Services to surpass $500 billion

Worldwide revenue for the public cloud services market totaled $545.8 billion in 2022, an increase of 22.9% over 2021. Software as a Service – Applications (SaaS – Applications) continued to be the largest source of public cloud services revenue, accounting for more than 45% of the total in 2022. Infrastructure as a Service (IaaS) was the second largest revenue category with 21.2% of the total while Platform as a Service (PaaS) and Software as a Service – System Infrastructure Software (SaaS – SIS) delivered 17.0% and 16.7% of overall revenue respectively. This is according to new data from the International Data Corporation (IDC) Worldwide Semiannual Public Cloud Services Tracker.

"Given the economic challenges of the past year, it's easy to conclude that we are in a period where a focus on constraining new expenditures and optimizing the use of existing cloud assets will dominate CIOs' priorities and shape the fortunes of IT providers for the next several years. It's also a very wrong conclusion.

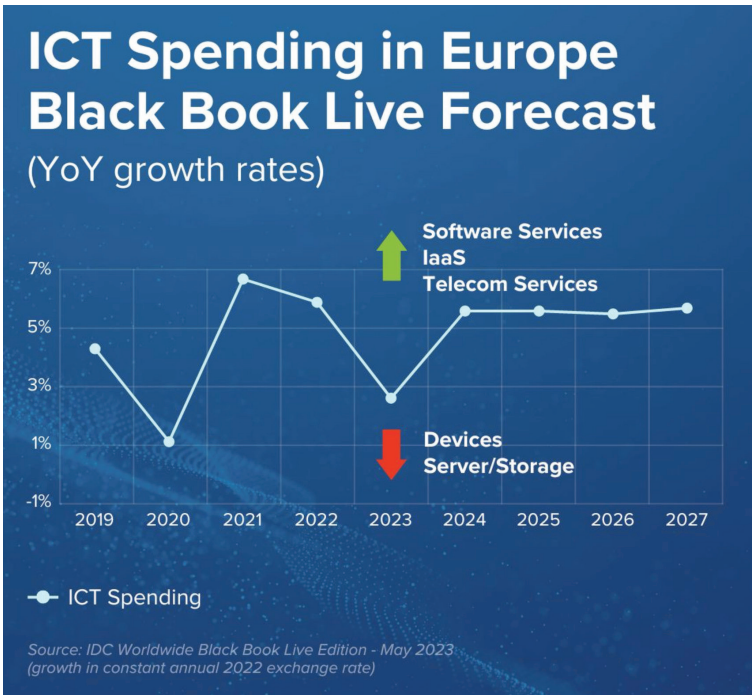
The assessment and use of AI, triggered by generative AI, is starting to dominate the planning and long term investment agendas of businesses and cloud providers will play a significant role in the evaluation and adoption of AI enablement services," said Rick Villars, group vice president, Worldwide Research at IDC. Spending with the leading providers of public cloud services further consolidated in 2022 with the combined revenue of the top 5 public cloud service providers – Microsoft, Amazon Web Services,

Salesforce Inc., Google, and Oracle – capturing more than 41% of the worldwide total and growing 27.3% year over year. With offerings in all four deployment categories, Microsoft remained in the top position in the overall public cloud services market with 16.8% share in 2022, followed by Amazon Web Services with 13.5% share.

While the overall public cloud services market grew 22.9% year over year in 2022, revenue for foundational cloud services* that support digital-first strategies saw revenue growth of 28.8%. This highlights the increasing reliance of enterprises on a cloud innovation platform built around widely deployed compute services, data/AI services, and app framework services to drive innovation. IDC expects spending on foundational cloud services (especially IaaS and PaaS elements) to continue growing at a higher rate than the overall cloud market as enterprises leverage cloud to accelerate their shift toward digital business.

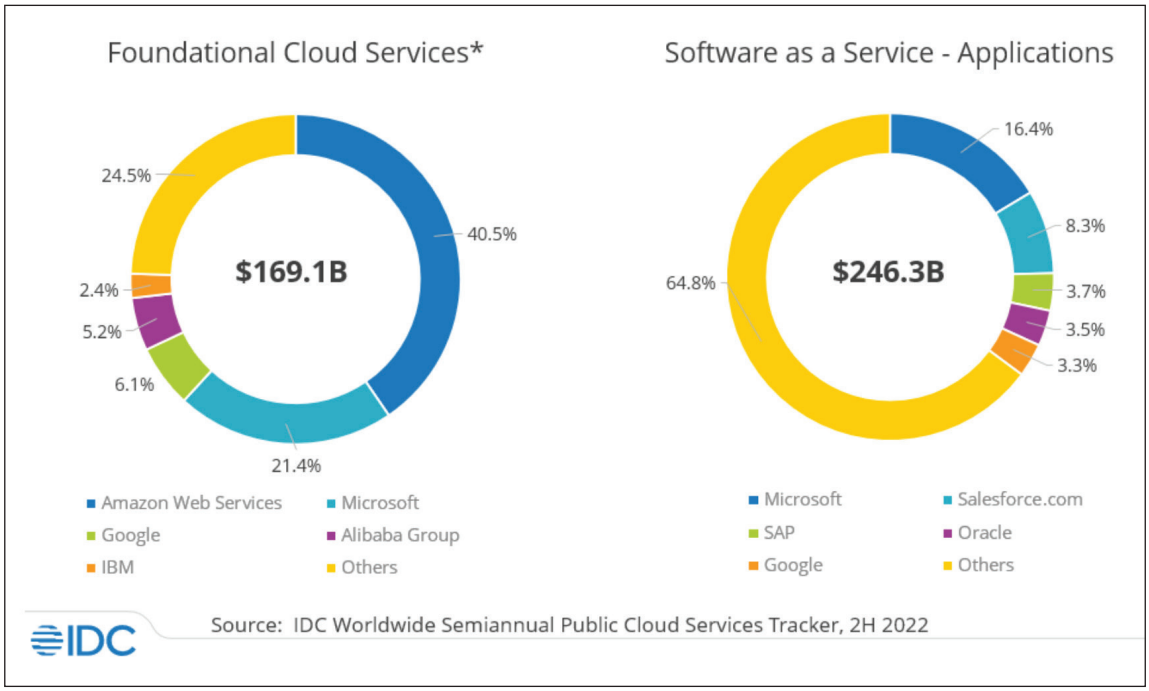
"Cloud providers are making significant investments in high-performance infrastructure," said Dave McCarthy, research vice president, Cloud and Edge Infrastructure Services. "This serves two purposes. First, it unlocks the next wave of migration for enterprise applications that have previously remained on-premises. Second, it creates the foundation for new AI software that can be quickly deployed at scale. In both cases, these investments are resulting in market growth opportunities."

"IDC research shows that most organizations rank their public cloud provider as their most strategic technology partner, with general agreement among IT leaders and business leaders," said Lara Greden, research director, Platform as a Service, IDC. "When it comes to planning for PaaS developer and data



services, organizations that haven't yet begun their journeys in developing AI-enabled applications are beginning to prioritize them. Those that have started to adopt AI are finding themselves well positioned to evaluate further adoption of generative AI capabilities in an intelligent app-strategy."

"SaaS – Applications remain the largest segment of the more than $547 billion cloud software market forecast by the end of 2023," said Frank Della Rosa, research vice president, SaaS, Business Platforms, and Industry Cloud at IDC. "Changing market conditions, exponential increases in cloud spend, and rapid cadence of supplier innovation help



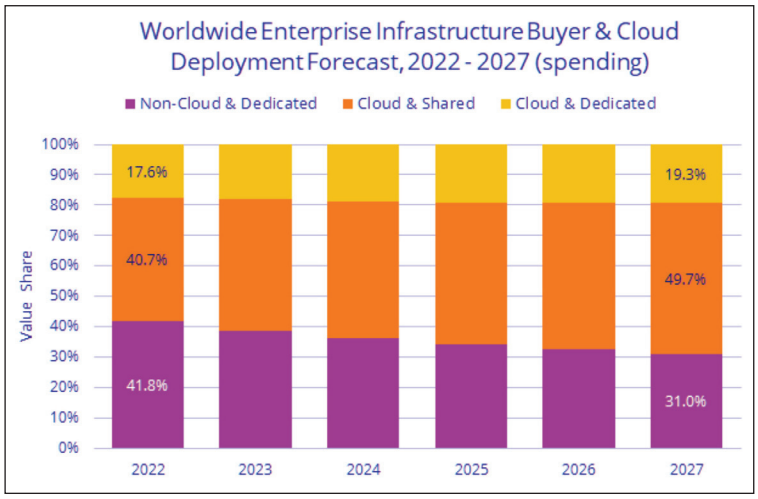
sustain double-digital growth. The next generation of SaaS applications will leverage advances in AI to deliver unprecedented performance improvements in personalization and customer experience, and operational efficiency while redefining functional markets across industries."

Compute and storage cloud infrastructure spend continues to grow

According to the International Data Corporation (IDC) Worldwide Quarterly Enterprise Infrastructure Tracker: Buyer and Cloud Deployment, spending on compute and storage infrastructure products for cloud deployments, including dedicated and shared IT environments, increased 14.9% year over year in the first quarter of 2023 (1Q23) to $21.5 billion. Spending on cloud infrastructure continues to outpace the non-cloud segment with the latter declining 0.9% in 1Q23 to $13.8 billion. The cloud infrastructure segment saw unit demand down 11.4%, but average selling prices (ASPs) grew 29.7%, driven by inflationary pressure as well as a higher concentration of GPU-accelerated systems being deployed by cloud service providers.

Spending on shared cloud infrastructure reached $15.7 billion in the quarter, increasing 22.5% compared to a year ago. IDC expects to see continuous strong demand for shared cloud infrastructure, which is expected to surpass non-cloud infrastructure in spending in 2023. The dedicated cloud infrastructure segment declined 1.5% year over year in 1Q23 to $5.8 billion. Of the total dedicated cloud infrastructure, 44.5% was deployed on customer premises during the quarter.

For 2023, IDC forecasts cloud infrastructure spending to grow 7.3% compared to 2022 to $96.4 billion – a slight improvement from the prior outlook for the year of 6.9%. Non-cloud infrastructure is expected to decline 6.3% to $60.4 billion. Shared cloud infrastructure is expected to grow 8.4% year over year to $68.0 billion for the full year, while spending on dedicated cloud infrastructure is expected to grow 4.8% to $28.4 billion for the full year. The subdued growth forecast reflects the expectation that the market will face significant macroeconomic headwinds and curbed demand with cloud staying positive due to the drive for modernization, opex focus, and continued growth in digital consumer services demand, while non-cloud contracts as enterprise customers shift towards capital preservation.



"Cloud infrastructure spending remains resilient in the face of macroeconomic challenges," said Kuba Stolarski, research vice president for IDC's Infrastructure Systems, Platforms, and Technologies Group. "However, the segment is grappling with substantial price hikes and Q1 marked the second consecutive quarter of declining system unit demand. Although the overall outlook for the year remains positive, its growth hinges on the expectation that volume will drive it. Prolonged stagnation in demand could pose a significant obstacle to growth for the remainder of this year."

IDC tracks various categories of service providers and how much compute and storage infrastructure these service providers purchase, including both cloud and non-cloud infrastructure. The service provider category includes cloud service providers, digital service providers, communications service providers, and managed service providers. In 1Q23, service providers as a group spent $21.5 billion on compute and storage infrastructure, up 14.6% from the prior year. This spending accounted for 60.8% of the total market. Non-service providers (e.g., enterprises, government, etc.) decreased their spending 0.5% year over year. IDC expects compute and storage spending by service providers to reach $94.5 billion in 2023, growing at 5.6% year over year.

On a geographic basis, year-over-year spending on cloud infrastructure in 1Q23 increased in all regions except Central & Eastern Europe (CEE) (impacted by the Russia-Ukraine war), China, and Canada. Spending in CEE declined 27.1% year over year, while China was down 20.4%, and Canada declined 4.9%. Latin America, the United States, the Middle East & Africa (MEA), Japan, and Asia/Pacific (excluding Japan and China) (APeJC) grew the most at 39.2%, 34.3%, 33.5%, 17.1% and 16.4% year over year, respectively. Western Europe grew at 7.4% year over year. For 2023, cloud infrastructure spending is expected to grow in all regions except CEE and Canada, with Latin America expected to grow fastest at 16.1%. All other regions (APeJC, Canada, Japan, Latin America, USA, and Western Europe) are expected to post annual growth in the 0-15% range.

Long term, IDC predicts spending on cloud infrastructure to have a compound annual growth rate (CAGR) of 11.2% over the 2022-2027 forecast period, reaching $153.0 billion in 2027 and accounting for 69.0% of total compute and storage infrastructure spend. Shared cloud infrastructure will account for 72.0% of the total cloud amount with an 11.9% CAGR and reaching $110.1 billion in 2027. Spending on dedicated cloud infrastructure will grow

at a CAGR of 9.6% to $42.9 billion. Spending on non-cloud infrastructure will grow at a 1.3% CAGR, reaching $68.6 billion in 2027. Spending by service providers on compute and storage infrastructure is expected to grow at a 10.6% CAGR, reaching $148.2 billion in 2027.

European IoT spending to reach nearly $227 billion

European organizations are expected to spend around $227 billion on Internet of Things (IoT) technology in 2023, according to the Worldwide Internet of Things Spending Guide published by International Data Corporation (IDC). IoT-related spending is expected to continue to expand at a five-year compound annual growth rate (CAGR) of 11%, reaching almost $345 billion by 2027.

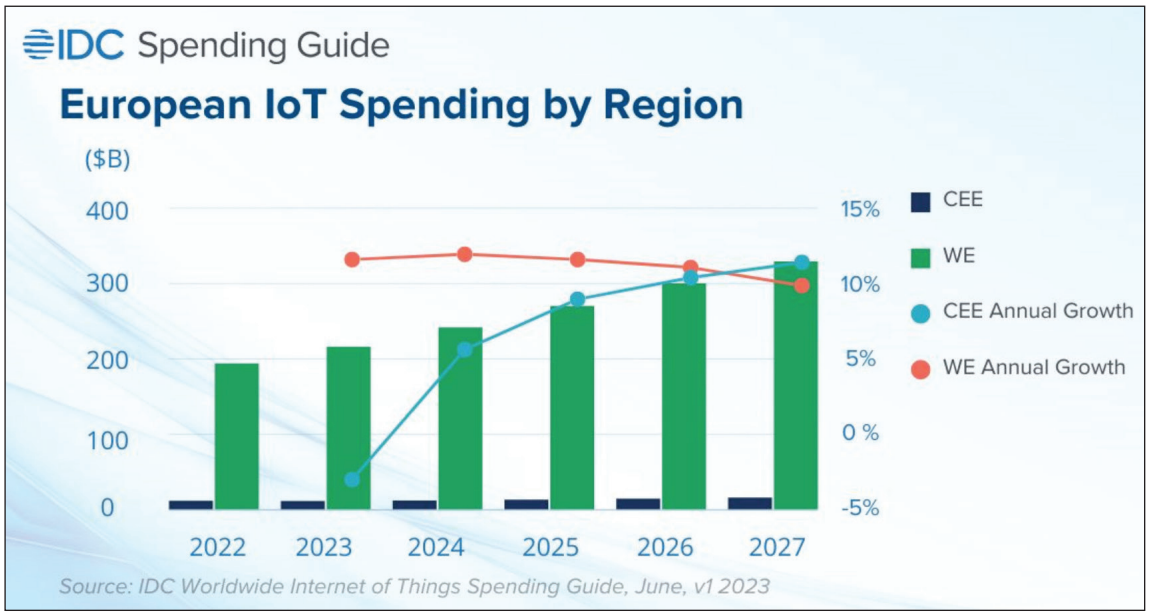
IoT development in Europe reflects enterprises' evolving digital transformation investment objectives related to cost reduction, process streamlining, automation, and enhanced customer experience. There are, nevertheless, varying dynamics in regional markets. Central and Eastern European (CEE) organizations' investments, for example, remain significantly below the European market average, with expected single-digit increases over the forecast period. In the last three years, many investments were put on hold in CEE, due to the various challenges related to the pandemic, the war in Ukraine, and the overall pressured macro-economic environment. However, as IoT has proven to be integral to cost reduction, process optimization, automation, and enhanced management and monitoring capabilities, IDC expects investments to accelerate by the end of the forecast period.

From an overall industry perspective, European IoT spending will be driven by investments from manufacturing, utilities, and professional services organizations. Prominent use cases will include production asset management, distribution automation, and infrastructure for smart buildings. The fastest adoption of IoT will be seen across use cases such as irrigation management in the resources industry and fleet management in transport.

In the latest release of the IDC's Worldwide Internet of Things Spending Guide, notable updates were made to the use case taxonomy across multiple industries (i.e., discrete manufacturing, process manufacturing, retail, resource industries, transportation, and telecommunications).

Updates to the use case taxonomy reflect enterprises' evolving DX investment objectives, some of which were spurred by the Covid-19 pandemic and subsequent business and societal disruptions. In terms of technology, modules and sensors will continue to drive IoT-related spending, followed by related services such as industrial maintenance to support the ongoing operation of device hardware ("things"), vertical business process outsourcing services, infrastructure as a service, and data as a service. Low power wide area networks (LPWANs) will see the fastest-growing investments and will be a critical IoT area for telecom providers in the next few years. Spending on analytics software will also increase, as organizations strive to turn data collected by connection endpoints into actionable insights.

"Due to the uncertain macroeconomic context, European organizations are expected to continue feeling pressure on budgets, with additional investments restrained in the short and medium term," says Alexandra Rotaru, senior research analyst with IDC's European Data & Analytics Team. "However, IoT will remain a critical tool for improving performance and efficiency and increasing automation capabilities. It will continue to be a key investment area, helping organizations to reduce costs and enhance productivity despite challenges."



Four trends shape infrastructure future

Gartner has highlighted four trends impacting cloud, data centre and edge infrastructure in 2023, as infrastructure and operations (I&O) teams pivot to support new technologies and ways of working during a year of economic uncertainty.

SPEAKING AT THE Gartner IT Infrastructure, Operations & Cloud Strategies Conference in Sydney recently, Paul Delory, VP Analyst at Gartner said, "In the current economic climate, the biggest problem companies face in 2023 may not be IT infrastructure. I&O teams, however, will be impacted by economic and geopolitical forces and will have a vital role to play in ameliorating their effects.

"This won't be a year to realize grand ambitions, but it marks a moment to refocus, retool and rethink your infrastructure. In every crisis lies opportunity, and in this case, the chance to make positive changes that may be long overdue."
According to Gartner, the top four cloud, data center and edge infrastructure trends include:

Trend 1: Cloud Teams Will Optimize and Refactor Cloud Infrastructure
Public cloud usage is almost universal, but many deployments are ad hoc and poorly implemented. I&O teams have an opportunity this year to revisit hastily assembled or poorly architected cloud infrastructure to make it more efficient, resilient and cost-effective.

The focus of refactoring cloud infrastructure should be on optimizing costs by eliminating redundant, overbuilt or unused cloud infrastructure; building business resilience rather than service-level redundancy; using cloud infrastructure as a way to mitigate supply chain disruptions; and modernizing infrastructure.

According to Gartner, 65% of application workloads will be optimal or ready for cloud delivery by 2027, up from 45% in 2022.

Trend 2: New Application Architectures Will Demand New Kinds of Infrastructure
I&O teams are continually challenged to meet new and growing demands with new types of infrastructure — including edge infrastructure for data-intensive use cases, non-x86 architectures for specialized workloads, serverless edge architectures, and 5G mobile service. Gartner predicts 15% of on-premises production workloads will run in containers by 2026, up from less than 5% in 2022.

I&O professionals must evaluate alternative options with care, focusing on their ability to manage, integrate and transform in the face of constraints on time, talent and resources. "Don't revert to traditional methods or solutions just because they've worked well in the past," said Delory. "Challenging periods are times to innovate and find new solutions to meet business demands."

Trend 3: Data Center Teams Will Adopt Cloud Principles On-Premises
Data centers are shrinking and migrating to platform-based colocation providers. Combined with new as-a-service models for physical infrastructure, this can bring cloud-like service-centricity and economic models to on-premises infrastructure.

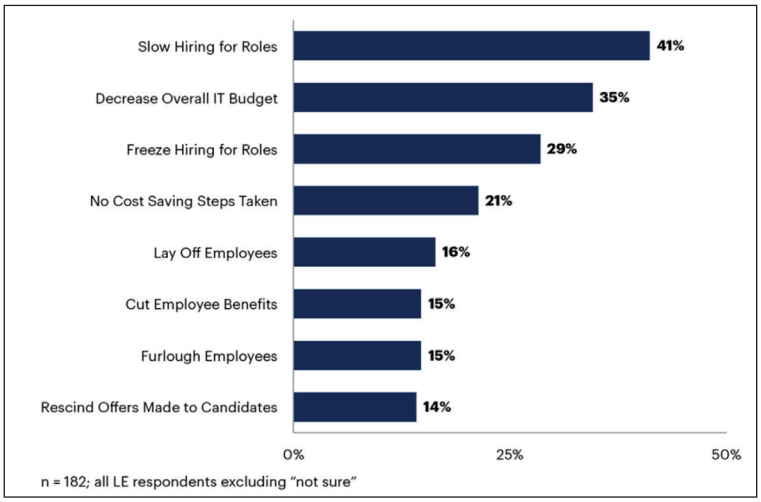
According to Gartner, 35% of data center infrastructure will be managed from a cloud-based control plane by 2027, from less than 10% in 2022. I&O professionals should focus this year on building cloud-native infrastructure within the data center; migrating workloads from owned facilities to co-location facilities or the edge; or embracing as-a-service models for physical infrastructure.

Trend 4: Successful Organizations Will Make Skills Growth Their Highest Priority
Lack of skills remains the biggest barrier to infrastructure modernization initiatives, with many organizations finding they cannot hire outside talent to fill these skills gaps. IT organizations will not succeed unless they prioritize organic skills growth.

I&O leaders must make operations skills growth their highest priority this year. Encourage I&O professionals to take on new roles as site reliability engineers or subject matter expert consultants for developer teams and business units. Gartner predicts 60% of data center infrastructure teams will have relevant automation and cloud skills by 2027, up from 30% in 2022.

81% of CIOs expect to grow their IT team in 2023

Eighty-one percent of large enterprise (LE) CIOs plan to increase their IT headcount in 2023, according to a recent survey by Gartner, Inc. Only 14% expect their IT staff to decrease and 5% expect their headcount to remain the same.



➤ Figure 1. IT Staffing Steps Taken in Response to Economic Volatility

Source: Gartner (June 2023)

"Attracting and retaining technology talent remain critical areas of concern for CIOs," said Jose Ramirez, Sr Principal Analyst at Gartner. "Even with advances in AI, Gartner predicts that the global job impact will be neutral in the next several years due to enterprise adoption lags, implementation times and learning curves."

Only 4% of CIOs surveyed reported AI-augmented worker as a resource producing technology work today.

The Gartner survey was conducted from October through November of 2022 among 501 respondents, 182 of which were LE CIOs in North America, EMEA and APAC region. The LE segment consists of enterprises with a total annual revenue of $1B USD or more.

Why CIOs plan to increase IT headcount in 2023

"Enterprises have undertaken various digital initiatives over the past two years, with operational excellence and customer or citizen experience being the most popular," said Ramirez. "Still, these initiatives often do not meet enterprise needs quickly enough." Sixty-seven percent of LE CIOs plan to grow their IT headcount in 2023 by at least 10% to support their enterprise's digital initiatives.

While CIOs are looking to expand their IT teams, many have faced roadblocks in hiring due to economic conditions. Due to prevailing economic volatility, 41% of LE CIOs report slow hiring for IT roles, 35% report decreasing overall IT budget and 29% report an IT hiring freeze (see Figure 1).

"CIOs are taking proactive steps to combat economic volatility by relaxing geographic and role requirements to expand their IT talent pipeline," said Ramirez. "Some organizations have found success by hiring early-career technologists and providing

upskilling opportunities to fill critical technology needs."

The survey also found that full-time equivalents (FTEs) do the majority of tech work in the enterprise. Full-time IT employees perform 56% of the work, while technology advancements such as automation and AI-augmented work account for just over 9% of work today.

"This reliance on FTEs to meet the demands of digital transformation explain why LE CIOs plan to increase IT headcount in 2023," said Ramirez.

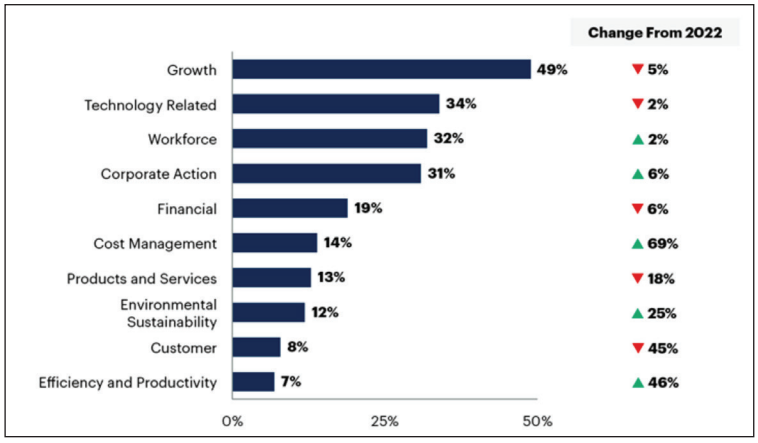
How CIOs plan to upskill IT talent

With the growing demand for IT talent, the most important candidate qualities LE CIOs look for during the hiring process are having the requisite technical skills, soft skills (e.g., communication, relationship management) and cultural fit. LE CIOs cite cybersecurity, cloud platforms and customer/user experience as the three most critical technical skills in 2023. Nearly half of LE CIOs plan to invest in training programs to upskill and reskill IT staff to ensure teams have the relevant roles, skills and capacity to meet enterprise objectives. Forty-six percent of CIOs also plan to establish fusion teams, and the same percentage plan to automate workflow to free up IT time.

"Recruiting the right IT expertise takes time and planning, especially for skills in architecture, cybersecurity, cloud computing and agile software development," said Ramirez. "Ensure that IT has relevant roles, skills and capacity to meet enterprise objectives. This may require embracing a blended workforce model of IT and business domain roles."

CEOs cite AI as the top disruptive technology

A recent survey of CEOs and senior executives by Gartner, Inc. revealed that artificial intelligence (AI) was the top technology that CEOs believe will significantly impact their industry over the next three years, cited by 21% of survey respondents. "Generative AI will profoundly impact business and operating models," said Mark Raskino, Distinguished VP Analyst at Gartner. "However, fear of missing out is a powerful driver of technology markets. AI is reaching the tipping point where CEOs who are not yet invested become concerned that they are missing something competitively important."



➤ Fig. 2: CEOs' Top Strategic Business Priorities for 2023-2024 (Sum of Top Three Mentions)

Source: Gartner (May 2023)

The 2023 Gartner CEO and Senior Business Executive Survey was conducted from July through December 2022 among over 400 CEOs and other senior business executives in North America, Europe, Asia/Pacific, Latin America, the Middle East and South Africa, across different industries, revenue and company sizes.

Half of CEOs cite growth as their top strategic business priority

"When determining business priorities, CEOs are hesitant, but not frozen," said Kristin Moyer, Distinguished VP Analyst at Gartner. "More than half of CEOs believe an economic downturn or recession in 2023 will be shallow and short, and the survey showed only a modest rise in cash flow, capital and fundraising concerns."

Despite the impact of these economic headwinds, half of CEOs cited growth as the top strategic business priority for the next two years. Technology also remains a top focus area for CEOs, closely followed by workforce issues (see Figure 2).

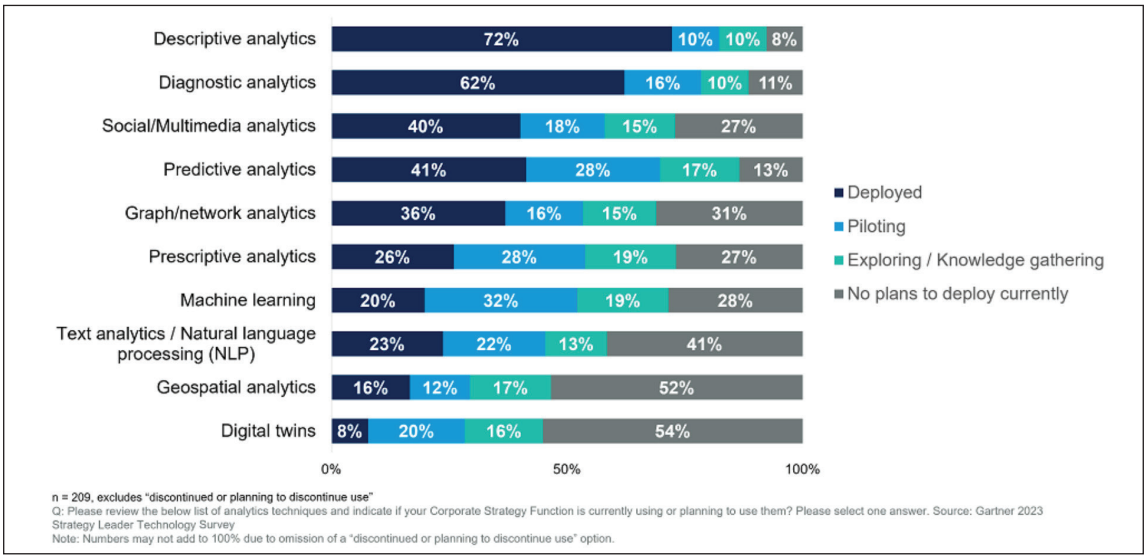
"After three years of volatility, CEO priorities are stabilizing," said Raskino. "Executive leaders are looking past the aftershocks of the omnicrisis period to a time when talent, sustainability and next-level digital change will be the levers of competitive performance."

In fact, mentions of environmental sustainability rose 25% over the previous year's survey, which was the first time sustainability ranked among CEOs' top 10 priorities. Gartner predicts that by 2026, environmental sustainability will be a higher CEO strategic business priority than the technology-related category. Inflation Drives Shifts in Customer Behavior Inflation was ranked as the most damaging business risk by 22% of CEOs, and nearly a quarter cited greater price sensitivity as the biggest shift in customer expectations they anticipate this year. However, increasing prices is still the top action that CEOs are taking in response to inflation (44%), followed by cost optimization (36%) and productivity, efficiency and automation (21%).

"It's concerning that CEOs do not yet seem to be focused on productivity as much as they should be in an inflationary period," said Moyer. "This may be due to wishful thinking that inflation will not become a persistent feature of the economic landscape. CEOs must embrace automation to redesign methods, processes and products for efficiency, rather than pushing cost increases onto customers."

Attracting and retaining talent is the top workforce priority

When asked about the impact of various risks on



➤ Figure 3: Corporate Strategists' Use of Analytics (Percentage of Respondents)

Source: Gartner (July 2023)

the business, 26% of CEOs cited the talent shortage as the most damaging risk for their organization. Attracting and retaining talent is, by far, CEOs' top workforce priority. Concerns about compensation are the biggest shift in employee and prospective employee behavior that CEOs anticipate, followed by a desire for greater flexibility and remote or hybrid work.

"The emphasis on pay is not surprising in an inflationary environment, but in prior economic cycles, unemployment would typically be undermining labor market power," said Raskino.

AI and analytics critical to success

Seventy-nine percent of corporate strategists said that technologies such as analytics, artificial intelligence (AI) and automation will be critical to their success over the next two years, according to a survey by Gartner, Inc. Strategists said that, on average, 50% of strategic planning and execution activities could be partially or fully automated; currently only 15% are.

The survey was conducted from October 2022 through April 2023 among 200 corporate strategy leaders in North America, Western Europe, Asia/Pacific, and Australia/New Zealand, across different industries, revenue and company sizes.

"Leveraging analytics and AI for more efficient, insightful strategy decisions is one of the biggest challenges, and opportunities, corporate strategists face this year," said David Akers, Director, Research at Gartner. "For years, strategists have told their businesses: If you want to stay competitive and effective, you need to go digital. Now, they appear ready to apply that guidance to their own workflows."

While most corporate strategists said that they are using descriptive and diagnostic analytics, less than half said they are using more advanced tools such as predictive, prescriptive or graph analytics (see Figure 1). Similarly, only 20% of strategists reported using AI-related tools, such as machine learning or natural language processing, for their function. However, a large percentage of strategy leaders said they are either piloting these tools or exploring use options. For example, 51% said they are investigating machine learning and 45% said the same for predictive analytics.

Build a use case strategy

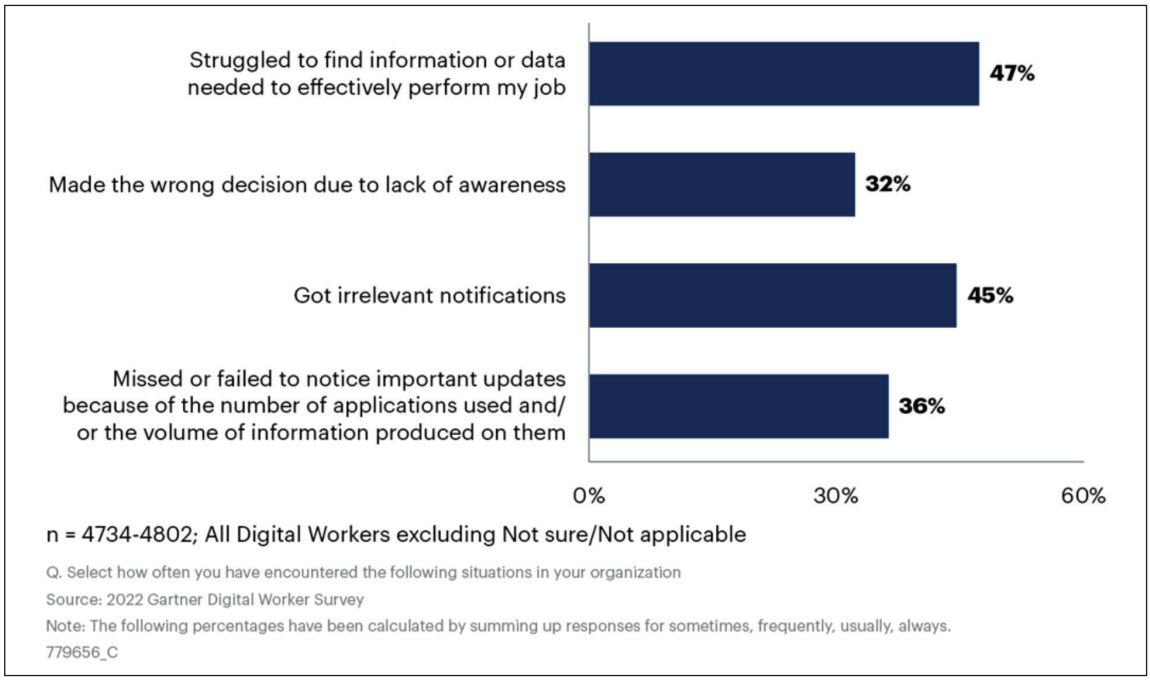
One of the biggest obstacles to implementation is establishing a clear use case for new technologies. Fifty-two percent of strategists report that this is a top-three challenge — the most selected response. "There are several reasons for this," said Akers. "Strategists face an unfamiliar vendor market, have too many options to choose from and have little precedent to build upon."

Much of the advanced technology that strategists said they are aiming to implement is already being used successfully elsewhere. To build a strong business case, Gartner recommends first mapping existing functionality to specific needs, then consider how to prioritize the different use cases that advanced technology could offer by asking questions about the purpose, impact and suitability of the new tools.

Digital workers struggle to find information

A recent survey by Gartner, Inc. found that 47% of digital workers struggle to find information or data needed to effectively perform their jobs. "Employees struggle to stay afloat as information and applications flood their digital workplace.

Although digital workers are putting in effort to try to efficiently manage this content to try reduce duplication and/or improve knowledge sharing and retention, finding the information needed to do their jobs can often be a challenge," said Tori Paulman, Sr Director Analyst at Gartner. "Digital workplace leaders need to create a process for



➤ Figure 4. Impact of Application Sprawl (Percentage of Respondents)

Source: Gartner (May 2023)

their employees that enables them to agree on applications they use to accomplish work."

The Gartner survey was conducted from September through November 2022 among 4,861 full-time employees that use digital technology for work purposes, at organizations with 100 or more employees in the U.S., U.K., India and China. Workers Want the Right Tools to Do the Job According to the survey, the average number of applications a desk worker, also referred to as a "knowledge worker," uses is 11, compared to six applications in 2019. Forty percent of digital workers are using more than the average number of applications and 5% of workers use 26 or more applications at work.

On an average, 66% of the respondents agreed that better business outcomes could be achieved if IT provided universally accepted and supported applications and devices to get work done. When a digital workplace applications strategy attempts to solve every challenge with a new application, the result is that digital workers struggle to find information, make the wrong decisions due to lack of awareness, get irrelevant notifications and miss important updates amid the noise (see Figure 1).

Workers would accept monitoring that helps them be more productive

Interest in employee productivity monitoring has grown since the pandemic. These systems are used to see whether employees are active on devices and in applications, or which employees are most productive and whether business outcomes are being met.

While employee productivity monitoring for the purposes at the lowest end of the spectrum is widely distrusted and disliked, 96% of digital workers indicated that they would be willing to accept monitoring in return for assistance in at least one of the options provided. Of the top three options, 34% of digital workers surveyed indicated they would accept monitoring in exchange for awareness of training classes and/or career development opportunities, 33% would accept monitoring for support in finding information to do their job, and 30% would accept monitoring in exchange for proactive outreach from IT support when facing problems with their computer or applications.

Workers want their technology problems solved proactively

The survey found that digital workers' top six preferred methods for solving issues with the technology they use for work are all through internal IT support, with the top three methods being live phone, chat and email conversations. When asked why, workers stated their top reasons were the expertise of the person solving their issue and the speed of resolution. These findings shifted from 2020, when workers also preferred other methods to solve their issues with digital technology, such as receiving answers on the internet and asking a co-worker.

"Digital workers are now demanding IT support be more proactive, solving problems with computers and applications before they are reported or even noticed," said Paulman. "Digital employee experience (DEX) tools can help IT teams achieve this by continuously improving device and application performance. "Digital workplace leaders must step up to lead DEX, and recognize they are an experience leader with a technology toolkit. They should focus on developing the qualities and practices of an employee experience leader, such as building connections across the business and increasing empathy for the way employees experience technology change."

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The Quantum leap

Uniting Industry 4.0 and Quantum Computing.

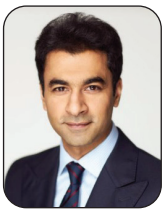
By Fawaz Aslam-Pervez, Partner, Business Development, Kyndryl

AI IS REIGNING SUPREME, with generative AI tools like ChatGPT, Bard, and numerous other AI-driven chatbots and image generators capturing the spotlight. 2023 has been hailed as the 'year of AI,' witnessing the rapid development of countless AI tools in the past six months alone. However, amidst the AI frenzy, there's another technology quietly proving its prowess as a driving force behind automation, data analytics, Internet of Things (IoT) and even AI: quantum computing. With its immense potential, quantum technologies are poised to seize the next big opportunity, ushering in a new era of possibilities.

The growth of quantum technologies

Quantum computing harnesses extraordinary computational power, surpassing the capabilities of traditional supercomputers. At its core are quantum bits, or qubits, which possess the unique ability to exist as both zero and one simultaneously in an entangled state. This extraordinary property empowers quantum computers to simultaneously explore multiple possibilities and uncover optimal solutions.

The potential impact of quantum computing is profound. It holds the key to revolutionizing every sector, unlocking breakthroughs in materials and drug development, providing novel approaches to address environmental crises, enhancing communication security, and advancing fields such as food production and weather forecasting.] Quantum computing has the potential to profoundly impact artificial intelligence (AI) and machine learning (ML) with transformative possibilities.



As the demand for advanced AI and ML applications continues to rise, traditional computers are limited in their ability to meet the complexities of these tasks. Quantum computing offers exponential growth and the capability to address these challenges head-on, presenting an opportunity for groundbreaking advancements in AI and ML. By harnessing the power of quantum mechanics, quantum computing unlocks new possibilities, propelling these fields into a new era of innovation.

Government spending on quantum technology reflects the buzz around it, with the US committing $1.8bn to research and development in 2022 and the UK launching a 10-year programme to invest £2.5bn in March 2023. However, the technology is far from being fully developed or as accessible as AI tools have become. Most computer scientists predict it will take around 1 million qubits to realise the technology's potential.

Industry 4.0 and its potential

Industry 4.0, also known as the Fourth Industrial Revolution, signifies the digital transformation of the manufacturing and industrial sectors. This revolution involves the convergence of IT, engineering technology (ET), and operational technology (OT), as well as the integration of emerging technologies across physical and digital environments. By modernizing OT and fostering collaboration between IT, ET and OT teams through Industry 4.0 methodologies, manufacturers are revolutionizing the potential of the industrial sector.

Industry 4.0 is supported by nine fundamental pillars:
1. Autonomous systems
2. Internet of Things (IoT)
3. Augmented Reality (AR)
4. Simulation
5. Cloud computing
6. Big data
7. Systems integration
8. Additive manufacturing
9. Cybersecurity

Outlined by the Boston Consulting Group, these nine technologies are the drivers of Industry 4.0, enabling factories, warehouses, plants, and other industrial environments to become "smart" through

the capture, optimisation, and deployment of data. Where quantum computing meets Industry 4.0 Quantum computing has a number of applications within the manufacturing industry, with unmatched data capabilities able to help find new correlations in data, enhance pattern recognition, and advance classification beyond classical computing, enabling optimised data analytics and performance.

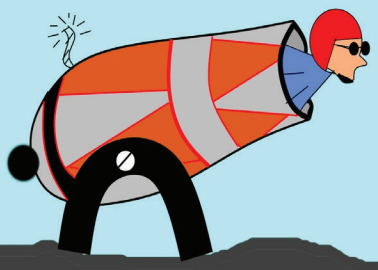
In production, quantum computing can be used with machine learning to analyse factors and processes to increase yield of products like semiconductor chips. Quantum computing also allows optimisations to be applied more dynamically to production flows and highly complex robotics, which would be very intensive for standard computing. This enables predictive analytics and more comprehensive quality control, using simulation technology to continually test components as they are being manufactured. As a result, future errors are minimised, security incidents are reduced, and unnecessary downtime is avoided.

Quantum computing also has the potential to optimise supply chain management by accelerating decision-making through things like route automation, as well as improving risk management with secure communication and cryptography. With supply chains evolving from a linear model into a more responsive, continuously shifting form, quantum computing can use real-time decision-making to meet these changing needs, adjusting supply chains based on industry demands.

A key example of quantum computing within the manufacturing industry today is Bosch. With over 120,000 connected machines and more than 250,000 devices used across their 240 plants, Bosch is using the vast amounts of sensor data taken from the machinery in just one plant to understand the ways in which they can improve operations as a whole. Using quantum computing and machine learning tools, Bosch is developing its own algorithms, based on existing data, to boost performance, productivity, and maintenance schedules.

Secure, educate, collaborate

As with most emerging technologies, quantum computing must be monitored carefully for security risks. The sheer power of quantum computing means it can unlock most encryption technology, making stored personal data or company IP vulnerable. Improved security measures are vital in protecting its use and future accessibility, and action from governing bodies is needed to ensure compliant behaviour before quantum computing becomes broadly commercialised.



To accelerate quantum computing's adoption in Industry 4.0, academia, industry players, and policymakers need to collaborate and work towards building the relevant skills within their organisations

To accelerate quantum computing's adoption in Industry 4.0, academia, industry players, and policymakers need to collaborate and work towards building the relevant skills within their organisations. With the right specialist skills and robust quantum architecture, as well as collaborating with the right solution partners, organisations can unlock new frontiers of innovation that give them a competitive edge.

Quantum computing has the potential to revolutionize Industry 4.0, transforming not only manufacturing but also reshaping the landscape of AI and ML. By unlocking unprecedented data resources, quantum computing enhances manufacturing processes, supply chain management, and various technological domains, including AI, VR, and IoT. Embracing the convergence of quantum computing and Industry 4.0 empowers businesses to enhance agility, expedite decision-making, and mitigate risks, placing them at the forefront of manufacturing's evolutionary journey. Moreover, quantum technologies redefine the boundaries of AI and ML applications.

While quantum computing may not have experienced the meteoric rise in popularity that AI or Industry 4.0 has, its transformative power holds the potential to shape the future of all industries. It is poised to redefine the boundaries of what is possible and revolutionize the way we approach challenges in fields beyond AI or Industry 4.0, making a profound impact on the entire spectrum of industries.

Why the traditional storage vendors have failed to sell into the AI market

(without mouthwatering discounts)

Pewak This time it is AI that has the storage industry reevaluating, pivoting and embracing this evolving market.

BY PEAK:AIO FOUNDER AND CEO MARK KLARZYNSKI

THROUGHOUT the last generations storage vendors have defined not only the technologies, but these vendors have also actively created the demand. It is this particular vision and perception of the market that has led to the development of new technologies. The vendors would evaluate the market from their perspective, which is sometimes a narrow vision, and determine what could be improved and add value, if presented correctly. The vendors then evangelise that new technology, create the value and in some situations create the feeling of fear of not having such features.

In many cases these technologies are simply incremental improvements - faster, bigger, more secure. In other cases, these innovations provide a new direction that adds to or replaces an existing method. All improvements have one thing in common, they are designed to differentiate the vendor from the competition and move away from simple parameters such as performance, price, reliability which are easily defined and therefore easy to compare.

Realistically, increased performance and its ilk are relatively simple to develop. The challenge lies in implementing a business model that can sustain the storage industry's traditionally high margins when the value of a solution comes down to performance, price, and reliability. It is much more profitable to focus on features that offer a potential value

For example, if a vendor's main value propersition is 40GB/sec performance within a simple internet search, within minutes a potential buyer could search competitive options. Add a feature like 'line speed varible deduplication' and what could a potential buyer compare? There is no benchmark.

Realistically, increased performance and its ilk are relatively simple to develop. The challenge lies in implementing a business model that can sustain the storage industry's traditionally high margins when the value of a solution comes down to performance, price, and reliability. It is much more profitable to focus on features that offer a potential value. Example, should your storage solution be struck by a lightning bolt, without the foresight of purchasing a 'snapshot driven duplication synchronise replication' solution, who knows what the cost would have been? Provides a viable value to present to for example eBay, who would lose millions for every moment it lost service.

The AI market is different in two ways:
The AI market is evolving and largely driven by startups and research institutions. It's all about funding: Both startups and research institutions require funding to develop new algorithms, build prototypes and push the boundaries of AI capabilities.

It is crucial to allocate funds strategically to prioritise elements that yield the best results for a project. Most specifically, at the hardware level, GPUs are high priority, Storage is low. Storage is certainly needed and must be fast, but ideally not at the cost of fewer GPUs.

The value of the actual data is also different. If we look at the traditional IT model and consider the likes of eBay at one end of the scale and the local convenience store at the other end, the data is very much the lifeblood of both businesses. With eBay, even one moment of loss of access to their data would be catastrophic. The convenience store may not be as time critical, but losing its stock control, credit and debit balance and deliveries would be a nightmare. It is simple to see why storage features are commercially needed for a mainstream business. eBay requires 24/7 uptime with zero recovery time. The convenience store might instead need a timed backup routine with snaphots. Either way, the data often cannot be recreated and therefore data management and protection features are important and provide realistic value. Data in this case is considered 'output', as it is created by the applications, is not easy to recreate and needs protection.

In AI, as much as data is important, contrary to the norm, the data is likely the 'input'. Take for instance, a dataset that consists of many copies of MRI scans. The valuable process in this case is how the AI reads and analyses the data, and the result it produces, which could be as simple as an algorithm, a model or an uncomplicated decision. No matter how hard we tried to force fit traditional storage features, other than performance, connectivity, reliability, and price it simply makes minimal commercial or technical sense to the new market which is focused on pushing innovation and is not concerned with legacy IT or fear and doubt. The new innovators are driving past 'what if this happens' and focused on creating solutions that will change our lives.

There will be a time when AI is more mainstream. We will see it at the fuel station, in schools and at the local shop. When it reaches this level of ubiquity, it will have created a new IT requirement and many new features will have been made essential. However, today's innovators need performance, connectivity and stability and at a price that does not grab funds from GPU resources.

Many storage vendors have attempted to re-brand and re-purpose existing high-end solutions for the AI market. After failing to justify the cost or value of the fatures, most have already moved out or have chosen to focus on the small percentage of super-scaled AI solutions. The smart vendors, who have listened to the market, talked to the end users and determined the real needs, have redesigned their offerings and are doing well within this extremely exciting market.

It's a completely new market with completely new visions and needs. Why would we expect storage designed specifically for an established market and model to simply fit in? In fact, just because it was ready and available does not mean it is appropriate.

Delete, don't destroy

Tackling the challenge of hard drive waste.

BY B.S. TEH, EXECUTIVE VICE PRESIDENT AND CHIEF COMMERCIAL OFFICER, SEAGATE

ACCORDING TO the United Nations, around 53.6 million tons of e-waste is produced every year worldwide. However, 83% of this e-waste is not being collected and recycled. With increasing volumes of technology hardware being produced and disposed, we face what the United Nations have referred to as a "tsunami of e-waste", which puts our planet at serious risk.

Let's put this in the context of data storage devices. Our world is creating data more rapidly than ever before. According to research by IDC, by 2026, 221 ZB of data will be generated worldwide, further accelerating the demand for hard disk drives. As data volumes continue to grow, creating more products also introduces the potential for more items entering the waste stream. A European Commission study estimates around half of all hard drives in the EU are destroyed when they are decommissioned, producing a huge amount of waste. There is now an urgent need to create a more sustainable datasphere.

At the end of a drive's life, the data obviously needs to be protected, and remains subject to global data privacy laws, intellectual property regulations, and data breach regulations, which all come with severe financial and brand penalties for data breaches. Many believe the only solution is to destroy old, discarded hard drives through shredding to make sensitive or confidential information totally irretrievable, helping companies save money on storage, as well as adhere to these privacy laws and protect their data or intellectual property.

While it is of course critical to avoid data leaks and security breaches at all costs, this should not preclude safe data deletion to help reduce e-waste. Disposal and shredding are not the only answer and are certainly not the most sustainable. This practice can create huge amounts of e-waste and in addition unnecessarily throw away rare metals. Without recycling, it's estimated that £370 million is lost annually in valuable raw non-renewable resources via e-waste, including gold, silver, copper, platinum, aluminium, and cobalt.

According to industry experts, including Felice Alfieri from the European Commission who produced a policy report on making sustainability in technology hardware and data centres, there is no need to shred from a data security perspective, and advocates for data deletion over device destruction. The reality is there is innovation that can prevent more e-waste from ending up in a landfill. While hard drives will eventually be retired, there is the real possibility to repurpose, reuse and recycle the drives before it enters the landfill.

Here are five things the data storage industry can do to play its part in tackling the e-waste challenge and reducing environmental impact.

Offer more secure solutions: Wiping software exists to securely delete information from hard drives that cannot be accessed again. Self-encrypting drives and Instant Secure Erase (ISE) capabilities are available, and hard drives can be digitally wiped through data sanitisation for redeployment into the market. For example, Seagate Secure Certified Erase feature provides standardised and certified data-erasure capabilities, which does not include physically destroying the drive, to prevent negative data-loss consequences.

Extend product life: Invest in enhancing the design and production process of hard drives from start to finish to reduce carbon emissions and use less of the earth's precious, finite resources. Circular design will take into consideration key factors such as modular components, using materials that are recyclable, and that can easily be taken apart and refurbished. Extending the life of the drive obviously offers significant financial benefits for buyers too.

Work in partnership: Collaborate with industry partners and suppliers to plan for the reuse, repair and resale of parts and materials along the production line. Also draw on the expertise and networks of industry bodies such as the Circular Drive Initiative (CDI), of which Seagate is a founding member. CDI works in partnership with global leaders in digital storage, sustainability, and blockchain to focus on reducing e-waste by enabling the secure reuse of storage hardware.

Be more energy efficient: Apply more sustainable measures throughout the manufacturing process of hard drives, such as water cooling, using renewable energy to power manufacturing sites, and recycling wherever possible. Aligning with ISO standards in implementing energy management systems will help create a common and sustainable energy management program across all manufacturing sites.

Introduce circular economy initiatives: It is time to stop scrapping hard drives and instead use circular economy initiatives that collect drives and reuse components. Seagate has itself extended the life of over one million hard disk drives (HDD) and solid-state drives (SSD) during FY22 through refurbishment and redeployment, preventing over 540 metric tons of e-waste from going to landfill. We have further diverted 87% of non-hazardous e-waste from landfill and recycled 82% of hazardous waste generated.

Circularity and repurposing data drives will preserve precious finite resources and extend the life of the product or even parts of it. As an industry, we must recognise our responsibility to address the environmental impacts of data storage and enable a more sustainable datasphere

Beyond these measures is the longer-term need to build sustainable innovation into R&D investment. For example, mass capacity enabled by Seagate's industry-leading HAMR (heat assisted magnetic recording) technology will greatly reduce CO2 emissions per Terabyte. The manufacturing process and lifetime power consumption of a 2 Terabyte drive have roughly the same carbon footprint as a 20 Terabyte drive, delivering a more sustainable and cost-effective data journey for customers.

Circularity and repurposing data drives will preserve precious finite resources and extend the life of the product or even parts of it. As an industry, we must recognise our responsibility to address the environmental impacts of data storage and enable a more sustainable datasphere. Working closely alongside customers, suppliers, partners, and employees, it is now time to identify and implement substantial improvements that will serve our industry and ultimately help protect the planet.

Accelerating business growth with data management

Whether stored in the cloud, on-premise, or at the edge, business leaders must prioritise strategic thinking and employ the right technologies to optimise data utilisation.

By Marco Pozzoni, Director EMEA Storage Sales, Lenovo

DATA IS DISTINCT as its value escalates with its volume. This is precisely why data management holds immense significance for present-day businesses, as this precious asset can be found in various forms, be it within vehicles, sensors, or point-of-sale systems. By effectively managing data across the cloud, on-premise devices, and edge devices, leaders can rapidly capitalise on data's potential value.

Think of a video camera which monitors traffic or customers in a shop. A few years ago, that information would have gone to a data centre, and been accessible if you needed to look back at what had been recorded. Today, that is no longer enough; the data is put to work immediately. Artificial intelligence (AI) is applied in the camera itself, and processing at the edge means decisions can be made instantly. Information still moves to the data centre, but in a smarter way.

Data management is not just about hardware or software, it's a whole vast ecosystem. Regardless of where it's located, you must be able to guarantee that your data is available to users and applications across the business. Data management ensures that data is ingested, stored, and used effectively, allowing businesses to take advantage of it. This delivers the fuel for business applications, operational decision-making and strategic planning.

Data management's potential

For every business, data management is going

to grow in importance over the coming years. Organisations' data requirements aren't getting smaller; it's always the opposite. Companies are generating more data, as are applications, and an increasing amount is coming in from outside organisations. Legacy data management systems, which were built for closed data centres, don't have the capacity to keep up with these growing demands. Subsequently, only 23% of companies feel prepared to manage the vast amounts of data generated by connected devices, according to Lenovo's 'Data for Humanity' report.

Effective data management means business leaders can stay abreast of the ever-surging tide of data, as well as deploying new services quickly, and scaling faster. It can deliver insights which lead to new business streams or even the reinvention of the entire company.

Data management comes in multiple forms, encompassing both hardware and software. Solutions include unified storage, which enables organisations to run and manage files and applications from a single device, and storage-area networks (SANs), offering network access to storage devices. Hyper-converged infrastructure (HCI), which virtualises all elements of conventional hardware systems, also helps with offering unified management for virtual resources across compute, storage and networking. This helps to streamline innovation, reduce costs, increase flexibility, and accelerate results when it comes to data.

Unlocking a successful data strategy

For business leaders hoping to develop a data management strategy, open-mindedness is key. Beyond the infrastructure layer, it's important to think carefully about which solutions to adopt in order to find the strategy that works for your specific business needs. There is no one-size-fits-all for any organisation. Scalability is helpful, with pay-as-you-go models offering the flexibility to buy in the power you need, when you need it. Whether dealing with a data lake, or smaller data silos which talk to each other, a
holistic approach is key. Business leaders should ask themselves what they are trying to achieve, and where they want to be in five years.

In businesses that have truly mastered data management, IT teams work closely with the rest of the business, ensuring that data is available promptly, delivered effectively, and that users are enabled to leverage the insights they need. According to Lenovo's research, only 52% of organisations feel happy with their current data platform. The study singled out a small number of organisations (15%) categorised as 'Data Leaders' who use data effectively, finding that 40% of businesses in this elite group feel that their IT team works in partnership with the business to deliver data-led initiatives, compared with just 24% of those deemed Data Followers. Similarly, only 13% of Data Leaders feel there is a communication gap between those responsible for purchasing data technologies and the rest of the business, rising to 39% of the Data Followers. Among the Data Leaders, data tends to be used collaboratively across different business functions, such as sales or marketing teams, rather than being predominantly owned and accessed by one team. Leaders in these organisations are reaping the benefits, with 78% showing increased revenue and 70% enjoying improved customer satisfaction.

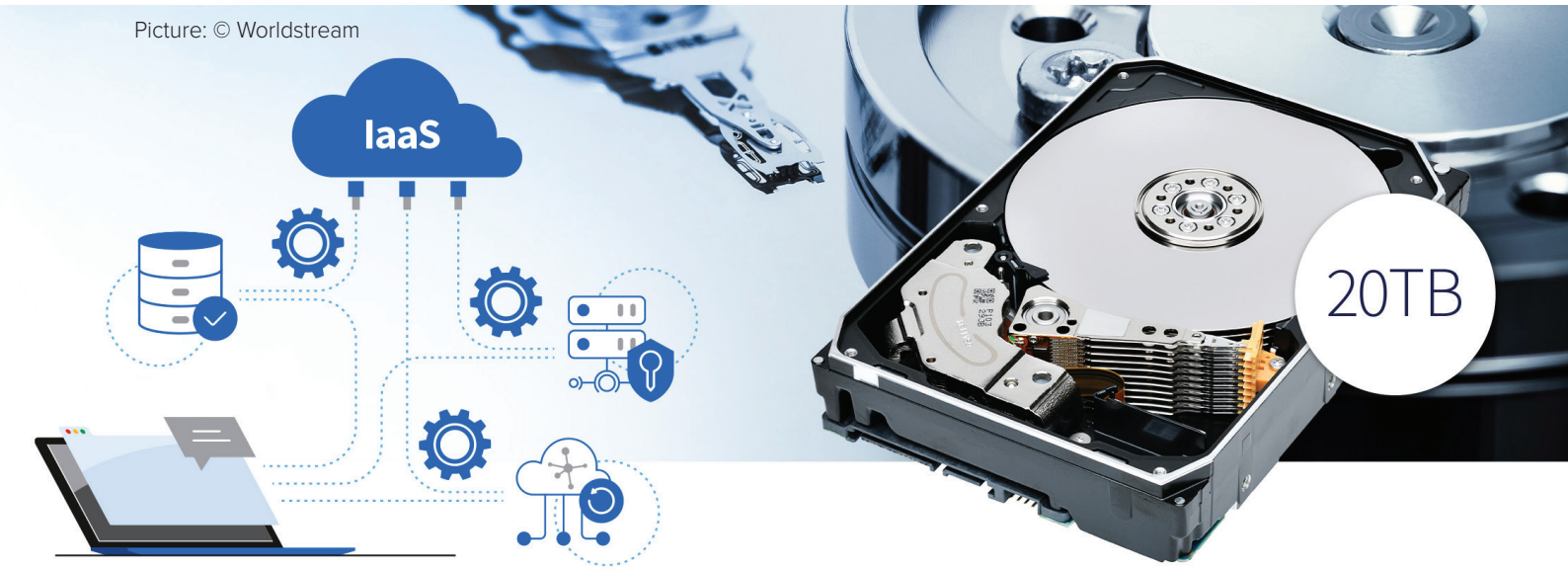
No matter how you look at it, effective data management delivers clear, measurable results. Incorporating data analytics and data security
As well as data management, the Data Leaders thrive in two other key areas: data analytics and data security. These three elements are interdependent. Data management naturally works hand-in-hand with data analytics, and data security is increasingly important as business leaders hope to share data with partners securely. It's impossible for leaders to thrive when it comes to data management if they haven't harnessed data security, or to adopt data analytics without mastering data management. Business leaders have opportunities to build on these synergies.

Increasing automation of data management is regarded as a central factor in helping businesses unlock the value of their data in the coming years, according to 89% of organisations in the Data for Humanity report. But many still lack an automated solution for dealing with data, leading to the potential for it being underused, or languishing in silos within the organisation. Data security is also regarded as an area for development. With continuously evolving threats and an ever-complex landscape, security capabilities need to grow in tandem. By opting for data management solutions with end-to-end security built in, stretching from edge to cloud, organisations can ensure that data is protected at all times, and from any location.

The fourth element at play is data culture. Improving this within an organisation can help to boost collaboration between data teams and business units. Methods for achieving this include upskilling employees with data skills, or employing a Chief Data Officer to oversee the use of data within a business, ensuring that it is stored, shared and used effectively.

Business benefits of data management

In today's business landscape, data holds immense value, making data management a critical aspect for companies to unlock its potential and drive growth. Whether stored in the cloud, on-premise, or at the edge, business leaders must prioritise strategic thinking and employ the right technologies to optimise data utilisation. The business benefits can be substantial if companies home in on data management, leverage data analytics and security measures, and cultivate a data-centric culture, making the most of their most valuable asset: data.



Picture: © Worldstream

Focusing on the emerging IaaS industry

Worldtream needs to ensure operational reliability 24/7 without impacting the services provided to customers - balancing large storage capacity and high-performance benchmarks with cost-effectiveness. The company deployed the ultra-reliable, high-capacity Toshiba MG-Series 3.5-inch format HDDs across its main data centre sites in Europe.

WITH STATE-OF-THE-ART facilities covering over 5,000 square meters and 15,000 servers in operation, Worldstream is a major player in the IaaS market. Headquartered in the Netherlands, the company serves an international customer base that includes major financial institutions, as well as established brands in the industrial, broadcasting, enterprise, and agricultural sectors.

Customer needs always in focus

Worldstream offers a wide range of services to its customers, including public and private cloud, colocation, dedicated server infrastructure, and various storage solutions. The company places a strong emphasis on providing value for customers and ensuring their data is fully protected from possible cyberattacks through the implementation of top-tier security measures. As the data requirements of Worldstream's SMB, CSP, MSP, and enterprise customers continue to grow, effective storage technology is essential. The management team at Worldstream prioritizes the reliability and performance of their storage solutions to avoid downtime and keep up with demand, all while keeping costs in check. Rapid capacity scaling is also crucial to meet customer needs.

Outstanding partner needed

To meet their storage needs, Worldstream's management team was seeking a vendor that could provide data storage solutions that met specific criteria, including speed, longevity, small footprint, scalability, and attractive pricing. Each server needed to be able to incorporate at least 60TB up to a maximum of 200TB of storage capacity, with provision for as much as 300TB at a later stage.

Toshiba was selected as the outstanding partner due to their cutting-edge recording technology and the compact high-capacity HDDs they brought to market. Toshiba's MG Series HDDs feature an innovative 9- and 10-disk helium-sealed design that allows for heightened storage densities to be attained. These 3.5-inch form factor units feature capacities of up to 20TB and 18TB respectively, with a data transfer performance of 268 MiB/s and disks that rotate at speeds of 7200rpm.

Customer benefit from inventive technology

The Toshiba MG Series HDDs come with either 6.0Gbits/s SATA or 12.0Gbits/s SAS interfaces included. Their long-term reliability, with a MTTF of 2.5 million hours, combined with low power consumption, delivers significant advantages to customers in terms of total cost of ownership (TCO). With their 3.5-inch form factor, these HDDs can easily be added into Worldstream's server bays, providing large data capacities in a small amount of space. This has allowed the Worldstream

engineering staff to make optimal use of the available space.

Trusted partnership for optimized results

Toshiba has now become the company's go-to supplier for data storage components. There are currently over 10,000 HDDs deployed at the Worldstream data centre sites in Haarlem, Naaldwijk (the Netherlands) and Frankfurt (Germany). These provide a total of 100 PB of storage resources, and planned installations over the coming years are set to increase this still further.

Toshiba has now become the company's go-to supplier for data storage components. There are currently over 10,000 HDDs deployed at the Worldstream data centre sites in Haarlem, Naaldwijk (the Netherlands) and Frankfurt (Germany)

Lars Kleijn | Purchasing Manager, Worldstream, comments: "At Worldstream, we rely on cutting-edge HDDs from Toshiba to deliver the high-quality services our customers expect. With Toshiba's enterprise-grade storage resources, we can meet rising demands without sacrificing quality or affordability. Partnering with industry leaders like Toshiba ensures we have the resources we need to stay competitive and satisfy our customers."

Larry Martinez-Palomo Vice President & General Manager, Storage Products Division, Toshiba Electronics Europe GmbH adds: "High reliability, quality and flexibility characterize the cooperation between Worldstream and Toshiba. Worldstream is a major player in the data centre and IaaS sector and Toshiba has decisively shaped the development of hard disk drives over the past 40 years with his pioneering spirit. Together, the two companies want to advance green technologies - for a future that uses resources sparingly and focuses on constantly improving the efficiency of products and infrastructures."

Picture: © Toshiba

What is Generative AI and is it the way to AIOps?

What ChatGPT has done is supply a proof-of-concept for Generative AI. It has given us a glimpse into the possibilities of how we might work differently and, for us in the F5 Office of the CTO, some interesting exploration into how it might be applied to app delivery and security.

LORI MACVITTIE, F5 DISTINGUISHED ENGINEER

GENERATIVE AI is an application of machine learning that can create a variety of content such as text, images, or audio from natural language prompts. It gained broad popularity with the introduction of ChatGPT – an OpenAI project – that resulted in an explosion of new uses across industries.

If you haven't tried ChatGPT, I encourage you to take a moment and ask it a few questions. Ask it to tell you about, well, you or someone in history or explain how something works. While caution is advised – ChatGPT isn't always right – it is an eye-opening experience because it is a new experience.

What ChatGPT has done is supply a proof-of-concept for Generative AI. It has given us a glimpse into the possibilities of how we might work differently and, for us in the F5 Office of the CTO, some interesting exploration into how it might be applied to app delivery and security.

From imperative to declarative to generative

One of the challenges in infrastructure is configuring the myriad devices, services, and systems needed to deliver and secure even a single application. Organizations rely on an average of 23 different app

services – if you exclude 'as a service' offerings. Now, I don't have to tell you that configuring a web app and API protection service is different to configuring a plain old load balancing service. What that means is that the folks responsible for configuring and operating app services may need to be experts in a dozen different languages.
The industry has been trying to address that for years. When APIs became the primary means of configuring everything, app delivery and security services were no exception. Everyone started with imperative APIs, which simply changed how you issued commands. Instead of typing commands on a CLI you sent API commands via HTTP. Fairly soon it became clear that the API tax incurred by relying on imperative APIs was too high, and the industry shifted to declarative APIs. But unfortunately,

most of the industry decided declarative meant "configuration as JSON." So instead of the intent (that word is important, so remember it) behind declarative, which is "tell me what you want to do, and I'll do it for you," we ended up with "here's the configuration I want, go do the hard work of doing it."

It's not quite the same, and it still needed the same level of expertise with the operating model specific to a given solution. I'm not sure the industry ever reached agreement on whether load balancers used "pools" or "farms," let alone the more complex details of how virtual servers interact with real servers and application instances. So, all the industry did with declarative was to offload the command-level work from operators to the system.
Now, what Generative AI brings to the table is a form of low code/no code. These are more reliable than some results because they're based on well-formed specifications that guide the generation of results. There are only so many ways you can write "hello world" after all, while there are millions of ways to answer a question. Which means I should be able to tell a trained model, "Hey, I want to configure my load balancer to scale App A" and the system should be able to spit out a configuration. But more than that, I should be able to tell it, "Give me a script to do X on system Y using Z" and BAM! Not only should it generate the configuration, but the automation necessary to deploy it to the right system.

Oh look. It already does.

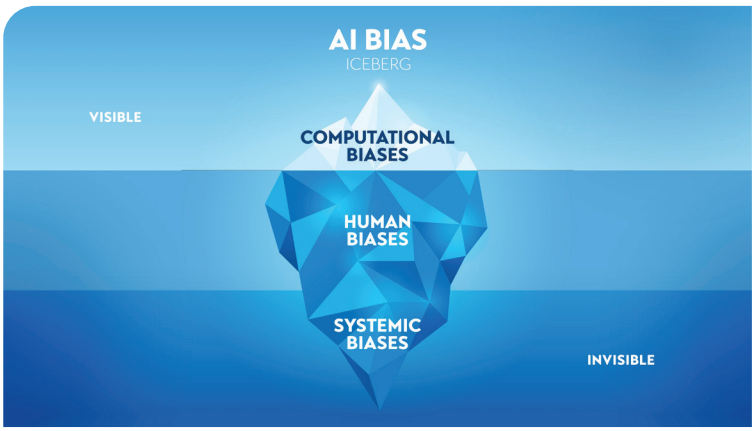
Certainly, this is not production ready code—neither the IP nor credentials are valid, and it picked Python (not my first, second, or third choice)—but it's 90% of the way there based just on publicly available documentation and a remarkably simple prompt. The more detailed the prompt, the better the results. Again, not ready to deploy, but it's much closer to being functional and took literally less than fifteen seconds to generate with no training from me.

Beyond generation to automation

But this is the easy stuff. I should further be able to tell it, "Oh, by the way, deploy it." And the thing should do it while I'm enjoying my morning coffee. And perhaps sing me a little song, too.
But wait, there's more! What if I can also tell a Generative AI system later, "Hey, users in Green Bay are logging in a lot and performance is down, clone App A and move it to our site in Milwaukee."
And it does. Because under the hood, all of this is just a web of APIs, configurations, and commands that can and are often automated by scripts today. Those scripts are often parameterized, which loosely correlates to the parameters in my AI prompt: Green Bay, Milwaukee, App A. So what changes is the generator, and the speed with which it can be generated.

I often say that AI and automation are force multipliers. Because technology doesn't know what it needs to do, we do. But AI and automation can do it much faster and efficiently, effectively amplifying productivity, increasing time to value, and freeing up experts' time to focus on strategic decisions and projects. And over time, the AI can learn from us, further multiplying our capacity and exposing new possibilities.

This is no longer science fiction but computer science reality.



Generative AI will enable the AIOps we need Many of today's AIOps solutions focus solely on delivering the insights 98% of organizations are missing. They answer yesterday's problems, not tomorrow's needs.

Even those AIOps platforms that can act more autonomously – like security services – are highly dependent on pre-existing configurations and well-formed responses. It doesn't typically use AI to enable operations to execute more autonomously across the heterogenous app delivery and security layers. They use AI for data analysis and uncovering insights we, as humans, don't have the ability or time to uncover. But that's where it often ends, at least for layers above the networ

That's where Generative AI can take over, and why I'm all in on investigating just how far we can take this technology to make app delivery and security ridiculously easy.

Welcome to the tip of the AI iceberg.

APM: The symbiotic relationship between network and end user experience

If CIOs take time to understand the capabilities of APM to improve network experience, application experience and, ultimately, customer experience, their tech teams will save valuable time and deliver the high levels of app performance that users expect.

BY PAVEL MINARIK, VICE PRESIDENT, TECHNOLOGY AT PROGRESS

WHEN IT COMES TO IT infrastructure, end users tend to focus on what they can see in front of them - all that matters is how the applications and software perform. Users' are increasingly intolerant of poor application performance. According to research by Cisco AppDynamics, 60% of customers blame the application or brand when performance issues happen. It's therefore vital that organisations prioritise performance and overall user experience above all else.

However, apps do not exist in isolation. The overall performance of the network largely determines an app's performance for end users. While applications run both on internal servers and the cloud, the performance of the network governs an app's performance. User experience (UX) and application experience (AX) are also based on this.

It's a requirement to understand how fast apps are running, any existing pain points and how to mitigate these. Ensuring that apps are providing an optimum user experience can be achieved through implementing Application Performance Monitoring (APM) as an essential component of network management.

Why APM matters

Every app, whether a retail app or accessible in the cloud should perform at a high level and provide a positive user experience. Tech teams need to know how fast their apps run, in order to rapidly identify and address sluggish performance. It's important to know if customers and prospects are happy with the speed and performance of an app. And it is equally important to distinguish between network and application delay to avoid endless discussions and finger pointing. In the case of any problems arising, IT needs to know the root cause of the issue so they can solve it.

Not only does APM play a key role in ensuring quality end user experience, but it also ensures compliance with performance-related service level agreements (SLAs). From a network perspective, APM can show how long the user waited for a request response and measure response times for the application as well as databases and the network. If the solution is agentless, it detects the network traffic and monitors the responses. An APM solution can generally monitor all modern HTTP and HTTPS applications as well as transactions between the application and related database servers.

How effective APM benefits user experience

APM solutions work on the application layer and perform essential calculations for speed and delivery of engagement. They detect application traffic, then do TCP (transmission control protocol) assembly of the connection, parsing the application layer and measuring responses and other metrics. Importantly, APM measures the transport time of a request from user to application. It has the ability to track precise application delay, and response time from the application server to the request. Details of

any application delays can easily be viewed by IT in the APM console.

Ensuring optimum application experience depends entirely on monitoring application performance and comparing delivery to agreed goals. This meaningful data can be provided for the network-based apps in various different charts and reports, including the number of transactions, server response time, network transport time and number of concurrent users.

Should an application error arise, APM solutions empower IT and network teams with error details such as the error code, its timing, user identification and further information about the transaction. IT can then troubleshoot the transaction, accessing as detailed information like the query details including parameters. The issue can then be resolved and application performance restored.

Key foundations for best practice APM

Application performance management isn't a completely plug and play solution, but requires a few considerations for effective implementation. Some of key foundations for establishing best practice APM include:

1. Prioritise apps to monitor

Monitoring the many apps of a typical enterprise is no mean feat – it might not be possible to monitor the performance of them all. IT and business leaders can prioritise the key applications to monitor in terms of response time. The accounting system may seem critical, but its performance is not as crucial as a customer-facing eCommerce application. It's best to prioritise according to what kinds of transactions each application is responsible for.

2. Integration

For maximum effectiveness, APM must be considered an integral part of the organisation's IT monitoring, management and surveillance ecosystem. APM is often tightly integrated with network and IT infrastructure monitoring solutions and ties into their dashboards and reports.

3. Automation

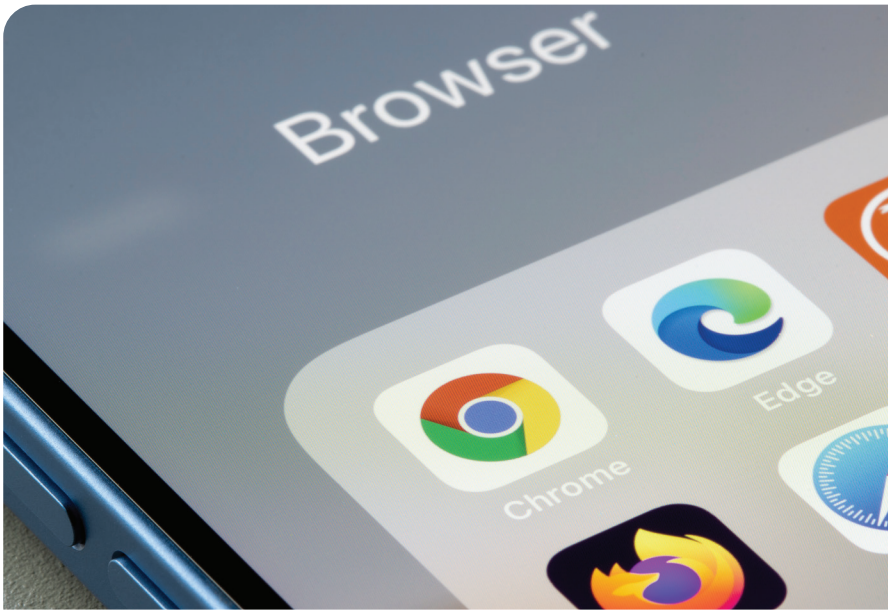
Automation is an IT godsend. For APM, look for ways to automate the collection of data, reporting and even automate responses to common IT issues, such as restarting a frozen server. For applications, there can be automated responses to performance problems or to deal with traffic spikes.

4. Minimise alerts

APM systems avoid flooding IT with alert overload by informing the appropriate person for an issue that needs attention. They can alert them through their chosen communication method – for instance, email, Slack, or Teams.

5. Tailored reporting

With the right solution, reports can be tailored according to the recipient's role. This means that the IT staffers can pull dedicated activity reports, with high-level reports generated for the management team. With reports integrated into forecasting tools, IT pros can more easily predict an application's future performance.



Maintaining app performance is table stakes for loyalty

Substandard or slow app performance – whether network or app-related - is usually the biggest threat to a good user experience. This is why complete visibility into the network, its related resources and the state of applications is table stakes to identifying and resolving issues quickly and effectively. With spiralling user expectations, quick resolution of any issues will ensure the high level of frictionless customer experience that maintains brand loyalty.

Tech pros can only improve application performance if they are measuring it. If CIOs take time to understand the capabilities of APM to improve network experience, application experience and, ultimately, customer experience, their tech teams will save valuable time and deliver the high levels of app performance that users expect.

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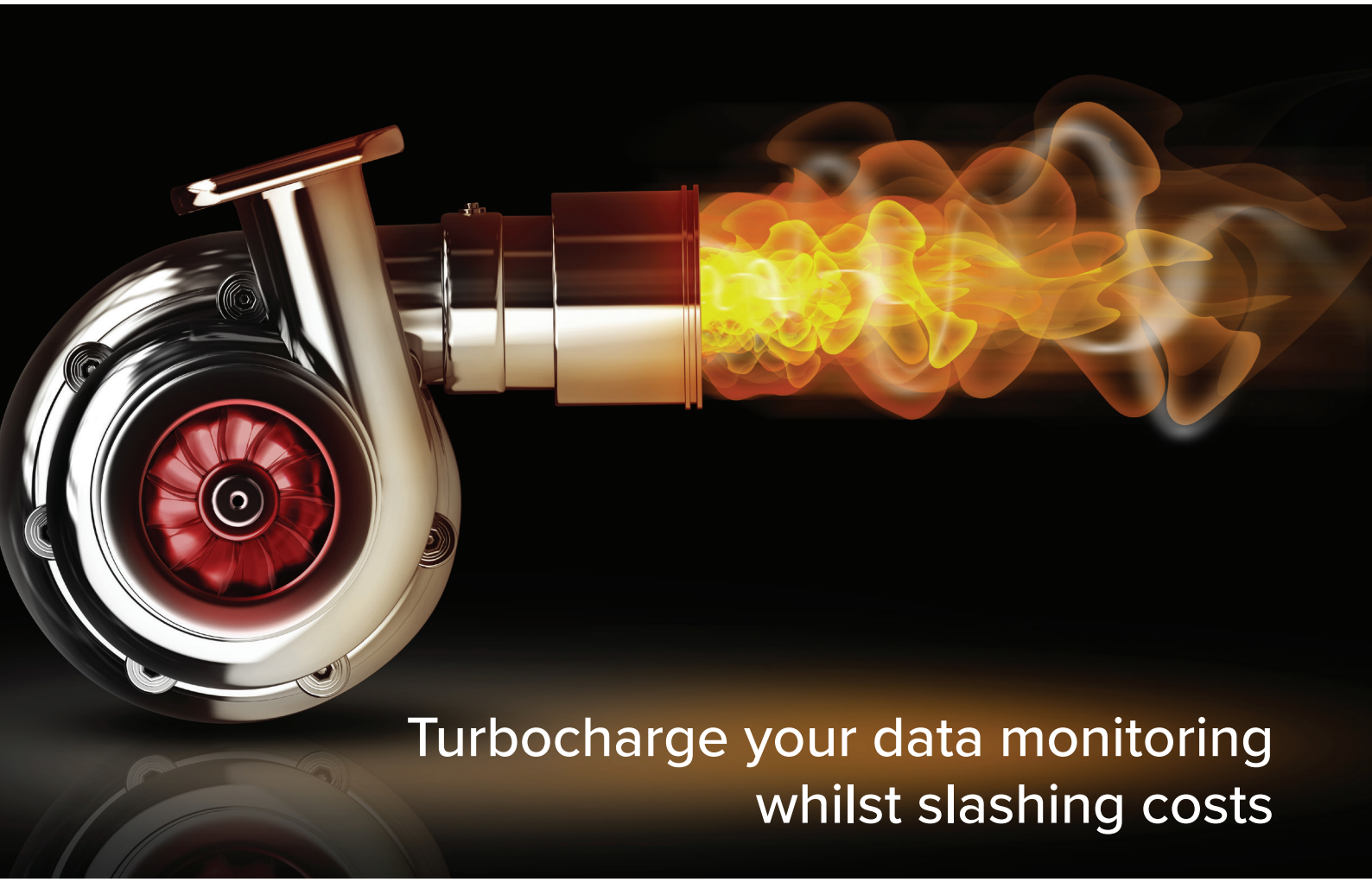

Turbocharge your data monitoring whilst slashing costs

In the realm of data-heavy businesses, the significance of data monitoring and measurement is steadily increasing. Organisations seeking valuable insights from the influx of information within their ecosystem have likely contemplated the latest monitoring tools available in the market.

BY ROMAN KHAVRONENKO, CO-FOUNDER OF VICTORIAMETRICS

DATA IS OMNIPRESENT, and as technology continues to advance, the volume of data continues to increase exponentially. In fact, it has been predicted that by 2025, the world will hold over 200 zettabytes of data, meaning any monitoring solution needs to be operational on an immense scale.

Huge amounts of data have always existed, we just now have increased capabilities to monitor and observe it. New technologies mean we can produce more observations from data, simultaneously contributing to the exponential growth of data, which we couldn't previously do. However, despite this, many traditional data management approaches often fall short of addressing these challenges, leading to scalability issues and increased costs.

Data monitoring is well-suited for open source solutions, as the innovative and adaptable nature of the community propels progress. The primary challenge in the field of monitoring lies in keeping up with the growing volume of data within. Consequently, any monitoring solution which cannot accommodate this growth will swiftly become obsolete. Hence, scalability becomes imperative.

Open source monitoring solutions must strive to achieve scalability that approaches the limits of infinity in order to make a lasting impact. While the term "infinite scalability" is frequently used, it technically defies the laws of physics. Nonetheless, there are various ways in which projects can structure their monitoring systems to optimise scalability.

Vertical and horizontal scalability

The conventional approach to scaling, known as vertical scaling, involves enhancing the resources

of a single server to handle increased data or load. This can be achieved by upgrading the CPU, increasing RAM, or expanding storage capacity. Vertical scaling is effective in the short term, and top-notch monitoring solutions excel in scaling across single nodes.

However, to achieve scalability that is as close to "infinite" as possible, scaling vertically and horizontally proves to be the most effective method. If enterprises rely solely on vertical scaling, this can result in major costs on hardware and software, and can be a drain on data management time.

Horizontal scaling, also known as sharding, entails distributing a single dataset across multiple databases, which can then be stored on numerous machines. This enables larger datasets to be divided into smaller segments and stored across multiple data nodes, expanding the overall storage capacity of the system and ensuring scalability. Horizontal scaling allows for near-limitless scalability, enabling efficient handling of big data and demanding workloads.

This scalability enables businesses to monitor and analyse vast amounts of data without the need for expensive infrastructure upgrades. Furthermore, open-source solutions offer flexibility, allowing businesses to customise and extend the monitoring capabilities according to their specific needs, eliminating the cost of vendor lock-in.

However, it is equally important to consider the structure of these smaller clusters and the most effective way to scale out, which leads us to the concept of multilayer architecture. Sharding distributes data across smaller compute instances called shards, with each shard holding a portion of the overall database. For instance, with five shards, there would be five compute instances, each holding 1/5th of the total database.

Multilayer architecture

Multilayer architecture empowers developers to increase the scale of data handled by each shard. This involves assigning additional smaller databases to each individual shard. Consequently, instead of having one large database split across five shards, the original database is retained while five smaller databases are added. For example, instead of having 100 shards, you have 4 shards. And each shard represents a separate database with 25 shards in it. So you logically separate data across multiple databases, while for the user it remains as one single database.

Compression algorithms

Compression algorithms play a vital role in any scalable monitoring solution by reducing the number of bytes needed to represent data and the amount of memory required to store and transfer it. Effective compression techniques are crucial for maximising the return on investment from available disk space. Simply put, efficient compression algorithms make storing and transferring more data on the same disk easier. Compression also improves data reading and transfer times, resulting in faster overall database performance.

Downsampling

Downsampling is another technique for reducing the number of samples stored required per data series, enabling organisations to increase the amount of data stored on a disk without sacrificing insights into historical trends. Downsampling involves lowering the resolution of older records, using compression algorithms to condense them into a manageable size. This approach provides valuable insights into long-term trends and improves query times for databases.

Simplicity and single responsibility

When designing a scalable distributed system, using simple components facilitates future scalability. Simple components should focus on one or two functions and perform exceptionally well without relying on other components. This decoupling enables the independent scaling of individual components. Otherwise, scaling any one component can cause a ripple effect throughout the system. For instance, scaling the serving of read queries might require scaling the caching layer, which in turn necessitates scaling another component.

Lastly, this approach helps minimise the cost of scaling. While theoretically infinite scaling is (almost) possible, cost efficiency plays a crucial role in realising this potential. The key to achieving cost efficiency lies in simplicity and transparency. The fewer hidden mechanisms and components involved, the greater the efficiency will be.

Cutting costs

Nowadays, with the plethora of data monitoring solutions out there, enterprises can fall into the trap of spending excessive amounts. For example, Coinbase previously invested $65 million on

Datadog, when it could have utilised open-source technology instead, and saved copious amounts of money. Monitoring doesn't need to break the bank. Scalable and cost-efficient solutions have existed for years, so enterprises are self-sabotaging by deploying expensive and sometimes inefficient solutions.

Open-source solutions are free by default or have lower licensing costs compared to proprietary software in the case of open source vendors who offer a commercial version of their software. This reduces upfront expenses for businesses, allowing them to allocate their resources more efficiently. Furthermore, open-source solutions can be deployed on existing hardware infrastructure, eliminating the need for additional hardware investments.

Additionally, many industries have stringent compliance and regulatory requirements, such as data retention, security, or auditing. Open-source time series data monitoring solutions often provide customizable compliance features, ensuring businesses can meet these requirements without incurring additional expenses associated with proprietary software or third-party compliance solutions.

Data Gravity

Open-source solutions allow businesses to deploy monitoring tools in close proximity to their data sources, whether it's on-premises or in the cloud. By placing monitoring agents or collectors near the data, businesses can reduce the need for data movement, thus minimising latency and network bandwidth constraints associated with data gravity.

As open-source solutions are designed to enable businesses to deploy monitoring components across multiple locations or nodes, this distributed approach aligns with the idea of data gravity by allowing businesses to monitor their data where it resides, rather than consolidating it in a central location. This not only reduces data movement but also provides a holistic view of the entire data landscape, including diverse data sources and distributed systems.

In conclusion, leveraging open-source software for data monitoring offers significant advantages in terms of scalability, cost-efficiency, and addressing the challenges of data gravity. By leveraging open-source solutions, businesses can optimise performance, reduce costs associated with data movement, and gain a comprehensive view of their entire data landscape.

Moreover, open-source solutions often come with lower licensing costs and can be deployed on existing infrastructure, enabling businesses to allocate resources efficiently and avoid additional hardware investments.

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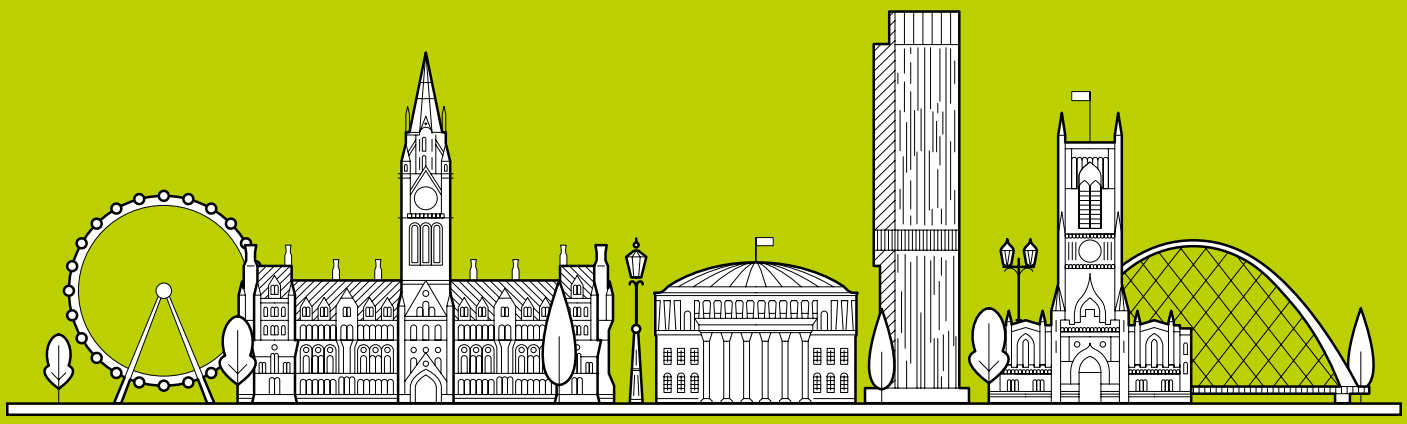

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The challenges of database modernisation in the Cloud Native era

Yugabyte, the open source distributed SQL database company, shares their cloud database modernisation insights and reflects on the importance of strategic planning and finding the right expert support.

BY DAVID WALKER, FIELD CTO, EMEA

DATABASE MODERNISATION is fundamentally about bringing the benefits of cloud native to the data layer.
There are tangible motivations for embarking on this transformation, including mitigating exorbitant license fees and leveraging databases specifically designed to meet the demands of the modern cloud era. But for now, let's set those factors aside to focus on the broader perspective.

A driving force behind database modernisation is realising the promised advantages of the cloud, such as eliminating over-provisioning and redundancy. For example, China's Singles Day is the busiest day for card transactions globally and requires substantial computing power. Traditionally, a global payments provider would need a massive on-premises server to handle this huge peak in workload. However, for most of the year, the enterprise would require just a fraction of the server's capacity.

In the conventional IT landscape, businesses purchased infrastructure, services, and extensive database admin support, to cater for just a few peak periods. However, times have changed! You can now migrate to a modern cloud native database technology to gain elasticity and scalability without incurring additional costs. This allows you to add or remove nodes and eliminate asset wastage.

Additionally, as a cloud native database has a distributed architecture, if a single server fails, it won't jeopardise your entire operation. Attempting to make legacy monolithic databases function optimally in the cloud by resorting to workarounds like sharded databases is ineffective, complex, and time consuming. Even NoSQL databases, which take resilience and elastic scaling in their stride, are a step removed from the transparent transactional consistency vital to most systems of record.

Infrastructure and application modernisation has progressed within the enterprise, but it is becoming evident that database modernisation (traditionally left behind) now requires critical attention to ensure it can adequately support modern business operations.

Embracing a cloud native approach not only offers cost savings, resilience, and scalability, but also paves the way to unlocking the full potential of the cloud. However, it's crucial to recognise that embarking on this journey without proper planning and guidance can lead to (sometimes severe) complications.

Understanding and managing complexity and cost

Understanding and managing your data is paramount. Most IT organisations live in a highly

heterogeneous, and often highly complex, database environment. So, it's likely that your organisation deals with multiple database types, such as Oracle, IBM Db2, Microsoft SQL Server, and others, alongside numerous instances of these databases. Enterprises generally juggle between two and five database types, but many companies (especially those that have been around a long time, or acquired other organisations) can have ten databases or more!

While it's very common (and often required) to utilise different database types for various jobs, reducing the number of database types and instances should be a priority. Unnecessary data duplication leads to management and integration complexities, it also requires you to employ a higher number of DBAs with varying skill sets, pushing up your IT department costs.

Instead, you should strive for an optimal combination of two or three database types, each with dedicated instances for specific business services. This will reduce costs and maximise resilience—both essential aspects of the database modernisation journey.

When migrating databases from a platform (such as the monolithic legacy provider Oracle) it's important to understand that it's not as simple as just copying data and performing a lift and shift.

A migration requires a comprehensive redesign of your data layer to fully exploit the potential of cloud infrastructure. This is undeniably complex, but the emergence of modern cloud tools and dedicated professional services allows you to automate many aspects of the database migration project.

Although a database modernisation programme requires a resource investment, it offers long-term operational cost reduction and greater business agility. A well planned and executed migration programme will be incremental, delivering business benefits continuously through what may be a multi-year project.

A programme like this is essential for organisations that want to fully leverage the powerful upside of a cloud native data layer. However, these benefits come at a cost and will require in-house commitment from multiple teams to ensure a successful business outcome.

Database migration is not a one-off task; each application may require individual attention. While the cost of a single application migration might be acceptable, organisations with a large number of applications, such as financial services companies, will need to programmatise and optimise the process.

Automating a migration at scale will result in substantial cost savings. For example, if a single migration is £50,000, an automated approach could potentially save millions when applied across multiple applications.

Avoiding cloud database migration pitfalls

So, let's assume that you have identified a new cloud native, distributed SQL database that you want to implement enterprise-wide.
The database is perfect and you're excited to try all the cool new features, but your biggest challenge arises when your chosen database partner fails to provide adequate support during the migration process.

Unless you have the right plans and partnerships in place during a database migration project, you can lose significant time and money. Conversely, if you attempt the process independently, reaching your desired destination might prove impossible. Migrating your applications and data to a new home is a significant undertaking, and not one to be approached lightly.

Your data is your business's most crucial asset, so it's imperative that you don't make any mistakes. If your data is spread across multiple databases with varying origins, the migration process becomes even more challenging.

Setting your business up for database modernisation success

There is an increasingly compelling business case for leveraging cloud native standards like PostgreSQL to handle transactional business applications in the cloud. However, success requires thoughtful planning and an exacting execution.
Now might be the right time to explore the market and identify the cloud native database technology that best aligns with your goals and, crucially, offers a pain-free migration process. Once you have identified your database technology, it is essential that you follow all necessary stages when planning, assessing, migrating, finalising, and executing the transition, to ensure database modernisation success. Skipping or neglecting any of these critical steps may result in a sub-standard outcome and future challenges.

Finally, it is crucial that you choose a cloud native, transaction-friendly, database partner that provides the tools and support you need for the entire modernisation journey. Having a reliable and knowledgeable partner, who understands the intricacies of database migration and can guide you through the process, is imperative for achieving a successful and seamless transition.

By carefully considering your database modernisation approach in advance, leveraging automation where possible, and partnering with the right strategic experts, you can navigate complexity and unlock the potential of the cloud. This allows you to reap the rewards of enhanced scalability, cost efficiency, and future-ready operations.

Key qualities for a woman in tech: adaptability, self-belief and inspiring the next generation

In recent months the media has been dominated by discussions relating to artificial intelligence (AI), with commentators variably predicting that the tech will transform our world while also presenting risks that need urgent regulation.

BY CATHERINE BODDY, HEAD OF VULNERABILITY OPERATIONS CENTRE, ORANGE CYBERDEFENSE

Another theme underpinning the topic is a concern that the development of AI is being hindered by gender bias. The theory is that if there are not enough women contributing to the machine learning required to develop AI systems, there will be gaps in its knowledge and bias will occur. It is just one example of how men have historically dominated the tech sector, and why I am such a passionate advocate of the role which women play in the industry.

My pathway into tech has certainly not been conventional. I didn't go to university and spent my early twenties temping and travelling before securing my first tech job at the age of 25. I initially developed an interest in the tech industry through a family friend, who worked as IT director for a fashion brand. I began to look for roles in the sector and soon found one as a technical administrator, which required admin experience but not IT experience so sounded perfect for me. During the first three years, I gradually expanded my remit to manage the entire

ticket system as well as administrative work, and got my ITIL qualification.

I started at SecureData – which Orange Cyberdefense later acquired – in February 2020, just four weeks before the UK national lockdown hit. My role then was as CyberSOC delivery coordinator, so I was heavily focused on project management and had no previous experience managing a team, as I do now.

I'm proud of the speed I've progressed through the company so far and also pleased that I was able to discover my passion for people management when I was given the chance to temporarily manage the Vulnerability Operations Centre (VOC) team alongside my existing role and was, fortunately, able to take this on in an official capacity shortly after. My time at Orange Cyberdefense has been somewhat of a rollercoaster, managing two job roles simultaneously while creating a new global service for our VOC, all through the sudden shift to remote working.

Lessons learned

One of the biggest lessons I have learned over the past six years is that you shouldn't be afraid to get your voice heard. As a woman in a male-dominated industry, you need to have the confidence to speak up. Despite knowing nothing when I first started, I now feel comfortable ensuring my opinions are heard and valued, which has been helped by the people that I work with and for.

I have also learned that you should not let your fears stop you from succeeding. Despite having little tech knowledge, I have demonstrated that through determination and adaptability – as well as with the help of a supportive company – women can thrive in IT roles. And yes, the majority of people who work in the industry are still men – according to a ISC2 study on women in cybersecurity, just 25% of the workforce in this sector is female. However, the industry is working hard to try to shift the balance through female-focused awards schemes and support groups.

One of those initiatives is Women4Cyber, which has more than 30,000 members and aims to create a network of men and women committed to the challenge of cyber skills. At Orange Cyberdefense we have partnered with Women4Cyber to form a mentoring scheme. The programme aims to help women at each stage of their careers by putting them in contact with experienced mentors who have successful careers at leading cyber companies. The aim is to help women to develop their skills and progress their careers in cybersecurity. The tech industry is constantly evolving and the range of roles and opportunities for someone interested in a tech career is growing all the time. When I speak with young women about to embark on their careers, I urge them to find a role they are passionate about to ensure they flourish in their professional lives. And when you find that role, tell the world – I hope that my own story will inspire others to take their first steps on the path to a career in tech.

The four steps to ensure digital transformation has long-term success

It's perhaps become a bit of cliché but change really is the only constant in any successful business these days. Technology continues to astound and terrify in equal measure, presenting organisations with unprecedented opportunity – as well as challenge.

BY RUSSELL FERRIS IS CEO OF WEATHERBYS

RATHER THAN the idea of change itself being an organisational challenge however, leaders should be focussed on creating change before change becomes necessary. Many high-profile examples from around the world show that if this stage arrives, it is often too late.

It is essential that businesses do not ignore the essence and heritage that made them successful, embracing their history and innovation equally. Technology can be at the heart of the way you work, however, any major changes will come with hurdles. Dynamics, inertia, and resistance are natural and need to be overcome. However, with total clarity on a vision for change and making clear the many benefits innovation brings, you can make strong progress in the past few years.

True synergy between heritage and transformation is only achievable though embracing dynamism, willingly disrupting the status quo and being uncompromising on digital transformation; whilst at the same time understanding history of a business and the core of what made it great.

Such a process doesn't come without its challenges. There are two key areas in any organisational change project – the 'solution' side of change and the 'people' side. The solution side – the likes of products, competitive advantage, operations, processes, and technology – typically garners most attention given it is the cornerstone what digital transformational change is.

However, I would argue that the people side of change is most critical in achieving a successful change project. What use is a comprehensive solution-side innovation, if it isn't implemented effectively or doesn't affect behaviour change?

The people side of transformational change is a four-step process:

1. Change in awareness

Provide the business & operational context about the need for change. Everybody is aware change is a necessity, make the case compelling and detail the impact it will have for the organisation and its people.

2. Change in commitment

Detail the vision and the story for change. Share the strategy and move through the key dimensions of involvement, communication, enablement, measurement and mindset.

3. Change in behaviour

Decide upon tactics and interventions that will determine behaviour change. Have a change roadmap and support all levels of the organisation with what successful new behaviours look like. Change agents are critical in this phase – train the trainer concept.

4. Change in mindset

To successfully achieve a mindset of change, communication is everything. Creatively communicate the new style of playing and working. Lead from the front with transparency, authenticity and honesty.

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Enabling a metaverse-ready network

If businesses want to provide immersive and interactive services and experiences in the metaverse in future, they will need their CSPs to provide an adaptive and technologically advanced network to support the substantial bandwidth at very low latencies required.

BY DAVID KRAUSS, NETWORK ARCHITECTURE, OFFICE OF THE CTO, CIENA

READY OR NOT, the metaverse is coming. For customer-facing businesses in particular, it will have a real impact because one application is to be a channel for connecting to customer services. As surely as chat, social and digital channels have become contact centre must-haves, driven by younger generations who are used to interacting with friends in the same way, the metaverse will follow.

An immersive, interactive metaverse – whether being used as a customer service channel or for countless other reasons – requires a robust network. Today's applications are already pushing the limits of available bandwidth and latency low enough to provide high quality experiences. So, what does a network need if it is going to support a metaverse-ready future?

Today's metaverse

The product of bandwidth and latency define a network measurement that can be referred to as "Mean-Time-to-Cloud". This is the amount of data to be transferred to the Cloud, the time to process that data, and then the time to return it to the user. Today's networks can deliver performance characteristics of 10s of milliseconds, but only at relatively low bandwidths. Networks can deliver large amounts of bandwidth, but they will incur significantly more latency when doing so due to the sheer amount of data being transferred.

In a virtual environment, when the lag between a user making a motion and the movement being displayed reaches about 10ms, dizziness or motion sickness (also known as "motion-to-photon" latency) starts to kick-in and ruins immersive experiences. To avoid this happening and deliver a network performance capable of supporting a metaverse with movement that is as smooth as users need it to be, the network will require massive amounts of bandwidth, coupled with huge amounts of computation and storage accessible at ultra-low latencies. This is where the transfer of data is at, or below, the threshold of human or machine perception, that is, "instantaneous communications".

Adaptive networks

Building a metaverse-ready network is complex. For example, users will want to be able to access any metaverse application - and have the highest possible level of experience - from any device, anywhere at any time. Consider a home or business, which is connected to a nearby datacentre. Both these points are fixed, so a fibre connection (specifically broadband connectivity through passive optical networking (PON)) would provide the high bandwidth and low latency needed for a positive metaverse experience. But mobile is different, requiring advanced wireless connectivity like 5G, 5G Advanced, and eventually 6G. As a person moves, their connected datacentre must change so that the application and its computation can shift to whichever is the closest datacentre to them at any one time. To preserve the required high bandwidth and low latency, the network must shift and make sure resources remain close by.

A metaverse-ready network will require improved network technology in three main areas:

- Faster and larger networks to deliver huge amounts of bandwidth to end-user applications. This will require a combination of both fibre and wireless networks, with the ability to deliver as much information through a given communications channel as is physically possible.
- Networks that put the massive amounts of computation and storage as close to the users and the applications that rely on them. This will reduce latency and keep mean-time-to-cloud in check.
- Smarter networks with automation and AI/ML to manage resources in a closed-loop manner with the ability to heal or reorganise the network quickly. This will require a self-optimising fabric where applications dictate to the network the level of performance and the resources needed, and then the network delivers them.

Coming soon

With Web 2.0 users are connected across the network to where the application resides. With Web3, applications and functions are decentralised and don't reside in one place. The role of the network begins to look like a fabric interconnecting these Web3 services. To a certain extent, the applications and their functions become embedded in the network infrastructure, allowing them to exist throughout the fabric.

Sooner that we realise, generative artificial intelligence will fundamentally shift the way we access and interact with information. For decades, we've formulated questions and queries in a way that search engines understand ("Ford Fiesta boot dimensions"). But soon we'll be able to use natural language to work with data ("Will my new 65-inch TV fit in my car?").

Imagine an intelligent avatar tool that can preserve your presence in the metaverse when you're not online, interact with people or other avatars with your mannerism and your knowledge, and then report back to you with what transpired. This tool might even be able to conduct autonomous decentralized finance (DeFi) transactions on your behalf, function as your proxy for a DAO (decentralized autonomous organization), and even "create" for you independently with the correct training.

Even with a network to connect the required computation and storage, how this physically connects to our body will be important. Today we wear headsets, glasses, or goggles to offer photo-realistic images or augmented information to our eyes. These are bulky and uncomfortable, and can only be worn for short periods of time before fatigue sets in. Haptic feedback, via gloves or suits, is rudimentary at best. Scents can be created with a squirt of mixed liquids integrated into a VR headset, but this just adds complexity to an already non-ideal solution. What will be needed is a non-invasive way to interface directly with our brains, a non-invasive brain-computer interface (BCI.)

Innovators have already begun exploring BCI techniques, but they currently require placing sensors in or near the brain. The accuracy of simply trying to understand the meaning of brain signals is based on the resolution of information gathered, which could require thousands to millions of sensors. Today's challenge of collecting, computing, and storing large amounts of data at the metro city level will likely evolve into a scaling issue at the "body area network" level as well. Now add to this the next step after interpreting brain signals: inducing signals within the brain to produce a multi-sensory effect.

Today's challenge of collecting, computing, and storing large amounts of data at the metro city level will likely evolve to a scaling issue at the 'body area network' level as well.

Realising the future of the metaverse

30 years ago, who could have predicted the profound impact the Internet and mobile communications have had on the world today? Similarly, how can we predict the impact that the metaverse will have on the world 30 years from now?

The metaverse will be the evolution of the internet. The sheer number of internet applications show that IP-based innovation can produce incredible results, and the metaverse will be no different. But this will only be possible with a metaverse-ready network. If businesses want to provide immersive and interactive services and experiences in the metaverse in future, they will need their CSPs to provide an adaptive and technologically advanced network to support the substantial bandwidth at very low latencies required. Businesses should look for internet service providers that work with leaders in networking systems, who are developing hardware and software to program and orchestrate the Adaptive Network.

Digital health – why better wellbeing may mean more fun and games

Parents often complain about the amount of time their kids spend playing games, but the principles behind this growing form of entertainment are being used in some highly positive ways. Perhaps the best example is the emergence of 'gamification' as a powerful tool in the realm of healthcare.

BY CADE WELLS, BUSINESS DEVELOPMENT DIRECTOR, CENSIS

FOR THOSE unfamiliar with the concept, in this context gamification refers to the integration of gaming elements, mechanics and design principles into healthcare services via an online platform or a smartphone app. Game-like features are used to engage, motivate and encourage users to adopt healthy behaviours.

This was the topic of a cybersecurity workshop we hosted with students from the University of Glasgow, exploring the potential benefits, challenges and future possibilities that adopting gamification platforms may pose to our health and wellbeing.

Can gamified apps level up your health?

From fitness tracking apps like Strava to immersive cycling experiences such as Peloton, gamification has successfully tapped into people's competitive spirit, turning exercise into an interactive and engaging experience. This was demonstrated in a study by the American Council on Exercise, finding that those who use fitness apps with gaming features showed a 22% increase in physical activity.

Financial incentives traditionally played a key role in gamification – for example, lower health insurance premiums – but there's been a notable shift towards non-financial rewards. Gamified apps increasingly focus on correlating health outcomes with benefits like social recognition. Apple Watches, for example, allow users to share their fitness activity with friends and family, stimulating motivation and encouraging long-term behaviour changes.

These apps have also proven their potential in improving mental health. The link between physical

and mental wellbeing is well understood, but they also create a sense of achievement through progress tracking and reaching objectives.

At the same time, it's important to recognise the benefits game-like features can bring to the older population. Apps can be used to help them break sedentary routines and increase overall fitness levels. Various studies have demonstrated a link between physical inactivity and cognitive decline, which a more engaging experience can help to prevent.

Hurdles still to jump

There are, of course, challenges to overcome. Integrating gamification into health-related activities can be difficult for those with limited experience of digital platforms. Traditional approaches may be the best way of encouraging the current generation of older people to be more active – albeit that should change over time.

In addition, as with any form of monitoring, there are legitimate concerns over privacy. Gamified strategies have to be implemented without fears of a 'Big Brother' approach from whoever is collecting the data, with clear boundaries set out. Likewise, at the core of any app is the quality of its data – care needs to be taken to ensure that what is being collected is credible and insightful, otherwise it is of little value. This is where psychology and sociology are just as important as technical nous, with the need to reflect human behaviour in how apps are designed.

Debugging cyber threats

Cyber security is also a paramount concern. Health-related data is one of the prime targets for extortion attacks from cyber criminals, so app creators must invest time and resource in robust cybersecurity measures to protect sensitive information and maintain user trust.

The UK Product Security and Telecommunications Infrastructure regime[2] is set to play a significant role in ensuring the security and privacy of health-related devices, when it comes into effect early next year. While the law will not apply to products that fall under the Medical Devices Regulations 2002[3], consumer health and wellbeing devices will be affected.

Manufacturers will have to read the fine print to ensure they comply. Based on advice from the National Cyber Security Centre, the law will require product developers to act in accordance with minimum security standards, such as preventing default passwords, providing a point of contact for cyber-security issues and informing people how long their device will receive updates for. In the meantime, certification schemes, such as IASME's IoT Cyber scheme, can provide assurances over a device's compliance to both UK legislation and the leading global technical standard in IoT security. And, it's important to remember that every market has its own regulatory requirements, ensuring organisations adhere to the law.

What's the endgame?

The next stage of gamification in healthcare will likely be combining data from different sources to provide a more comprehensive view of people's wellbeing. Connecting devices like fitness trackers, sleep monitors and nutrition apps can enable a more accurate and complete understanding of someone's health and patterns of behaviour. Careful consideration is still needed to address the challenges of gamified healthcare technologies, but their potential is undoubtedly immense. While gaming may still be associated with sitting at a computer or on a couch, it may actually be the key to healthier lifestyles for generations to come.

FURTHER READING

- 1. ACE Personal Trainer Manual
- 2. The UK Product Security and Telecommunications Infrastructure (Product Security) regime
- 3. The Medical Devices Regulations 2002

Levelling up

Integrating back-end technologies for game development success.

BY TERRY STORRAR, MANAGING DIRECTOR, LEASEWEB UK

IN THE HIGHLY COMPETITIVE and technically demanding gaming industry, it's not uncommon for developers to put their infrastructure strategy and partners in place before building the accompanying tech stack. The problem with this approach is that the close relationship between infrastructure and back-end technologies means the process should operate the other way around. The main reason for this is that certain infrastructures don't support certain technologies, and not making future-proofed decisions can create problems down the line.

In this context, there are three main options for gaming companies looking to build an effective back-end strategy: a managed public cloud, a backend as a service (or BaaS), or an on-premise/hosting provider. Moreover, the choice of infrastructure provider should be influenced by a number of factors in addition to the type of game being developed. Decisions should also consider any commercial limitations and the availability of relevant in-house talent.

For example, unmanaged hosting offers a barrier-free route to most technologies, the option to set up a hybrid-cloud link towards other providers, no vendor lock-in and considerable cost savings, among many other advantages. What also must be in place, however, is a capable and experienced team to manage and build orchestration and scaling throughout the lifecycle of the solution.

For those considering a managed cloud solution, this is a tried and tested approach used by organisations everywhere, not least because it offers autoscaling and low maintenance. For game developers, the downsides are that there is typically no optimised hardware included, it creates vendor lock-in, can lack flexibility and is often the most expensive option.

In the case of Backend-as-a-Service (BaaS), this option can deliver a quick, easy and out-of-the-box solution. The problem here can be users end up being at the whim of their tech stack and can be forced to adopt whatever changes the service provider makes – there have even been cases of providers shutting down and the backend disappearing completely. There can also be a lack of transparency on how pricing is structured.

Data management: Embracing containers

Another issue that should be top of mind is a long-term plan for how data will be gathered, stored and interacted with. Gaming organisations should be thinking about whether they will use a multi-provider infrastructure or will integrate with services such as Kubernetes. They should also consider how to backup player data and disaster recovery strategies alongside fail-safe offline modes in the event of a network failure, and especially the best database for their needs.

For example, Certain Affinity, a renowned name in the gaming industry, employs an impressive methodology to streamline its infrastructure. They utilise containers to segregate their systems based on varying criteria such as memory, storage, and capacity. Notable technologies that facilitate this process are Kubernetes, Golang and Docker – tools which can simplify the distribution of backend services across different Virtual Machines (VMs). As a result, they are becoming extremely popular thanks to their ability to make life easier for

developers by enabling them to manage their infrastructure much easier – taking a lot of the management load off their hands and improving agility.

For newcomers who might not be versed in these technologies, there are managed container services available, a prime example being Kubernetes, which is offered as a managed service by Google Cloud.

Unlocking microservices

For many developers, microservices also play an integral role in managing various services within a game. As those familiar with microservices can attest, managing them can be a complex process due to the numerous moving components, meaning it is advisable to initiate this process with a more simple and manageable approach and gradually build upon it. Certain Affinity, for instance, adopts a practice where they begin with a monolithic architecture, deploying various API services within a single executable.

When a service proves its value, it is then extracted and made into a standalone service. This evolutionary approach mitigates the risks associated with deploying numerous new elements, which may be riddled with bugs or prove to be redundant.

Microservices offer a plethora of benefits, with multi-dimensional scaling being among the most important. This refers to both performance scaling, which allows parts of the system to be isolated and scaled based on resource consumption, and team scalability, which facilitates the division of labour among teams working on different microservices.

For newcomers who might not be versed in these technologies, there are managed container services available, a prime example being Kubernetes, which is offered as a managed service by Google Cloud

Ultimately, given that no two games are alike, how these models are then applied changes from game to game. Experience often allows developers to unearth new best practices, and it's great to see the gaming community is keen to share these ideas and help other studios overcome their challenges. What most people agree on, however, is that game developers should aim to be able to build their own backend within a five-year timeframe, the objective being to have complete control and ownership of their whole architecture.