

The 2023 Mainframe User Survey

An analysis of the profile, plans, and priorities of mainframe users.

Many thanks to all those who took part.

As usual, our annual mainframe survey provides a snapshot of the IBM Z user community's existing hardware and software configuration, and also their plans and concerns for 2023.

This year we have continued to track the growth of mainframe integration with mobile and cloud computing, and other areas of new development, as well as gauging the extent to which the API economy, DevOps, and ransomware are really impacting on the mainframe world. In addition, we have continued to explore relative costs in some details, asking respondents how fast their cloud computing costs are growing relative to the mainframe.

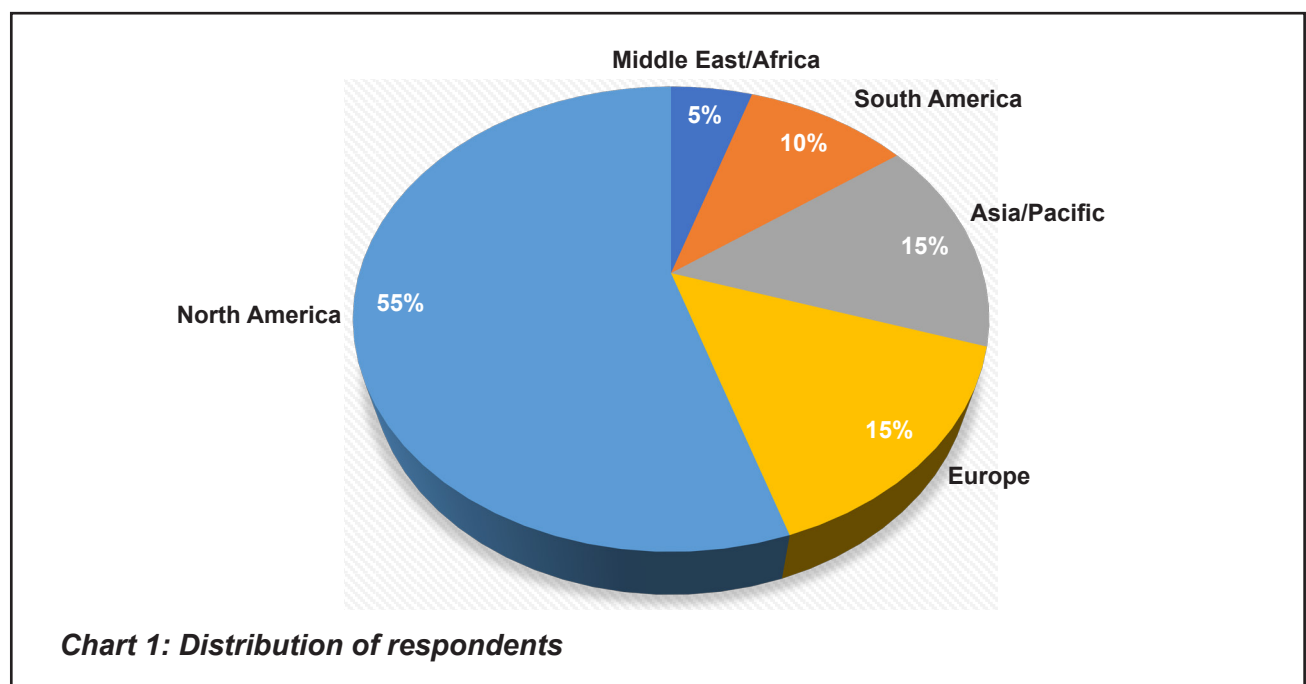
Profile of respondents

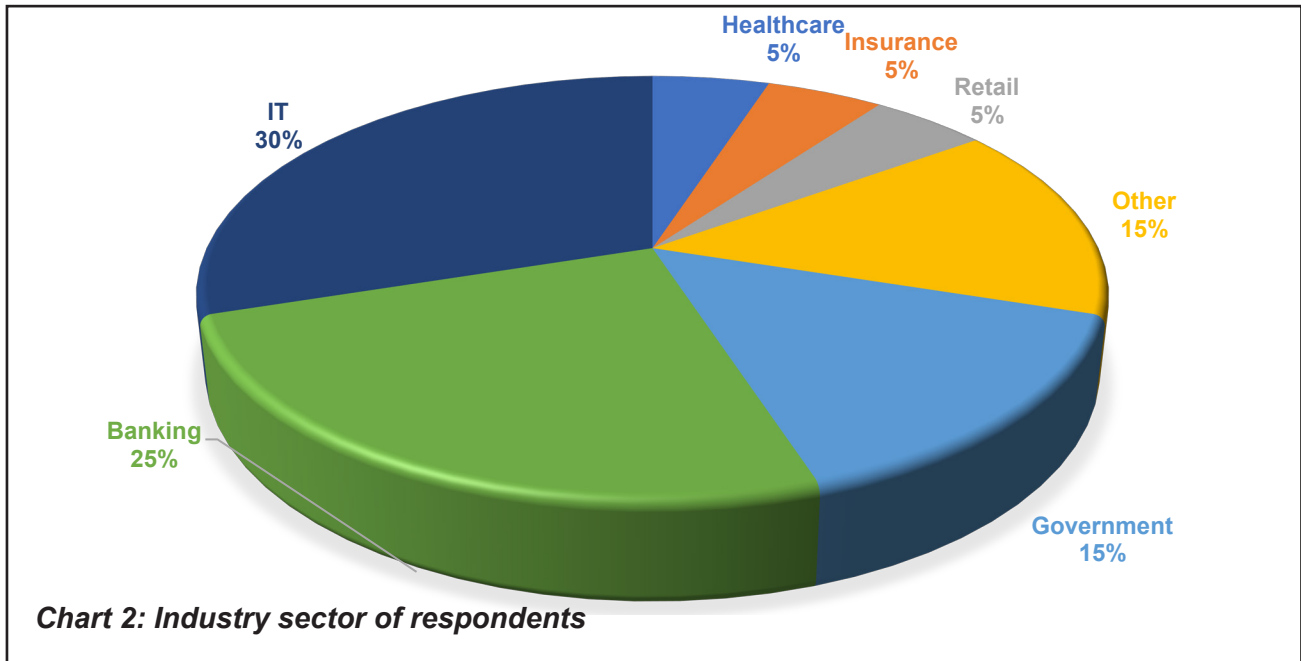
The mainframe user survey was completed by 100 individuals between the 21 October 2022 and the 25 November 2022. Survey respondents were either contacted directly by email or other online means and invited to complete the mainframe user

survey on the iTech-Ed Ltd website. Responses from large mainframe vendors and multiple entries from different people at the same site were excluded from the survey, as were largely incomplete responses.

The distribution of all respondents is shown in Chart 1. Just over half (55 percent) were from North America. 15 percent were from the Asia/Pacific region, and another 15 percent of respondents were from Europe. 10 percent were from South America. And five percent were from the Middle East/Africa.

As usual, a wide range of industry types are represented in our sample (Chart 2), with IT making up 30 percent of respondents. Banking made up a quarter of respondents. Government and the industries that didn't fit any of the categories offered each made up 15 percent of sites responding. Lastly, Healthcare, Insurance, and Retail are each five percent of the sample.



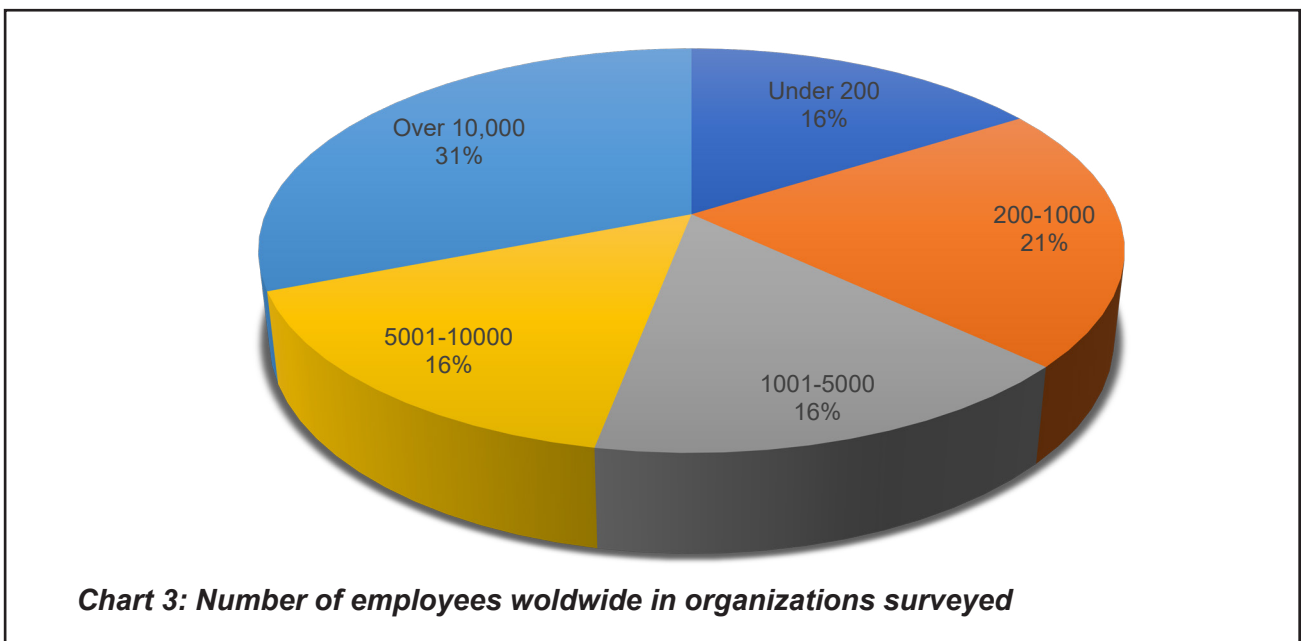


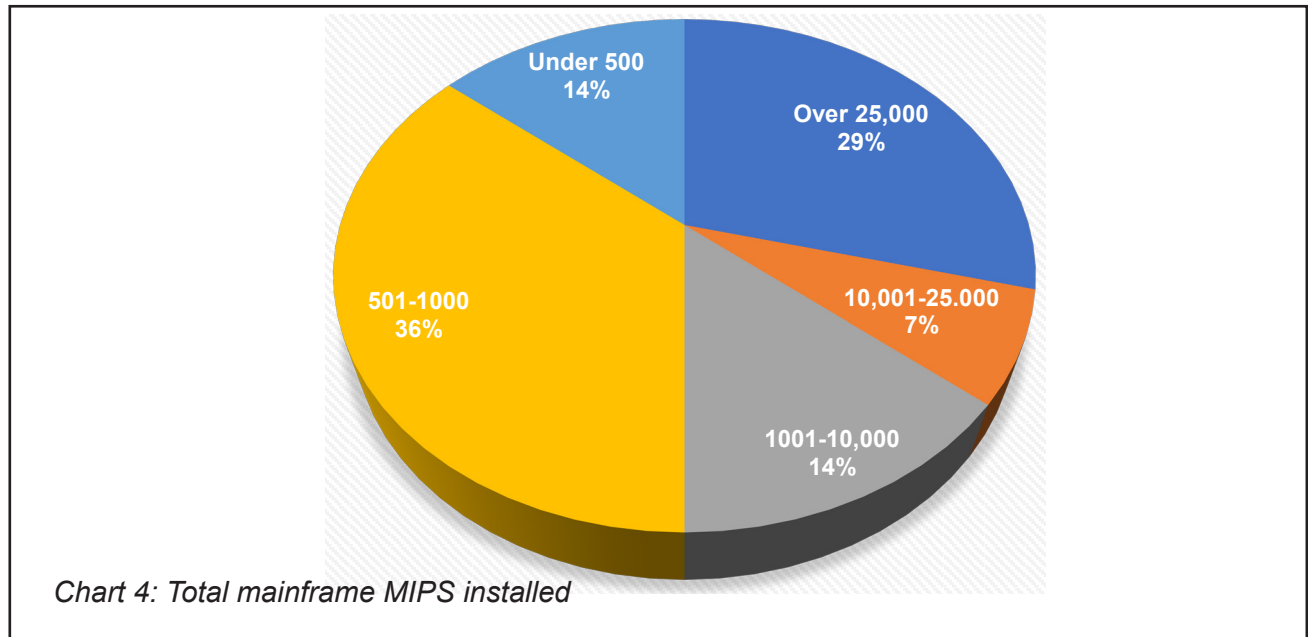
A third way to categorize respondents is to look at business size. As shown in Chart 3, the largest group of respondents are from companies with over 10,000 employees worldwide (31 percent). Just over a fifth (21 percent) had 200 to 1000 employees. And 16 percent of respondents were each from companies with under 200 staff, between a thousand and five thousand, and, lastly, between 5000 and 10,000 employees worldwide.

74 percent of our respondents were involved in running in-house data centres. 16 percent said that they were completely outsourced, and 10 percent were partially outsourced.

Installed MIPS and capacity growth

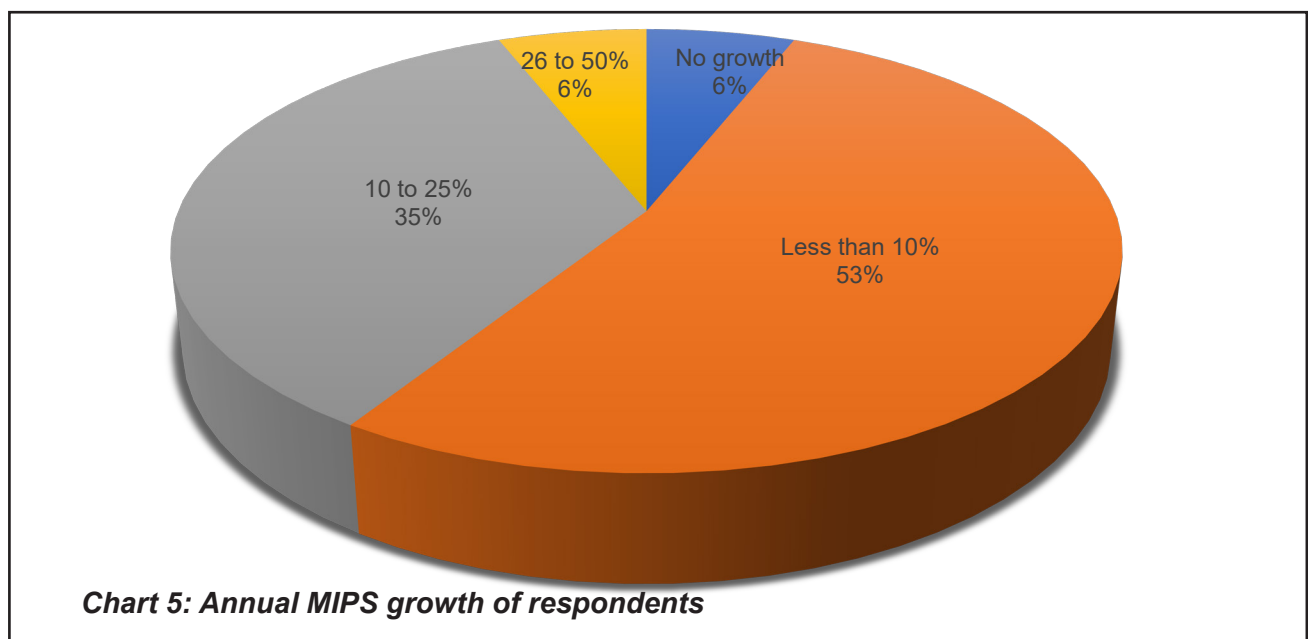
As in previous surveys, we have used MIPS as the principal measure of size. We asked respondents to indicate the total mainframe MIPS installed on





their systems, and the result is shown in Chart 4. 36 percent of respondents had 501 to 1000 MIPS (well up on last year's figure of 13 percent). 29 percent had over 25,000 MIPS (much the same as last year's figure of 31 percent). 14 percent of respondents had 1001 to 10,000 MIPS (well down from last year's value of 31 percent), and 14 percent had under 500 MIPS (also well down

from last year's figure of 25 percent). Lastly, seven percent of respondents reported having 10,001 to 25,000 MIPS (last year, none of our respondents reported that value for MIPS). And, as in previous years, we use installed MIPS later in the survey to identify differences between small, mid-sized, and larger users.



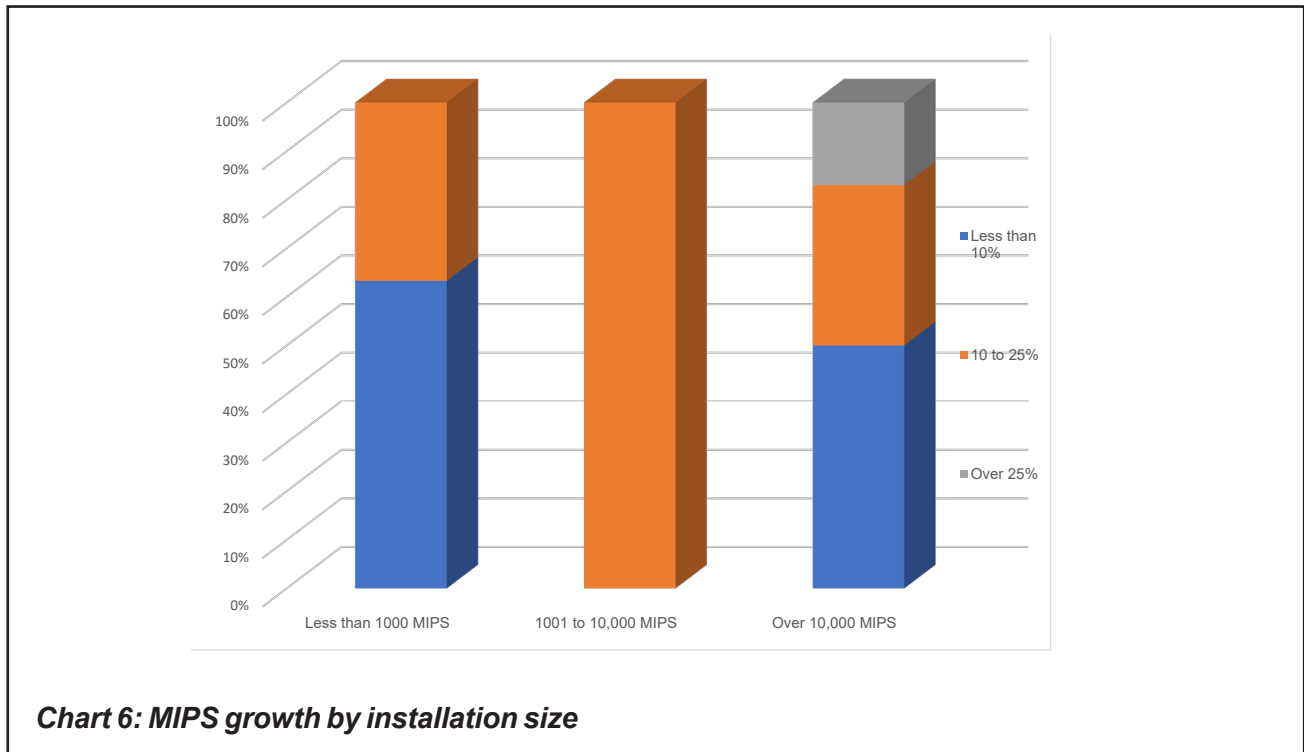
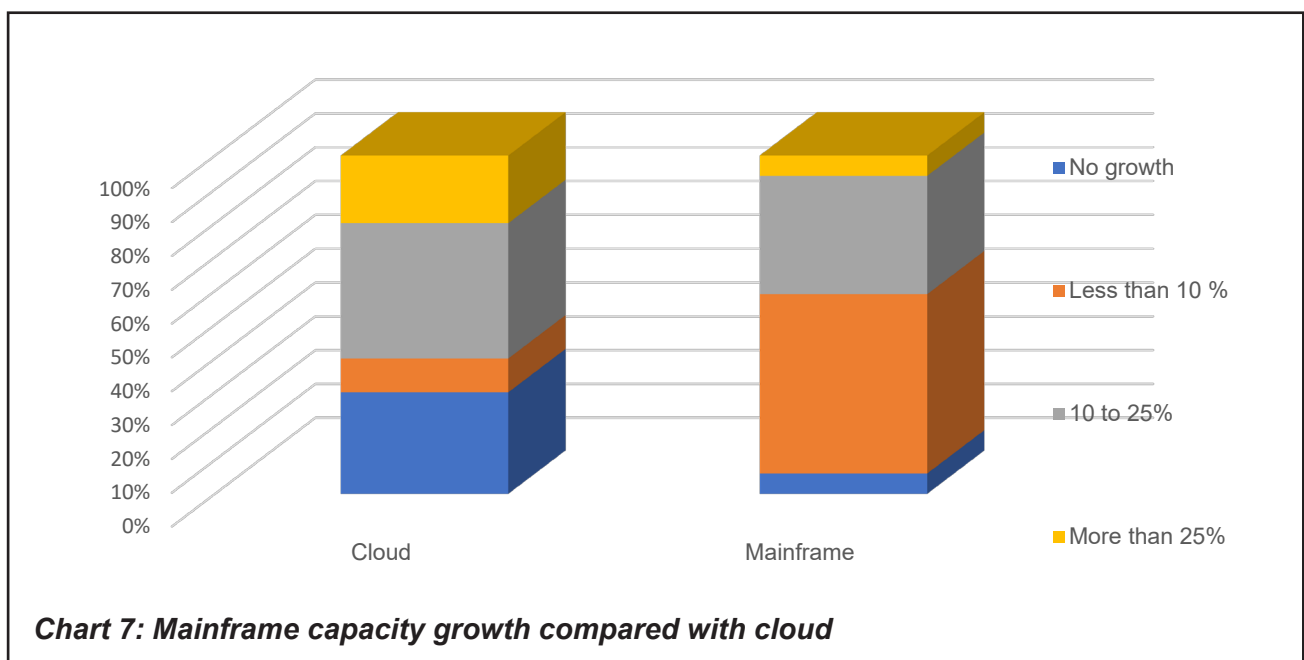


Chart 5 shows the annual MIPS growth of respondents. 94 percent of mainframe installations (well up on last year’s figure of 66 percent) are experiencing some growth, although 53 percent of sites (up from last year’s 41 percent) reporting that

growth, while occurring, is less than 10 percent. 35 percent of sites reported growth between 10 and 25 percent (up on last year’s figure of 25 percent). Only six percent of sites (well down from last year’s 17 percent) have not experienced any



kind of change in their MIPS this year. And no sites reported a decline in MIPS in the past year. Last year the figure was 17 percent. Hopefully, this means that organizations are moving the focus of their attention away from Covid and the impact that had, and the vast majority of sites are now seeing some kind of MIPS growth – which must be good for the industry.

Looking at Chart 6, we can see that the picture is fairly consistent across all MIPS values. All sizes of site are seeing growth in the 10 to 25 percent range. Some larger sites and some smaller sites are seeing growth below 10 percent, but some larger sites are seeing growth in excess of 25 percent. Again, a very positive picture.

We also compared the rate of growth of the mainframe with that of cloud. As shown in Chart 7, 30 percent of cloud sites are expecting no growth. 10 percent of respondents are expecting a growth of up to 10 percent, with 40 percent of sites expecting a growth in cloud platforms between 11 and 25 percent. And 20 percent of sites are expecting growth in excess of 26 percent. While the majority of mainframes expect growth to be

less than 10 percent, the majority of cloud users expect growth to exceed 10 percent.

Hardware and software currency

The IBM mainframe hardware range continues to receive a regular makeover, with new high-end and low-end systems generally being announced on alternative years (although that wasn't the case in 2021). 2022 saw the announcement of the z16 Model with its Telum processor, which is optimized for AI use. The IBM LinuxONE Emperor 4 systems were announced in September 2022. 2020 saw the announcement of the z15 Model T02 and LinuxONE III LT2 products. Delivery dates for each range of processor can be found in the *Mainframe evolution* section of the Yearbook.

Our research suggests that, typically, users have upgraded on a regular basis to the most recent hardware to take advantage of capacity increases and cost benefits. Chart 8 shows that the original z15 model is still the most popular model at 50 percent of sites surveyed. The z15 Model T02 was found at a quarter of the sites, as was the z14 Model ZR1. The original z14s are still in use at 20 percent of sites, and the original z13 model

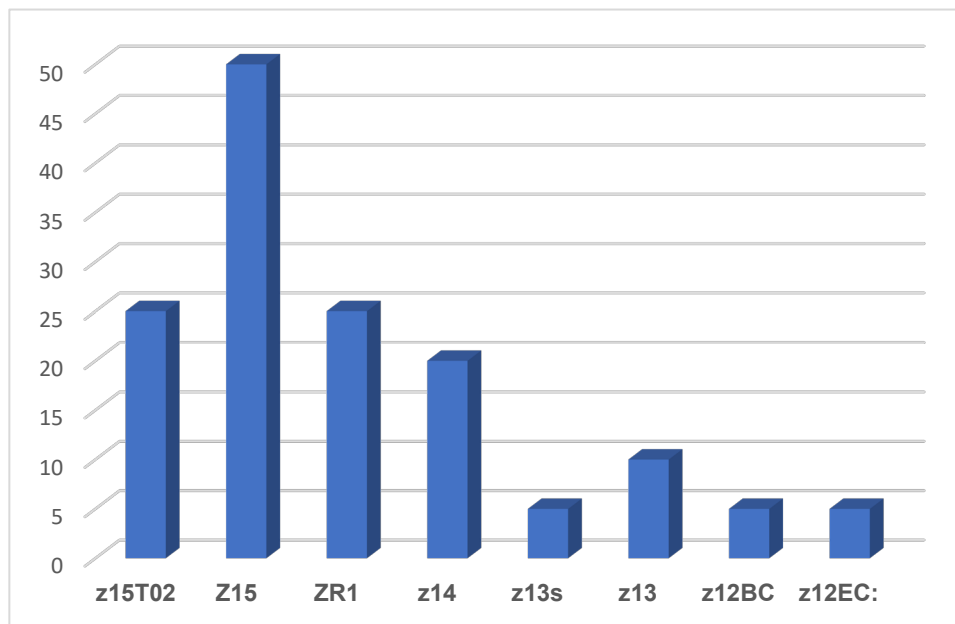


Chart 8: Mainframe processors installed

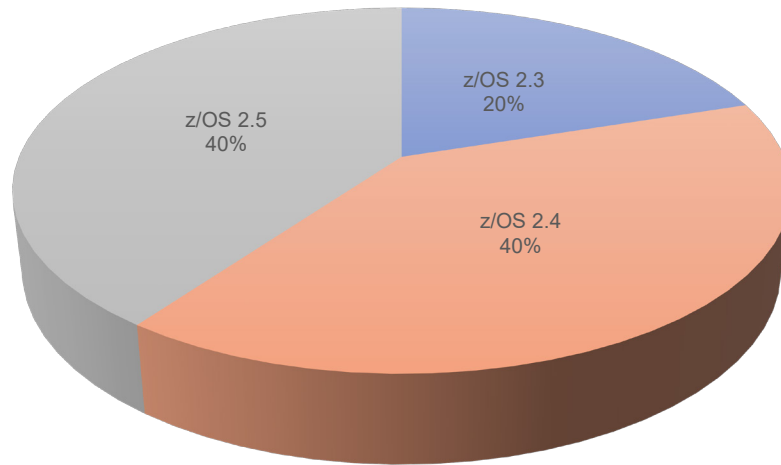


Chart 9: Primary mainframe operating system release in use

can be found at 10 percent of sites. Older models (z13s, z12 BC, and z12 EC) are still out there and still performing well. Other older models did get mentioned by some respondents, but were not statistically significant. It must be noted, when looking at these statistics, that many sites had more than one model of mainframe installed.

You may be wondering how many sites had z16s installed, which have been available since early summer. Unfortunately, although we asked the question, there was a problem with the software showing us the results.

We also took the opportunity to ask people whether they were interested in LinuxONE Linux mainframes and when they were likely to get one. With IBM's introduction of z/OS Container Extensions (IBM zCX), it's now possible to integrate Linux on Z applications with z/OS, perhaps reducing the need for Linux. Six percent of sites said that they already had one (last year, no-one reported having one), and 61 percent (down from last year's 77 percent) said they wouldn't get one in the foreseeable future. However, 11 percent expect to get one in the next six months, and 22 percent (up from 15 percent last year) of sites are expecting to get one at some time in the future.

Software currency (Chart 9) usually lags a little behind hardware. This year's survey found that 40 percent of respondents were using z/OS Version 2.5 (a huge increase on last year's figure of just seven percent). Another 40 percent of sites are using Version 2.4 (last year it was 57 percent). Lastly, 20 percent were using z/OS Version 2.3 (down from 29 percent last year). Those were the only versions captured by the survey results. No-one suggested Linux was their primary operating system. Clearly, sites are still migrating towards the latest versions of z/OS.

Mainframe strategy

We asked respondents what, in their opinion, are the main benefits to their organization of the mainframe over other platforms. This year's top of the list was availability, getting 85 percent of respondents voting for it (the figure was 95 percent last year). Security came next with 70 percent of respondents highlighting it as a benefit (last year the figure was 85 percent). It seems that mainframers are not recognizing just how secure mainframes are compared to other platforms. 65 percent of sites identified scalability (exactly the same as last year's figure) as a benefit, and 50 percent highlighted manageability (down slightly from last year's 55 percent). So, still plenty of

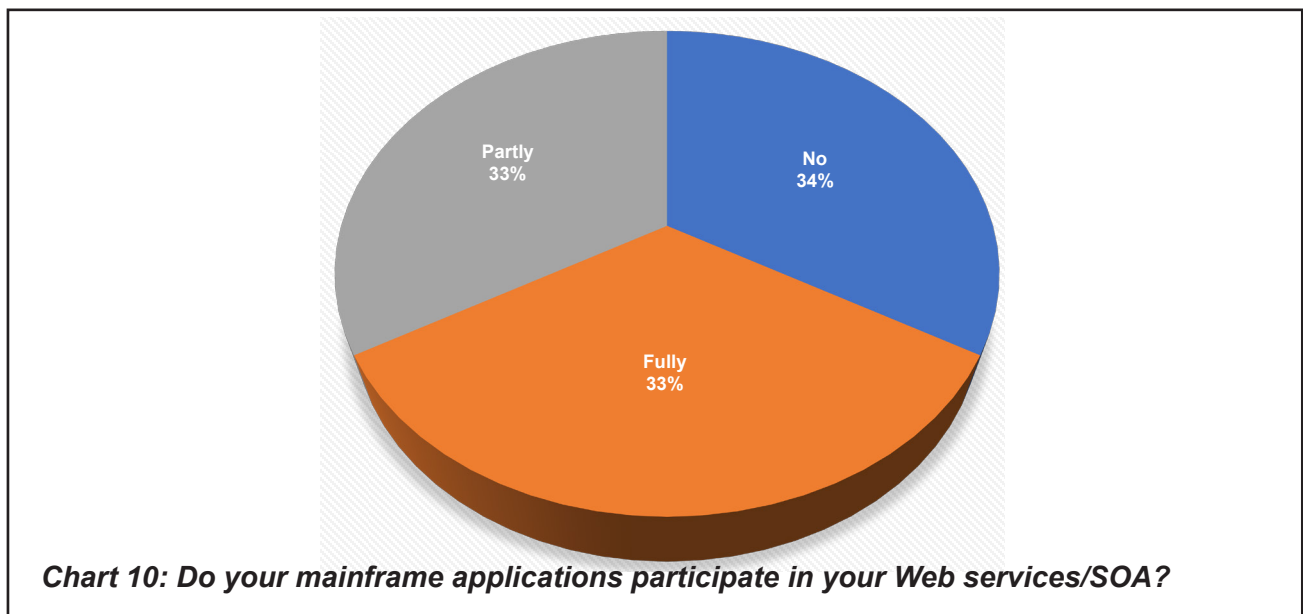
benefits from using a mainframe, although, perhaps, IBM needs to bang the drum about them a little more.

We also asked respondents what they thought were the main obstacles to mainframe acceptance within the enterprise. This year, 70 percent of sites thought that the biggest obstacles to mainframe acceptance within the enterprise was that it's too expensive (or appears to be). The figure was 55 percent last year. 50 percent of respondents (up from 30 percent last year) felt concerns about future availability/support of mainframe apps was an obstacle. Another 50 percent thought the cultural barrier between mainframe and other IT professionals was an obstacle (exactly the same figure as last year). 45 percent thought that difficulty in retaining the necessary skills (the figure was 85 percent last year) was an obstacle. And 35 percent of respondents thought that a barrier was the mainframe being too complex (or appearing to be too complex). This was up from 25 percent last year. Lastly, 10 percent of respondents didn't think that there were any barriers to mainframe acceptance, which was double last year's figure.

Within the industry as a whole, opinion is clearly divided over the role of the mainframe in new

applications. For some companies the mainframe remains a separate legacy environment, while others are leveraging the strengths of large systems by using them in cloud and mobile working. You hear mainframers talking about JSON and RESTful interfaces along with smartphone app designers. We found that 53 percent of sites viewed their mainframe as a legacy system (up from last year's 39 percent). Only 10 percent (down from last year's 17 percent and well down from the previous year's 40 percent) viewed mainframes as strategic. And 37 percent (down from 44 percent) viewed them as both strategic and legacy. It does feel as though many sites are failing to recognize the importance and strength of the mainframe as a computing platform.

We asked respondents whether their z/OS systems participate in Web services and SOA environments, and the results are shown in Chart 10. Unusually, we found a third of sites in each category. So, two thirds of organizations (down from 79 percent last year) said that their mainframes participate partly or fully in Web services. However, a third of sites said no they don't participate (up from 21 percent last year).



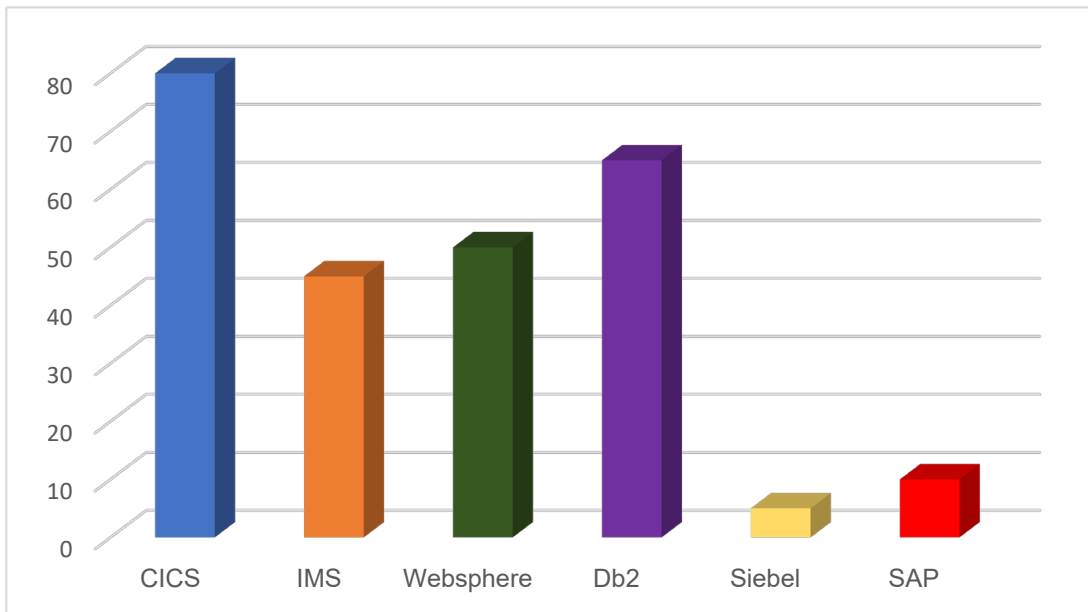


Chart 11: Which middleware have you, or do you plan to enable, with Web services?

44 percent (down from last year’s 56 percent) went on to say that they run Java-based applications on

the mainframe, with a further 17 percent (well up on last year’s figure of five percent) planning to.

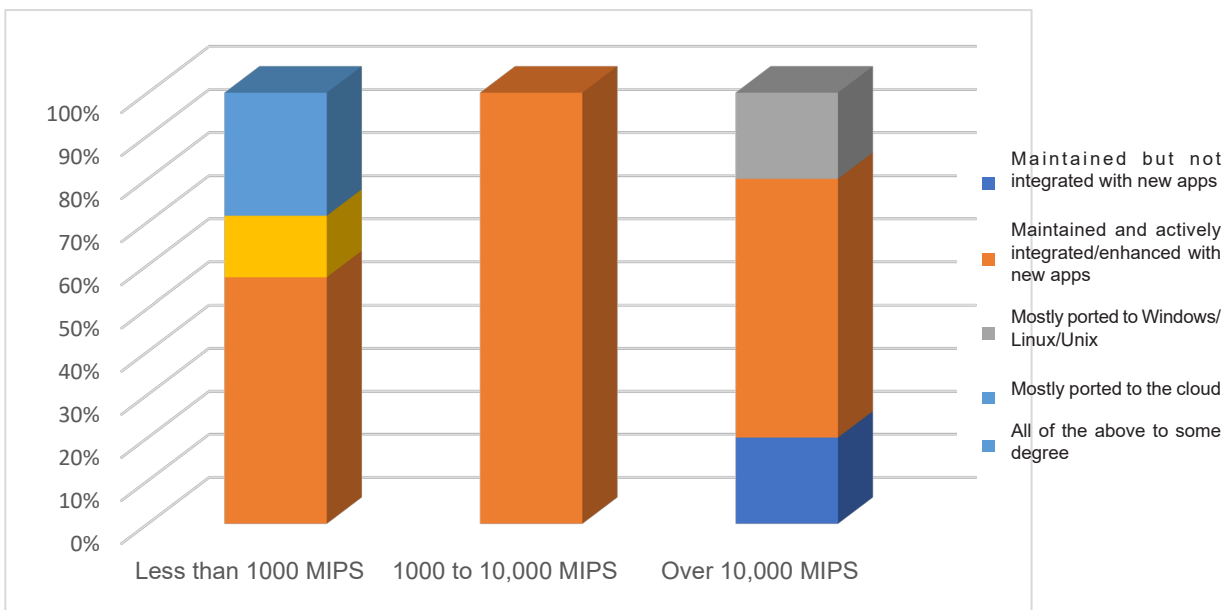


Chart 12: Legacy application plans over the next three years

31 percent of respondents (down from last year's 39 percent) said that they run Linux on IBM Z. 69 percent of respondents don't run Linux, and no-one said that they are planning to. There are considerable cost and management benefits of consolidating distributed Linux workloads onto the mainframe. IBM made the IFL (Integrated Facility for Linux) specialty processor available in 2001, and announced the LinuxONE in 2015, the Rockhopper II in 2018, the LinuxONE III Model LT2 in 2020, and the IBM LinuxONE Emperor 4 systems in 2022. Running Linux on a mainframe could so easily be a mainstream technology.

80 percent of organizations said that they are Web-enabling CICS (Chart 11), up from last year's value of 75 percent. 65 percent of sites are Web-enabling Db2, which is an increase on last year's figure of 50 percent. 45 percent of sites are Web-enabling IMS, which is the same as last year's figure. 50 percent (up from 30 percent last year) are Web-enabling WebSphere Application Server. 10 percent of respondents are Web-enabling SAP, and five percent are web-enabling Siebel and other software.

We asked mainframe sites whether they operate in a hybrid cloud environment. A hybrid cloud is, of course, a computing environment that integrates public and private cloud services with on-premises infrastructure with orchestration, management, and application portability across all three. 42 percent of respondents currently used their mainframe in a hybrid cloud environment (up from 21 percent last year). A further 16 percent think that they will run a hybrid cloud environment at some time in the future (down from 21 percent last year). A further 42 percent of the sites surveyed (down from slightly from 47 percent last year) don't use hybrid cloud and don't have any plans to do so.

In the past, the expected future of legacy systems often depended on the size and maturity of the installation. Interestingly, Chart 12 clearly shows that over half (58 percent) of smaller sites expect their legacy applications to be maintained and

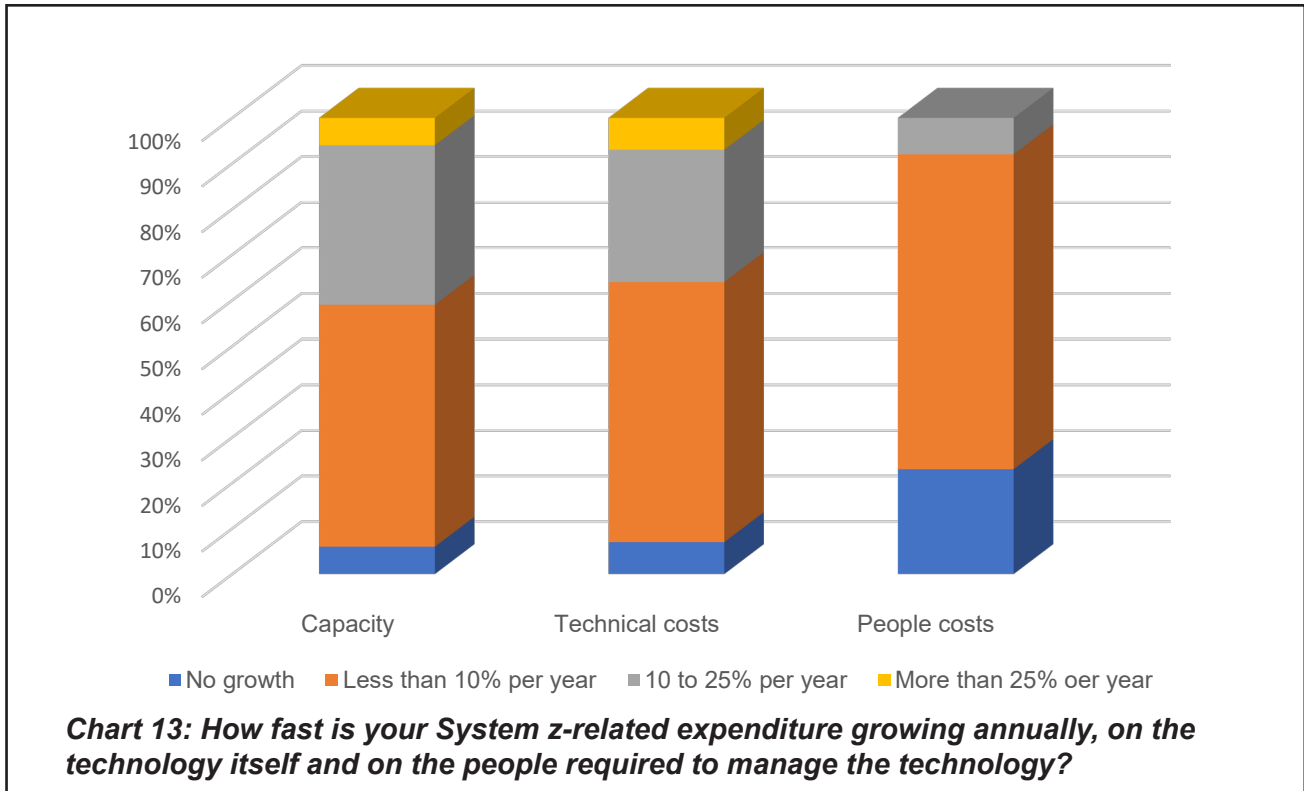
actively integrated/enhanced with new apps, but 14 percent of respondents in that category expect their applications will mostly be ported to Windows, Unix, or Linux. That leaves 29 percent of sites anticipating that anything could happen! Middle-sized sites all expect their legacy applications to be maintained and actively integrated/enhanced with new apps.

For the larger sites, 60 percent expect their legacy applications to be maintained and actively integrated/enhanced with new apps, but 20 percent think their legacy applications will be maintained but not integrated with new apps. That leaves 20 percent expecting their applications will mostly be ported to Windows, Unix, or Linux. So, that's quite a mixed set of results and a difficult one to draw any firm conclusions from.

When we asked whether application modernization was a priority, we found that 30 percent (well up on last year's 12 percent) thought they'd modernize a few applications here and there. A further 10 percent (well down on last year's 21 percent) had great plans for application modernization. And 10 percent suggested that at their site they had some plans to modernize applications. Another 10 percent anticipate that application modernization will be cloud based. However, 30 percent (down from last year's worrying 41 percent figure) still had no plans for any application modernization.

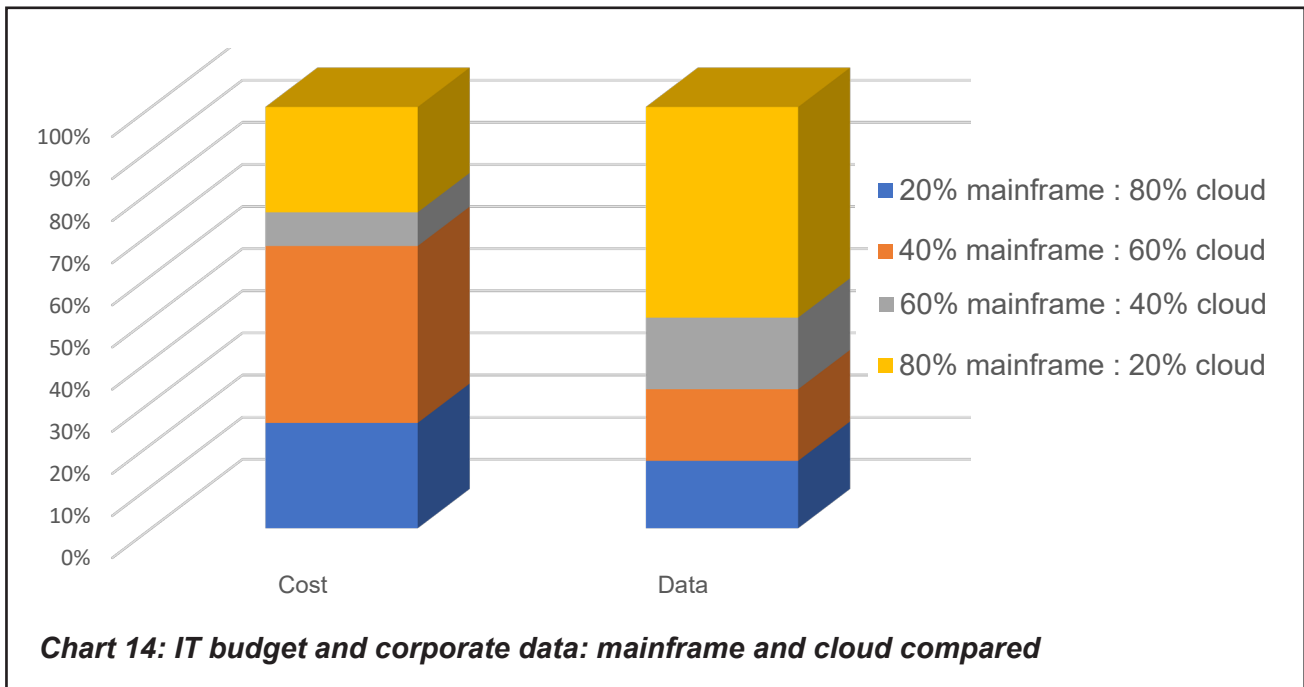
Relative cost

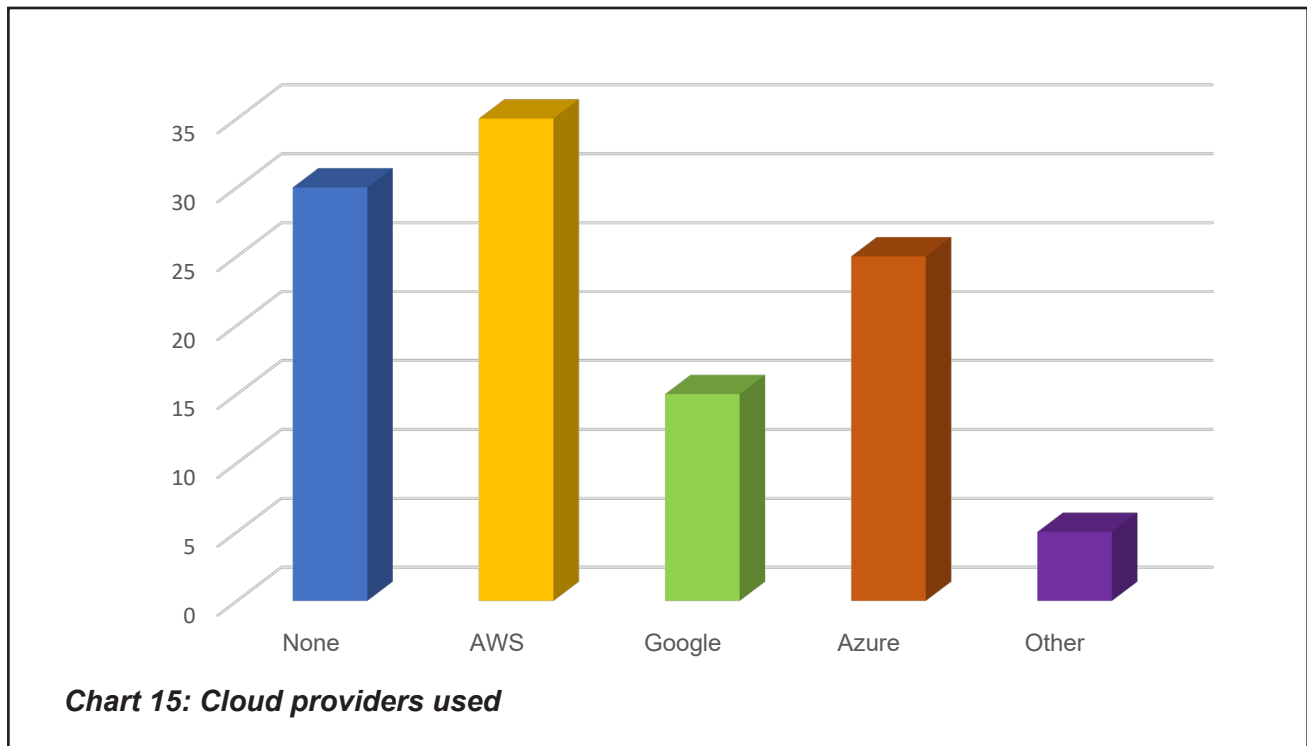
There are many ways of comparing the costs of mainframe systems with those of other platforms, but none of them are straightforward and few are meaningful. CIOs and finance directors all too often have little experience of the factors that contribute to mainframe total cost of ownership and there is still little published data available to help them make informed comparisons. It is beyond the scope of this short survey to go into detail on cost, but the following questions explore some areas where financial comparisons can be made between large centralized systems and cloud services.



We asked respondents how fast their IBM Z-related expenditure is increasing, in terms of the technology itself and the people needed to support

it. In Chart 13, we compare these results with the growth in mainframe capacity. From the graph, you can see that 94 percent of sites have seen some





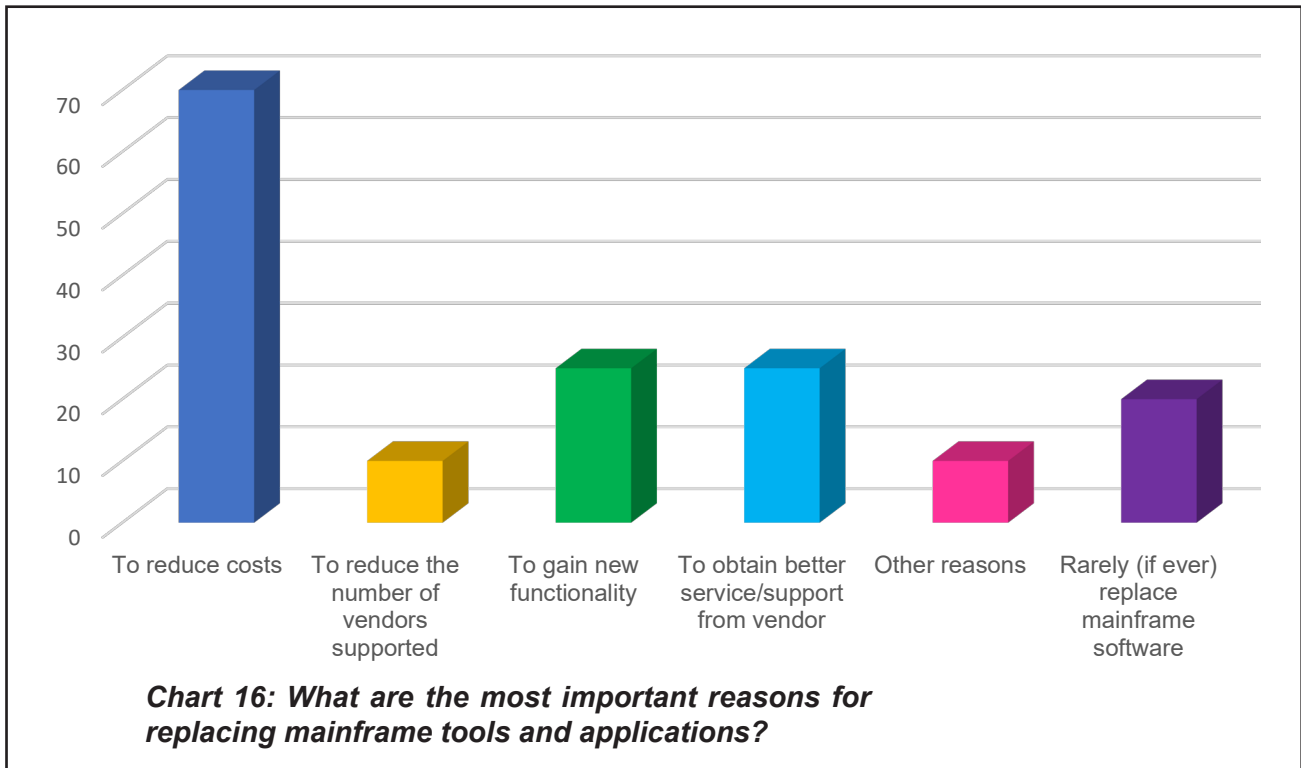
kind of increase in capacity and 93 percent have seen an increase in technology costs, but only 77 percent of sites believe their people costs have increased! In fact, 23 percent of sites have seen no change in their people costs. No-one reported seeing a decline in capacity or technology costs or people costs. While six percent of sites have seen a capacity growth of more than 25 percent, and seven percent of sites have seen technical costs rise by more than 25 percent, no-one has reported people cost increasing at that level. At some stage, management will have to realize that you can't always do more with less – no matter how good the technology is.

We went on to ask what proportion of the total IT budget is absorbed by mainframe-related costs and cloud computing (Chart 14). 67 percent of sites say that the bulk of their IT budget is spent on cloud (up from 56 percent last year), leaving 33 percent of sites where the majority of their expenditure is on the mainframe side. It will be interesting to see how that figure changes over the next few years. Chart 14 compares costs with

data storage. As can be seen, while two thirds of the spend is on cloud, only a third (33 percent) of the data is stored in the cloud, the bulk of it is still on the mainframe. It's worth noting that last year's figure was 16 percent for sites with more data in the cloud.

With flexibility, responsiveness, and cost fuelling the journey to cloud, we asked whether respondents use Red Hat OpenShift and/or IBM Cloud Paks on their mainframe. Only 12 percent of sites said yes (last year the figure was 13 percent), with nearly a quarter (23 percent) suggesting that they have plans to do so. That figure is down from a third of respondents last year. Nearly two thirds of respondents (65 percent) said no (which is up from last year's 56 percent).

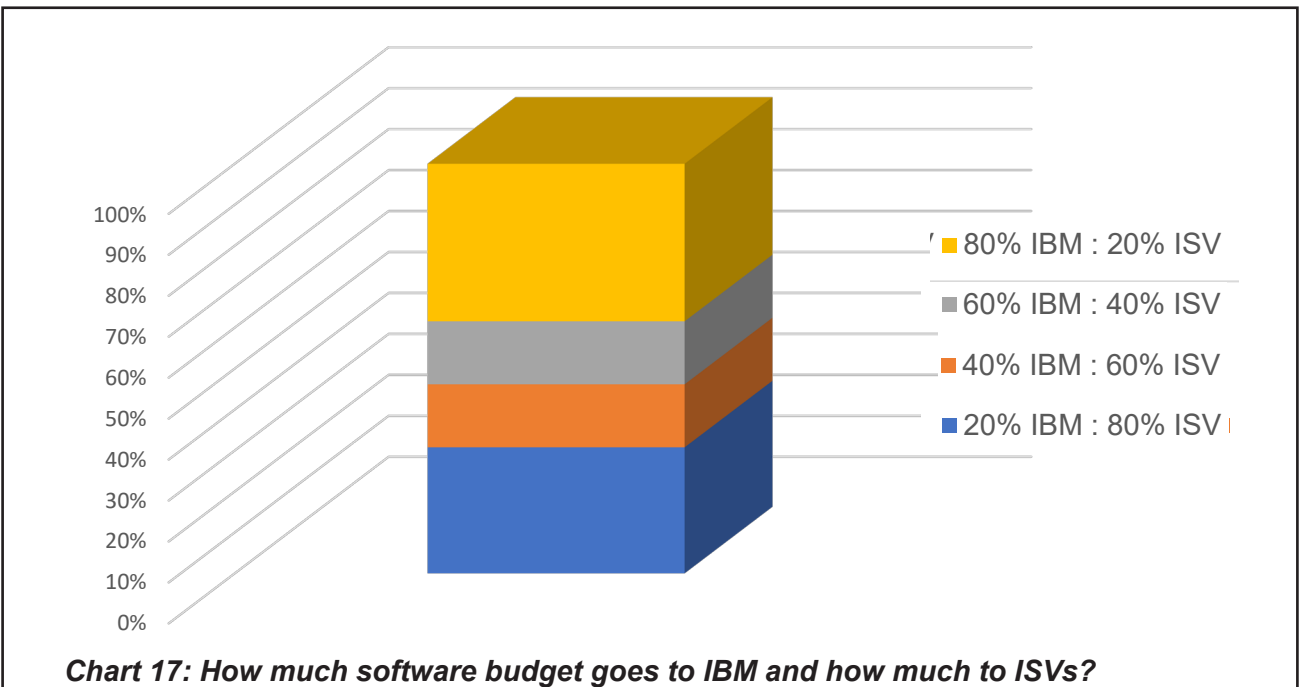
We also asked which cloud providers mainframe sites used (see Chart 15). Amazon Web Services (AWS) was, again, the most popular (used at 35 percent of sites), followed by Azure (used at 25 percent of sites). 30 percent of sites aren't using cloud yet, and some respondents are using more than one provider.



IBM versus the ISVs

The mainframe independent software vendor (ISV) business is continually evolving, and there

have been a number of small companies acquired by larger organizations, but, on the whole, not any obvious shifts in the landscape.



IBM regularly argues that some ISVs are too inflexible and need to change their software pricing strategies, while the third-party suppliers respond that IBM is placing excessive pressure on them by using its size and influence to win over their customers. Mainframe management is now sold as a way of allowing customers to maintain the quality of the service they get from the mainframe without the reliance on experienced mainframers. In other words, the software will identify a problem and, as well as informing a less-qualified human, will take the necessary steps to remediate the problem. In addition, vendors are beginning to use GUI-type screens, which younger IT people are more familiar with, to display important information. And much mainframe monitoring data can now be accessed from a browser.

What this doesn't do, of course, is develop new products. Experienced programmers are still needed for that to take place.

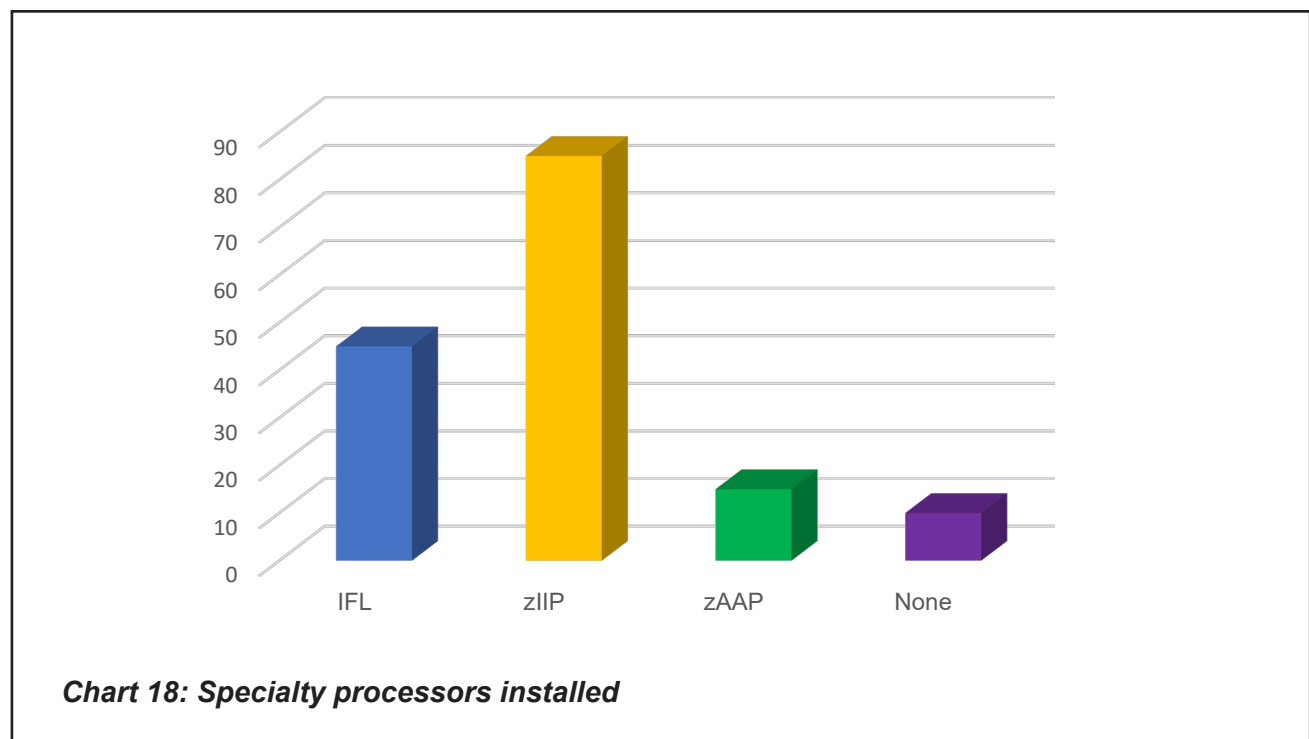
We asked respondents what makes them consider a change of vendor for their mainframe tools and utilities. It's clear from Chart 16 that

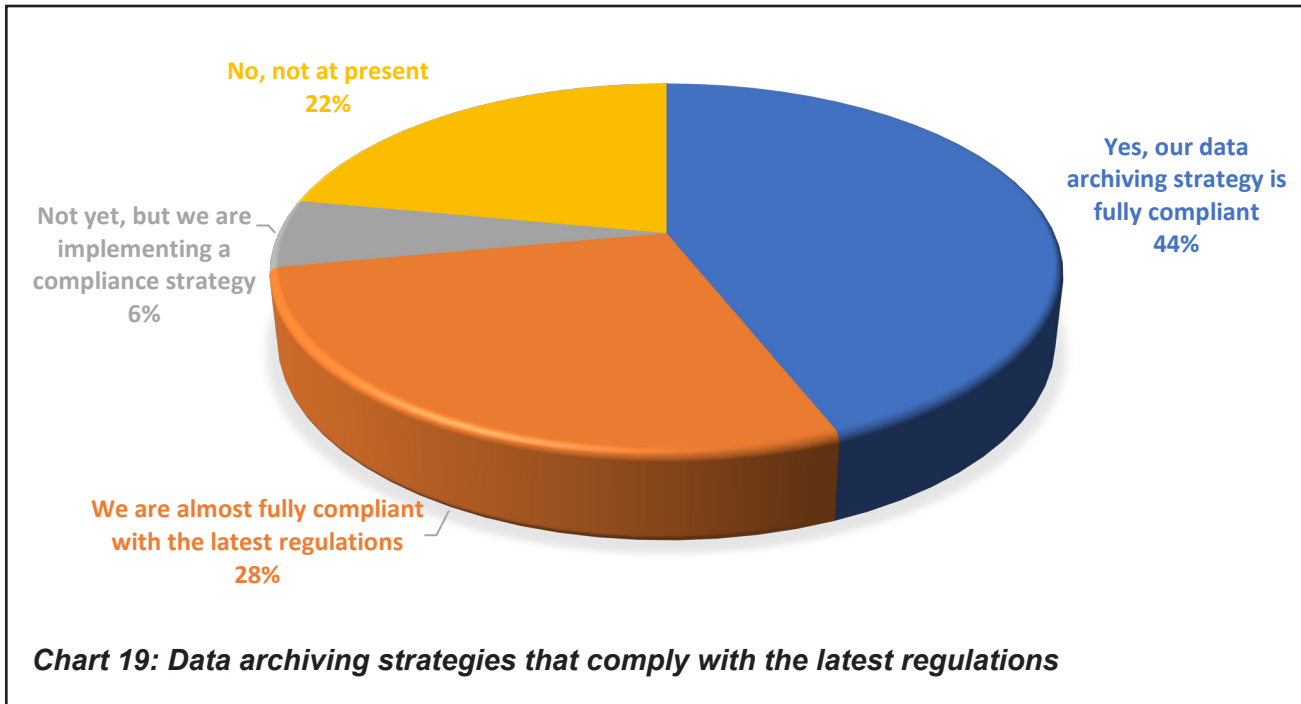
cost is by far the biggest driver, (70 percent of respondents) even though cheaper tools often offer less functionality, it may be the case that some customers feel the higher-priced software is filled with bloatware that they have to pay for, but will never use. ISVs may be pleased to know that 20 percent of sites said they rarely if ever change their software. These figures add up to more than a hundred because some people gave more than one reason.

We also asked how much of users' mainframe software budget is spent on IBM software, and how much on products from other vendors. Again this year (see Chart 17), we found that the majority, but only just, (54 percent) of respondents pay more to IBM for software than to other vendors.

Other issues

We asked about IBM's 'specialty' processors such as the Integrated Facility for Linux (IFL), the Application Assist Processor (zAAP) intended for Java applications, and the Integrated Information Processor (zIIP) intended primarily for Db2. We





asked respondents which specialty processors they had. This year, 95 percent of sites had a specialty processor installed. 85 percent of sites (the same figure as last year) had a zIIP processor. 15 percent of sites had all three specialty processors installed. Only 20 percent of sites had two specialty processors (the value was 60 percent last year). 45 percent up from last year's 20 percent) had IFL processors installed. The full results are shown in Chart 18.

In the USA, regulations such as Sarbanes-Oxley Act (SOX), HIPAA (Health Insurance Portability and Accountability Act), and BASEL II, plus what's estimated to be over 150 state and federal laws dictate the length of time that Electronically-Stored Information (ESI) needs to be retained. These regulations, and they do depend on the industry, have greatly increased data retention periods. The EU GDPR regulations came into force in back in May 2018. These affect any company in the world storing any data about EU citizens (airlines, car hire, banks, etc). Similarly, there's the California Consumer Privacy Act (CCPA), which came into force in January 2020.

In the light of this, we asked whether respondents had a data archiving strategy in place that was compliant with the latest regulations. 44 percent of sites (up from 33 percent last year) said they were fully compliant, with a further 28 percent (up slightly from last year's 25 percent) being nearly compliant with these regulations. The figure for sites not having an archiving strategy is 27 percent, a slight increase on last year's 25 percent. Clearly, compliance is an important issue and organizations are taking the matter seriously. It's worth recognizing that GDPR administrative fines for organizations that aren't compliant can be as much as 20 million Euros or four percent of annual global turnover, whichever is the highest. The full results are shown in Chart 19.

Social media is used by most people, and we wondered whether mainframers found social media (Facebook, Instagram, Twitter, YouTube, etc) useful for their work on the mainframe. Just over half (53 percent) of sites said that they did (down from last year's 69 percent), and the rest are not using it at all. IBM has Facebook pages and groups dedicated to IMS, CICS, and Db2,

it's good to see that social media is being used by some people.

With products like GateWAY z/OS from MainTegrity allowing mainframe access from a browser, and the growth in the number of software products that allow users to monitor the mainframe from a browser on a tablet or phone, we thought it would be interesting to see whether our survey respondents were using these devices to monitor or control their mainframe. 15 percent of sites said that they were (up from five percent last year). So, not a disruptive technology, yet!

A hot topic recently has been data analysis and all the things associated with that (such as Splunk). In particular, Splunk can be used to monitor log activity (as a SIEM), look for trends, and trigger alerts. We asked whether sites had any plans to use Splunk or its equivalents. 56 percent of sites said that they were already using Splunk (it was 31 percent last year). A further 12 percent said that they were planning to use Splunk or an equivalent.

DevOps (and DevSecOps) has also been talked about a lot for the past few years, and so we were interested to see whether sites were actually embracing the technology. The survey found that 67 percent of sites were already using DevOps (up from 44 percent last year), with a further 13 percent planning to use it (well down from last year's value of 39 percent).

Similarly, we asked whether sites had any plans to publish and reuse APIs to speed up application development. Using APIs means that organizations can re-use the best parts of their existing programs and new or updated applications can be created much faster by combining existing APIs. 62 percent of sites said that they were already using the technique (up from last year's value of 53 percent). And a further 19 percent of sites are planning to (up from 14 percent last year).

One way that CICS, IMS, and Db2 sites can easily allow their applications to link to mobile working is to use Liberty. Liberty is a JEE (Java

Enterprise Edition) application server based on WebSphere Application Server technology that can run stand-alone, on multi-platforms, or on z/OS. It dramatically simplifies the interaction with mainframe resources from Java applications. We asked whether people were making use of Liberty. 39 percent of sites already use Liberty (well up from 8 percent last year), with 15 percent (it was 18 percent last year) planning to install it.

Zowe was announced in 2018 as a way for non-mainframers to securely manage, control, script, and develop on the mainframe like any other cloud platform. 38 percent of sites said that they are already using this open-source technology (double last year's figure of 19 percent). With a further 31 percent of sites having plans to make use of it in the coming year (a decrease from 50 percent last year), which indicates how many sites actually did install it in the intervening year.

Blockchain is the cryptocurrency idea that can be used for securing and sharing ledgers and all sorts of information. Seven percent of sites reported already using it (last year no sites reported using it), with another seven percent planning to use it (similar to last year's figure of eight percent). We can conclude that blockchain isn't having a big impact at mainframe sites.

Docker is a way of containerizing applications – like little virtual machines – that allows an application to perform in the same way on any platform. 20 percent of respondents said they were already using Docker (up a little from 17 percent last year), with a further 47 percent (an increase from 33 percent last year) saying that they had plans to use it.

Robotic process automation (RPA) is a way of using software bots to automate repetitive or routine tasks that are usually performed by knowledge workers. Employees are then free to perform higher-value work. We asked whether sites were making use of RPA. 14 percent said that they were (down from 117 percent last year),

with further 14 percent (it was eight percent last year) at the planning stage.

Ansible, the open-source tool, can be used on mainframes as part of a provisioning and automation strategy, making life easier for systems programmers. We asked whether sites had any plans to use Ansible. 25 percent of the sites surveyed said that they are already using Ansible, and a further 17 percent said that they plan to use it.

The days of security by obscurity are long gone for mainframes and they have been the target of attacks by bad actors. With research conducted by the Ponemon Institute for IBM finding that the average cost of a data breach is \$4.35 million, we wondered how worried respondents were about ransomware on their mainframe. No-one reported having a solution in place. 53 percent of respondents (the figure was 33 percent last year) said that they were a little worried, and only 26 percent said that they were very worried (that figure was only six percent last year). However, 21 percent of respondents (well down from 61 percent last year) said that they were not worried at all, which must still be good news for criminal gangs and rogue nation state hackers.

We also asked about BYOD (Bring Your Own Device). We wanted to know how important respondents thought the idea of people using their own devices (BYOD) to access mainframes was at their site. 23 percent said it was very important to the way they work now (an increase on 13 percent in the previous two years). 18 percent are in the planning stages (up from none last year). But no-one had it as a future project (The figure was 27 percent last year). And 59 percent (much the same as last year's 60 percent) said it wasn't important.

Lastly, we asked the respondents how viable they saw mainframe computing at their site. 45 percent of sites thought it will continue much as it is (down from 58 percent last year), with 30 percent (up from 16 percent) suggesting they had positive plans for

the mainframe in the future, and 15 percent (sadly down from 21 percent) having great plans for the mainframe in the future. That left 10 percent of sites that didn't see their mainframe as viable, and are expecting it to be gone very soon. So, a slightly mixed picture, but nearly half of the sites surveyed (45 percent) were anticipating some growth. Perhaps, there are more positives than negatives to take from the results.

CONCLUSIONS

As always, it was an interesting survey this year, seeing how various sites are adopting the new technologies – although Java has been around for 25 years – and how the world of the mainframe seems to be integrating with cloud computing in a hybrid environment. Clearly, working with mainframes is an interesting way to spend your day – particularly as they are able to reach out to mobile devices and Internet of Things (IoT) devices, and the way DevOps practices can speed up what was a very slow process of application development. CICS, IMS, and Db2 continue to have quarterly updates that add value to the products.

In terms of what's new (or, perhaps more correctly, what appears on a lot of PowerPoint slides), the survey found that 56 percent of sites are already using Splunk or equivalent. And a further 12 percent said that they were planning to use it. The survey found that 67 percent of sites were already using DevOps (up from 44 percent last year), with a further 13 percent planning to use it. And 62 percent of all respondents (up from 53 percent last year) said that they were already reusing APIs to speed up application development, with a further 19 percent of sites planning to reuse APIs. Blockchain has been in the news a lot, but doesn't seem to be close to mainstream, yet. Seven percent of sites reported already using it (last year no-one did), and only seven percent are planning to use it. With Docker, we found that 20 percent of respondents were already using it (up from 17 percent last year) with 47 percent at the planning stage.

Zowe, the open-source way of accessing mainframes, was introduced in 2018. 38 percent of sites said that they are already using it (double last year's figure of 19 percent), with a massive 31 percent of sites having plans to make use of it in the coming year. Open-source technology is now becoming commonplace on mainframes.

When it comes to Web-enabling subsystems, we found that 80 percent of organizations were Web-enabling CICS. 65 percent of sites are Web-enabling Db2. 45 percent of sites are Web-enabling IMS. 50 percent are Web-enabling WebSphere Application Server. We also found that 39 percent of sites already use Liberty (well up from 8 percent last year), with 15 percent planning to install it.

Mainframes in an organization are just one of the computing platforms people use (along with phones, tablets, laptops, Power systems, etc), and, for a long time, there has been an issue, at many sites, with mainframes being accepted in the enterprise. The reason suggested by 85 percent of sites was that the biggest obstacle was the difficulty in retaining the necessary skills. And this, perhaps, highlights the need for a product like Zowe. 55 percent of sites thought that the biggest obstacles to mainframe acceptance within the enterprise was that it's too expensive (or appears to be). The figure was 90 percent last year. 50 percent thought the biggest obstacle was a cultural barrier between mainframe and other IT professionals (up from 40 percent last year). 30 percent felt concerns about future availability/support of mainframe apps was an obstacle. 25 percent of respondents thought that a barrier was the mainframe being too complex (or appearing to be too complex). And 10 percent of respondents didn't think that there were any barriers to mainframe acceptance. Let's hope that last figure rises in the future.

Reinforcing the value of the mainframe to organizations, the survey found that 94 percent

of sites have seen some kind of increase in capacity, and 93 percent have seen an increase in technology costs, but only 77 percent of sites believe their people costs have increased! Interestingly, 67 percent of sites say that the bulk of their IT budget is spent on cloud, leaving 33 percent of sites where the majority of their expenditure is on the mainframe. We'll track how those values change over the next few years.

But no organization is going to develop an asset unless they view it as having a future, and we all know the mindset that still exists about the mainframe, treating it as little more than your dad's technology. Unfortunately, the survey found that 53 percent of sites viewed their mainframe as a legacy system. Worryingly, only 10 percent (down from last year's figure of 17 percent) still viewed mainframes as strategic. 37 percent viewed mainframes as strategic and legacy!

When asked what, in their opinion, are the main benefits to their organization of the mainframe over other platforms, 85 percent of respondents highlighted the benefit of availability. 70 percent of respondents highlighted security. This figure is down from the 100 percent response last year, and yet breaches and ransomware still should be a major concern. 65 percent of respondents identified scalability, with 50 percent highlighting manageability as benefits.

This year's survey found that the z15 is the most popular model (at 50 percent of sites). The newer z15 Model T02 was found at a quarter of the sites, as was the z14 Model ZR1. The older models (z13s, z13, z12BC, z12 EC, and z114) are still out there and still performing well. It must be noted, when looking at these statistics, that many sites had more than one model of mainframe installed. We were, unfortunately, unable to collect information for z16 usage. In terms of operating system, 40 percent of respondents were using z/OS Version 2.5 (a huge increase on last year's figure of just seven percent). Another 40 percent

of sites are using Version 2.4 (last year it was 57 percent). Lastly, 20 percent were using z/OS Version 2.3.

We focused again on hybrid cloud computing. 42 percent of respondents currently used their mainframe in a hybrid cloud environment (up from 21 percent last year). A further 16 percent think that they will run a hybrid cloud environment at some time in the future, with 11 percent planning to run a hybrid cloud environment soon. A further 42 percent don't use hybrid cloud and don't have any plans to do so. We asked whether respondents use Red Hat OpenShift and/or IBM Cloud Paks on their mainframe. Only 12 percent of sites said yes, with nearly a quarter suggesting that they have plans to do so. We also asked which cloud providers mainframe sites used. Amazon Web Services (AWS) was the most popular at 35 percent, followed by Azure at 25 percent.

Linux is often in the news, so it was interesting to see what our respondents had to say about it. There are considerable cost and management benefits from consolidating distributed Linux workloads onto the mainframe. However, 61 percent of respondents weren't interested in LinuxONE mainframes. Six percent of sites said they already had one, with 22 percent expecting to get one at some time in the future, and 11 percent expecting to get one in the next year. No sites in the survey said their primary operating system was Linux. Having said that, around a third (31 percent) of respondents said that they run Linux on IBM Z.

The reported popularity of Java is reflected in the survey. 44 percent of sites (down from last year's 56 percent) said that they run Java-based applications on the mainframe, with a further five percent planning to.

Security breaches and ransomware are becoming a major issue – with the average breach costing

\$4.35 million. Perhaps worryingly, 21 percent of respondents said that they weren't worried about ransomware. No-one said they had a solution in place, although 79 percent were worried or very worried about it. So, still good news for criminal gangs and rogue nation state hackers.

When it comes to being compliant with regulations, eg PCI DSS, GDPR, and the California Consumer Privacy Act (CCPA), the survey found that 44 percent of sites were fully compliant, with a further 28 percent being nearly compliant with these regulations. However, the survey also found that the figure for sites not having an archiving strategy is 27 percent.

On the plus side, it seems lots of work has happened on mainframes since our previous survey, with a growth in the number of sites using newer technologies. In addition, nearly a third of sites (30 percent) suggested they had positive plans for the mainframe in the future, with a further 15 percent having great plans for the mainframe in the future. In addition, 94 percent of mainframe installations (well up on last year's figure of 66 percent) are experiencing some growth in MIPS. However, 10 percent of respondents didn't see their mainframe as viable, and are expecting it to be gone very soon. So, a slightly mixed picture.

Having said that, mainframe continues to offer a cost-effective, secure, and powerful platform for organizations with the necessary background and expertise in place to support it. It seems that non-mainframe IT staff and managers are not getting the opportunities to find out about the multitude of advantages that using a mainframe can bring to an organization – in terms of security, reliability, availability, flexibility, as well as understanding the true total cost of ownership figures for the platform. Perhaps Zowe will continue to help the mainframe to appear like any other server to a younger generation of programmers and managers.

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