White Paper

Extending Your Enterprise-Class Infrastructure to Accelerate Digital Transformation

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IDC OPINION

Digital transformation is not just a buzzword. It is the, by now unavoidable, approach with which enterprises must drive change in their business models and ecosystems by leveraging digital competencies. Digital transformation essentially reinvents an organization's approach to nearly everything — from the organization's business model to innovation strategies to products to, ultimately, the all-important customer experience.

Enterprise-class systems that run an organization's systems of record — the database, the transactions, and the analytics — have an increasingly critical role in this shift. The innovation opportunities are enormous with an existing enterprise-class scale-up system that is extended to connect to the organization's distributed environment as well as to the cloud and that utilizes its processing power, scalability, security, and reliability to serve as a cornerstone of that journey.

When enterprise-class large-scale systems are part of an organization's digital transformation, systems of record can be connected to systems of engagement; analytics are performed on the same data sets as transactions, leading to real-time insights; on-premises core business applications and core data connect to application development environments in the cloud; and next-generation (next-gen) apps that are ready for prime time get the same throughput and processing power and RAS that the systems-of-record workloads enjoy.

IBM Power's enterprise-class systems long ago opened up to open source Linux and now increasingly have also opened up to numerous open source applications, even to open source hardware — and they have long been ideally suitable for private and hybrid cloud deployments. Further, IBM has been at the forefront to add cognitive capabilities to applications and IT infrastructure capabilities.

For businesses around the world, an enterprise-class system that their IT staff has extended to the cloud, opened up for open source software, leveraged to consolidate systems or record and engagement, enriched with cognitive intelligence, and connected to next-gen applications represents a powerful and dynamic infrastructure continuum for digital transformation.

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SITUATION OVERVIEW

Digital Transformation

IDC identifies five stages of maturity with regard to the progress businesses have made toward digital transformation (the percentages represent data from IDC's February 2015 *Digital Transformation MaturityScape Benchmark Survey*).

The rearguard is made up of the Digital Resisters (14.2%) — they provide weak customer experiences and have a defensive posture toward digital. The next category is the Digital Explorers (31.8%) — they offer digitally enabled products, services, and experiences, albeit inconsistently and not yet well integrated. The third group consists of the Digital Players (32.4%), who provide consistent but not truly innovative products, services, and experiences. The fourth segment is made up of the Digital Transformers (13.6%) — they are leaders in their markets, providing innovative products, services, and experiences. And at the frontlines are the Digital Disruptors (9%), who are remaking existing markets and creating new markets to their own advantage.

As this data indicates, more than 50% of businesses now fall in the Player, Transformer, or Disruptor category. The remainder are at risk of losing their competitive edge unless they move aggressively to extend their capabilities.

Enterprise-Class Systems and Digital Transformation

Becoming Less Proprietary

An important element of digital transformation is openness. This is true for the operating environment and for the software that runs on it and even for the hardware. Enterprise-class systems from various vendors are increasingly losing their proprietary features. Furthermore, with every new layer between the hardware and the applications, such as virtualization and containerization, the nature of the underlying infrastructure becomes less important, while its capabilities — such as performance, scalability, and RAS — become the differentiating factors.

Indicative of this trend is the continuing move toward Linux. IDC predicts that in 2020, 8- to 16-socket server revenue on Linux will be as high as 8- to 16-socket server revenue for Unix. Arguably, this can be seen as the tipping point at which enterprise-class systems running Unix will have made the switch to open source Linux (see IDC's Worldwide Tracker Forecast, 4Q15).

Other open source software that is available for enterprise-class systems is nearly limitless in its breadth and variety and includes financial software that intends to replace expensive business applications from SAP or Oracle: Big Data tools (Spark), cloud infrastructure (Cloud Foundry, OpenStack), containerization (Docker, Kubernetes), CRM, data mining, developer tools (Node.js), IoT, machine learning, and so forth.

New Roles for Enterprise-Class Systems

Enterprise-class systems run the mission-critical database and core business applications. They deliver the highest transaction rates and ensure that every transaction is executed in a 100% reliable fashion. Digital transformation is assigning these systems important additional roles to play:

- **Shifting to open source databases, unstructured data, and hybrid cloud.** IDC expects the types of databases and the deployment approach to shift, extending the enterprise-class system toward open source and hybrid cloud. Over the long term, it is expected that relational

database management systems (RDBMSs) will migrate to a hybrid cloud deployment, that new applications will be increasingly designed to be served by nonrelational databases, and that data will be organized in ways more suitable for in-memory operations. Databases are also affected by developers requiring agility and scalability, just one reason why newer nonrelational database management system technologies, which are mostly open source, are seeing strong adoption rates (see *Worldwide Relational Database Management Systems Forecast, 2016–2020,* IDC #US40428116, July 2016). Open source databases such as MySQL or Postgres have reached enterprise-level quality and are cost efficient, not in the least because adding more cores to expand them will not affect an organization's IT software budget. Furthermore, nonrelational or NoSQL databases such as MongoDB and Cassandra are increasingly popular for their ability to store any type of unstructured data, and they are designed for deploying and massively scaling new applications.

- **Extending RAS features.** The RAS characteristics of an infrastructure matter more than ever even as new apps themselves are becoming more resilient. Reliability and high availability will continue to be key characteristics that businesses look for in an enterprise-class system that runs their core workloads, but RAS features will extend beyond the core workloads. Businesses that are bringing new open source solutions into their environments, for example, typically do not run them on their large, mission-critical systems right away. Instead, they run them on smaller systems first because it is easier to get started there. As these open source applications begin to scale, many organizations decide to add them to their enterprise-class systems. Ultimately, such open source applications will need the same infrastructure characteristics, including high RAS capabilities, as the core workloads.
- **Connecting core data to strategic applications.** IDC predicts that by 2018, enterprises pursuing digital transformation strategies will more than double software development capabilities and that two-thirds of their coders will focus on strategic digital transformation applications and services. Next-generation applications, a key component of the digital transformation effort, are distinctly different from traditional applications. They use different programming languages and are designed differently, increasingly with microservices. Enterprise-class systems that are deployed as part of a hybrid cloud will enable such applications to access the business' core data. Most businesses expect the portion of next-gen applications in their business to grow, and the infrastructure implications are quite impactful. In particular, containerization, the use of flash, and in-memory databases will grow because of further increases in next-gen app development.
- **Getting imbued with cognitive capabilities.** IDC defines cognitive systems as a technology that uses deep natural language processing and understanding to answer questions and provide recommendations and direction. The system hypothesizes and formulates possible answers based on available evidence, can be trained through the ingestion of vast amounts of content, and automatically adapts and learns from its mistakes and failures. IDC predicts that by 2018, more than 50% of developer teams will be embedding cognitive services in their applications (versus about 1% today). Cognitive applications are intensely data driven, and IDC expects cognitive applications to be making a major entry into datacenters and the cloud (see *Worldwide Cognitive Software Platforms Forecast, 2015–2019: The Emergence of a New Market,* IDC #258781, September 2015).

IBM's Power Enterprise Systems for the Cloud

IBM has introduced three enterprise-class POWER8 systems that are ideal for extending an organization's capabilities toward a digital transformation journey: the Power E850C, E870C, and E880C. These systems are built with IBM POWER8 processors that have speeds of up to 4.35GHz, which is the fastest per-core performance outside of IBM z Systems. They also have strengthened cores and larger caches compared with previous Power generations as well as two integrated memory controllers with improved latency and greater bandwidth. All three systems have an integrated I/O subsystem and hot-pluggable PCIe Gen3 I/O slots. Various improvements have increased the systems' already well-known reliability, serviceability, and availability, including redundant power supplies, advanced memory protection, and redundant service processors on the modular E870C and E880C. In detail:

- The E850C server is a space-saving 4-socket 4U enterprise-class server with up to 48 processor cores and up to 4TB of DDR4 memory, built-in PowerVM virtualization for high utilization rates, and IBM's pay-per-use Capacity on Demand (CoD). The system is designed for data-intensive workloads, analytics, and scalability, and it is targeted at medium-sized businesses and departments or as a building block for cloud deployment in large datacenters. It runs AIX and Linux.
- The E870C is a modular, high-performance enterprise system for large-scale, mission-critical transaction, database, and analytics applications with up to 64 processor cores and up to 16TB of memory. It also has built-in PowerVM as well as CoD, and it supports Power Enterprise Pools. IBM states that the E870C can reliably manage hundreds of virtual workloads on a single system. It runs Linux, AIX, and IBM i.
- The E880C system provides the highest levels of security, reliability, availability, flexibility, and performance in the portfolio as a private or hybrid cloud infrastructure. It is distinctly suitable for big data processing because of its 32TB in-memory capability. The E880C's built-in PowerVM virtualization enables the highest workload consolidation and provides IT with the widest range of large-scale, dynamic resource allocation, in addition to support for CoD and Power Enterprise Pools. It runs Linux, AIX, and IBM i.

The fundamental characteristics of the Power Enterprise Cloud models are:

- **Performance.** These are IBM Power's largest, most powerful and sophisticated industry-scale systems.
- **RAS features.** The systems provide the highest levels of availability in the Power product line, which is designed to increase the reliability levels from 2 to 4 to 8 to 16 sockets.
- **Virtualization sophistication.** They provide a high degree of granularity in terms of number of partitions and the flexibility to dynamically and automatically move capacity around, both within a system and between systems using Power Enterprise Pools.
- **Elastic Capacity on Demand.** IBM developed Elastic CoD in response to customer preferences for a pay-per-use consumption model. It enables businesses to purchase either traditionally (as a capital expense) or flexibly (as an operational expense) with a purchase or lease for the base infrastructure and then turn capacity on and off as needed on top of that.

Each of these new Power Enterprise Systems offers several cloud capabilities that are critically important for digital transformation. For on-premises cloud deployments, the new offerings have three key features:

- The foundation for the C-models is PowerVM and IBM's OpenStack-based cloud management solution, IBM Cloud PowerVC Manager. PowerVC can manage virtualization of up to 5,000 VMs and 200 hosts with a simple user interface and enables the capturing and deploying of VMs through replication as well as the resizing and migrating of VMs. For cloud management, PowerVC can act as a self-service portal for provisioning new workloads, provides access to OpenStack APIs, and gives businesses a window on cloud metering data. An optional advanced version includes an image catalog, capacity management, and orchestration blueprints.
- A second key piece, and a new built-in component, is a variety of open source tools that IBM customers like to use to manage private cloud automation. IBM says that its open source repository for AIX has more than 80 packages that were updated this year. Among them are cloud automation tools such as Chef, Cloud-Init, and yum as well as development packages such as GitHub and Node.js. IBM says it is dedicated to working with the open source community to keep these packages up to date and secure for enterprise users.
- The third feature is the new cloud-based Hardware Management Console (HMC) Apps as a Service offering,[1] which will provide businesses with the ability to aggregate Power Systems performance and inventory data from across their enterprise, removing the burden of manual collection and aggregation of system information.

The C-models' key features for hybrid cloud are:

- PowerVC can integrate with IBM Cloud Orchestrator as well as with VMware's vRealize to enable customers to manage their VMs from a single interface, whether on Power, on an Intel environment, or in the cloud.
- IBM's API Connect or WebSphere Connect enables businesses to develop hybrid, cloud-native applications and securely connect them back to the on-premises core business data. This allows customer-facing system-of-engagement applications to leverage systems-of-record business applications. IBM says it will help organizations understand how to use the tools and how to start developing applications with Bluemix or Cloud Foundry.
- A new offering is disaster recovery as a service (DRaaS) on Power E870C and E880C, which businesses can initially deploy within the enterprise between two datacenters as a GDR (geographically dispersed resiliency) or a DR service. IBM says that starting in early 2017, the service will be hosted on IBM's business resiliency cloud. IBM also intends to integrate the capability into the DRaaS environments of partnering managed service providers and cloud service providers.
- A starter-pack offer from IBM includes 6–12 consecutive months (depending upon model) of complimentary access to a Power bare metal server running Ubuntu Linux in SoftLayer's Dallas datacenter. Businesses that want to move on-premises capacity to the cloud can do so by reducing or turning off the on-premises capacity and moving it to SoftLayer. IBM's aim with this offer is to ease some of the up-front planning as organizations contemplate whether to invest in on-premises or hybrid cloud deployments.

IBM also provides Power to Cloud Reward points that may be redeemed for services to help businesses get started with cloud deployment leveraging the C-models. Its Lab Services can help organizations design for cloud provisioning and automation or help them build out and automate a DevOps environment.

[1] Currently in technical preview, with general availability in early 2017

Power Performance, Throughput, and Scalability

IBM's enterprise-class Power portfolio has been designed for the high transaction rates and for the reliability and availability requirements of today's systems-of-record applications and workloads – the database and the core business applications. As databases are moving to in-memory, the platform has been equipped with in-memory capability as well as server-side Flash cache. And as businesses are seeking higher throughputs from their systems of record, Power systems are designed with higher per-core performance, greater I/O bandwidth, more memory, increased memory bandwidth per socket, and an additional L4 cache to help with memory access as well as larger caches to support these requirements.

IBM states that for POWER8, the peak memory and I/O bandwidths per system node have increased over three times compared with POWER7 servers. POWER8 provides greater throughput in various ways:

- **Faster processors:** IBM's 22nm semiconductor technology used for POWER8 has 15 layers of copper wire of various sizes compared with 9 layers for the industry-standard architecture. Once all the basic functions have been accounted for, the industry standard has 12 wires left (with varying speeds), while the POWER8 chip has 25 available (also at varying speeds), providing POWER with more and faster connections, low-latency distance paths, and high-density complex circuits. In combination with various other processor designs, this enables POWER to deliver higher throughput per core.
- **Greater threadiness:** POWER8 has 8 logical threads per core, whereas standard architecture processors have 2 threads. Tests indicate that the latter cannot make up for the improved throughput achieved with POWER's Simultaneous Multithreading (SMT) by simply adding more cores. Additional advantages of POWER's SMT therefore are that it requires fewer cores and has lower software license expenses, fewer footprints, lower acquisition costs, and reduced operating expenses.
- **Higher memory bandwidth:** To handle operations that require very high memory bandwidth (such as a delta merge with HANA), POWER8 provides up to 8 high-speed channels for up to 230GBps sustained memory bandwidth in and out of an E870C or E880C processor, 32 DDR ports yielding a 410GBps peak at the DRAM, up to 128MB L4 cache, and up to 2TB memory capacity per processor socket.
- **Two-hop topology:** One of the key contributing factors to the scalability of POWER8 Systems from 4 to 8 to 16 to 32 sockets is the fabric bus that interconnects all the processors, which has been designed for maximum throughput. IBM has added more buses for interconnections between the sockets to flatten SMP scale via a two-hop topology as opposed to the three-hop topology in previous generations.

Further contributing to the system's performance and throughput is PowerVM, IBM's highly scalable virtualization technology. The enterprise-class systems ship with PowerVM built in. One reason for PowerVM's performance- and throughput-enhancing characteristics is the tight integration and optimization between PowerVM and the Power hardware. Unlike with competing hardware vendors, IBM owns the virtualization technology, which means that it can coordinate innovations in the hardware and the virtualization technology with every new Power generation. Systems that run on competing architecture typically add a third-party hypervisor such as VMware vSphere or Microsoft Hyper-V. Power's ability to scale with PowerVM is a strong differentiator for the product line. Indeed, although SAP HANA came out on x86 about three years before it became available on Power, today Power is the only virtualization platform for which SAP allows customers to run multiple HANA production instances on the same system.

Proven RAS

RAS on the Power enterprise-class systems has been proven in the market over multiple generations and is achieved in a myriad of ways. Memory buffers that are built into the system, for example, help eliminate soft errors. Soft errors can occur at a chip or system level, are caused by particles or noise, and will alter an instruction in a program or a data value. A soft error will typically bring down lesser architecture and require a reboot.

POWER8 also has automatic recovery processes designed to recover from internally detected faults. In other words, the system doesn't surface the fault and then ask a software package to deal with it; rather, it fixes the fault. POWER8 features intelligent memory controllers with replay buffers and error detection so that it knows when there is a problem, which it can then correct on the bus or between the controller and the DIMM. It also features spare DRAM modules.

IBM says that many of its SAP customers have historically purchased Power servers for their proven resiliency, including the ability to correct memory errors; POWER8 can absorb four failures on a single DIMM before the DIMM is flagged as bad. Customers that were running SAP HANA on standard architecture and switched to HANA on Power have mentioned that they made the switch because their previous systems failed as a result of memory failures.

Enterprise-class systems are integrated hardware and software platforms, designed with infrastructure redundancy throughout the systems to avoid outages, including I/O subsystem redundancy, redundant power, and redundant voltage. The PowerVM hypervisor is built-in firmware, which means that it is more secure and that it exploits the capabilities of the hardware more closely and scales more efficiently.

Furthermore, multiple I/O virtualizers provide additional reliability — if one of them were to fail or if a problem with a driver occurs, this will affect only half the configuration and the system will continue to operate properly. And IBM has added memory mirroring to the hypervisor so that if a memory error occurs, a VM can tolerate it and continue functioning.

Hybrid Cloud

The cloud is no longer just a strategy for competitive advantage; rather, it is a prerequisite for business survival. IDC also believes that a cloud-first strategy is one of the key components of a successful digital transformation strategy. Overall, 35% of scale-up server investments today are earmarked for a cloud deployment of pooled resources — this percentage will grow rapidly. Most cloud deployments will be in the form of a hybrid cloud, with mission-critical data remaining on-premises while unstructured data is processed in a public cloud.

Many enterprise-class Power customers do not consider it their end goal to perform a complete migration to the public cloud. They intend to have their core business applications and core data on-premises and connect to them in the cloud. For this purpose, IBM has created software connectors based on its API Connect family that have the ability to connect an organization's Oracle database or DB2 database or SAP applications into a cloud environment, for example, to IBM's Bluemix application development environment.

Power customers go to the cloud to develop applications and then connect them back to their enterprise-class systems. As mentioned previously, a current IBM initiative to help customers with creating a hybrid cloud provides them with lab services to connect them via SoftLayer, where most of them run Bluemix on standard architecture, to their on-premises enterprise systems. This is part of IBM's Power to Cloud services offerings.

Consolidation and Colocation: Combining Workloads for Cost Savings and Analytical Benefits

The enterprise-class portfolio of IBM Power Systems is ideal for consolidating workloads, thereby reducing cost while enabling new capabilities that are important for an organization's digital transformation. They empower IT to run mixed, data-intensive workloads on the same footprint while maintaining high throughputs and performance without them interfering with each other.

Important factors contributing to Power's consolidation capabilities are the networking remaining inside the box rather than being external, which reduces complexity and vulnerability; the system's ability to dynamically and automatically adjust required capacity between various applications over the course of a day, week, or month; the ability to leverage Power RAS for a larger number of diverse applications; and the extension of the system's security features to a large percentage of data as more data remains inside the system rather than moving between systems.

Additional factors are the system's high-performance characteristics, high throughput, large memory footprint, and powerful virtualization and partitioning technologies, including the ability to host multiple operating systems. The system also scales well to adjust to sudden increases in transaction volumes and can do so in a flexible and cost-efficient manner. In particular, POWER's 8-way SMT makes the system suitable for other workloads such as WebSphere or SAP, which is a highly threaded workload that leverages Power for massive scalability. Further, many industry-specific ISV applications for such verticals as retail and the financial services sector are combined on enterprise-class Power with other workloads.

Deploying applications onto fewer, more scalable Power servers also has distinct advantages for private cloud deployments. By hosting diverse workloads on fewer large-scale servers, applications have access to a greater number of shared resources, which helps maximize throughput and utilization. Enterprise-class Power servers also enable the use of larger VMs as well as more VMs per system, which reduces the number of nodes and lowers overhead for clustering. Reliability benefits from using fewer large-scale systems with high RAS features as VM movement is minimized. Finally, resources can be added quickly, nondisruptively, and dynamically with IBM's Capacity on Demand or Power Enterprise Pools offerings.

Combining Systems of Record with Systems of Engagement

One important opportunity for IT to pursue is to combine and integrate systems of record with systems of engagement on a single enterprise-class Power system to achieve what is sometimes referred to as a system of insight.

Systems of record are the operational ERP and transaction processing systems that include a database related to such fundamental business tasks as payments. They also execute the online transaction processing (OLTP) tasks and the batch transaction processing, and they run transactional applications as well as commercial and custom-developed software. They include the data warehouse and perform the business' online analytical processing (OLAP), data mining, and other business intelligence techniques. The data that systems of record process is structured, well formatted, and quantitative – transaction data or ERP data, for example.

Systems of engagement are the customer-focused front-office applications. They include CRM, marketing systems, and service and support systems (e.g., call centers), as well as commercial and custom-developed software. They produce the bulk of today's data, most of which is unstructured, qualitative, or language based — images, sensor data, social data, video, and documents.

Colocation of these two sets of applications on a single system has all the benefits of the aforementioned consolidation. It allows organizations to extend their core business systems rather than proliferating data to other servers, which would result in a more complex infrastructure. It is cost effective, makes management easier, protects more workloads with the same security and RAS features, and keeps interacting applications closer together. In addition, it enables analytical processing on the same data sets rather than on copies, which is increasingly demanded by business that want real-time analytics on transactional data for competitive advantage.

It should be noted that the systems-of-record workloads themselves are changing. A good example of this is SAP HANA, a popular workload on Power. SAP has moved not only its business warehouse and intelligence technology (BW) to HANA to speed up response rates but also its transactional systems (Business Suite) to in-memory with HANA. This means that the entire SAP environment will be in-memory, accessing the same data in the same environment versus having to replicate data to perform queries or generate reports. In other words, we are witnessing a transformation of the systems of record combined with integration with systems of engagement.

Gaining Cognitive Capabilities

Ultimately, these applications will gain cognitive capabilities. Across all industries, businesses are increasingly looking for ways to make their operations smarter using cognitive systems technologies. These technologies can provide IT automation and knowledge worker augmentation, reveal financial fraud, provide advice to medical professionals, produce operational predictions and recommendations for manufacturing businesses, or recommend financial products to brokers or customers, among many other use cases. In other words, enterprise applications are transforming to become expert advisors.

Cognitive solutions are entering the stage in many ways, via Watson in the Cloud, for example, and also as cognitively enabled process applications: IT performance management, procurement, HR, sales, finance, R&D, and marketing. These are enterprise applications that run on enterprise-class systems such as Power. The cognitive components that embed these applications with intelligence are such technologies as APIs, data stores, natural language processing, machine learning, and image analysis.

Deployment Speed

Speed is essential for digital transformation, and speed to deploy new systems is paramount. IBM says that it has done a lot of work on its installers, management consoles, and private cloud offerings to give customers the ability to quickly stand up new systems and deploy workloads on those systems, sometimes in less than a minute. For example, IBM has greatly simplified its hardware management console based on OpenStack to make it easy to stand up new systems.

There is also a facility in PowerVM called NovaLink with a new installer that asks customers a few questions and then allows them to stand up virtualization from bare metal in a standard configuration in less than an hour. Further, PowerVC enables customers to rapidly build an on-premises private cloud.

One popular workload on Power is HANA, which is installed using SAP's Tailored Data Integration (TDI) method as opposed to the HANA appliance model that many vendors market. Power customers tend to install 2TB+ HANA instances on 4-, 8-, or 16-socket Power servers. TDI does not mean that customers receive a pallet of parts from IBM — the company offers solution editions for HANA, with the TDI specs built in, including the right storage and networking, ready for customers to deploy the software on. What's more, IBM has worked closely with SAP to integrate SAP's Landscape Manager with PowerVC so that from Landscape Manager, a customer can push out new VMs with SAP instances on them.

Software Ecosystem and Skill Sets

Power platform customers do not need to run everything as a single operating environment. As mentioned previously in the Enterprise-Class Power Systems for Digital Transformation section, IBM has started bringing open source management and tooling workloads to AIX so that clients can run and manage their Linux and AIX environments using the same tools. For example, if a customer wishes to use Chef or Puppet or to leverage other open source tools, it will be able to do so in AIX, in addition to Linux.

IBM is currently engaging in a key initiative related to "openness," meaning that if customers are seeing value in certain new open source tools and management applications, then IBM will, on an ongoing basis, rapidly make them available for AIX as well as Linux. The goal is to become less proprietary by enabling Linux and various open source tools — by adopting OpenStack, for example, as the management structure. At the same time, IBM will continue to support the ISVs that develop software for AIX. This is also important in terms of aligning with customer skill sets.

With regard to skill sets, IBM provides migration services and training when customers migrate from other Unix flavors to AIX or when they move from Linux on standard architecture to Power. IBM has helped quite a few customers migrate from HANA in production on a standard architecture appliance to Power, both with the migration and with the required Power skills. Linux is Linux, but these customers do need help with understanding the system environment, specifically PowerVM and PowerVC. Support and training are abundant to ease these types of transition — a training course "PowerVM for VMware administrators," for example, or "Implementing Cloud with PowerVC" on IBM's Training and Skills website.

Next-Gen Application Support

Next-gen application developers require extremely flexible compute capacity, scalability, infrastructure redundancy, performance, storage capacity, bandwidth, and uptime as well as low cost per unit of compute, storage, and bandwidth. Increasingly, these applications also require instant access to the core business data in the enterprise-class system. By running these apps in a hybrid cloud with open APIs for access to the data on the enterprise-class Power system, businesses can develop a host of new business opportunities by leveraging their organization's core data.

The Power systems themselves are fully enabled to run open source workloads as well, with little endian Linux available across the portfolio. Power's Integrated Facility for Linux (IFL) processors allow customers to very economically run even the smallest Linux workloads, such as an emerging next-gen application might be. Even if customers sometimes start next-gen applications on smaller systems, they will ultimately need to migrate them to the enterprise-class Power system as they begin to scale and start requiring the same enterprise characteristics as the traditional systems-of-record applications. For example, Power customers are increasingly running Linux-based open source databases such as MongoDB, MariaDB, and Postgres next to or even instead of their traditional systems-of-record applications.

Total Cost of Ownership

IBM believes that the first key characteristic that enables it to deliver a total-cost-of-ownership (TCO) advantage with Power is the ability to execute more capability with a similar-size system as competing offerings. Because of its per-core performance, an IBM Power enterprise-class system's TCO can be significantly lower than the TCO of a competing scale-out system while delivering the same or better overall capability and performance. Power can save customers software licensing fees for workloads and applications that are priced based on the size of the system (e.g., per core from Oracle, IBM, and others). Next, the 80% utilization rates on Power E870 and E880 systems that IBM says it "guarantees" are almost twice as high as what is regarded as typical for competing offerings. It is also important to look beyond the TCO of a single system and, for example, consider the HA environment. Efficiency can be gained there with an economical HA system called Capacity Backup that enables customers to deploy HA while paying for only their production environment.

But businesses are also looking for opportunities to purchase capacity in a more cloudlike fashion, leading to an increasing trend to seek pay-per-use models. The flexibility to turn infrastructure on and off and pay for only actual usage to optimize cost is another major incentive for organizations to look at cloudlike infrastructure, even on their on-premises networks, that can facilitate such models. Pay-per-use models are also allowing organizations to respond more swiftly to changing demands — they have become one of the most important capabilities that IT infrastructure providers need for digital transformation, whether they are enterprises or service providers. IBM Power Capacity on Demand and Elastic Capacity on Demand address peak workloads and provide significant cost benefits. These programs allow customers to design for steady state and pay for only peak workloads when they need them, for example for five days at the end of the quarter.

Finally, an IBM Power customer that is moving from an older-generation Power to POWER8 can potentially achieve cost savings. Customers may grow without adding systems or software licensing and maintenance, or conversely, a customer that is running a Power7 system and that intends to run the exact same workload on POWER8 can likely buy half as many cores on the POWER8 system and dramatically reduce the license fees for AIX and PowerVM and other system software, as well as hardware and software maintenance costs. Required floor space too may be reduced by consolidating to fewer systems, which can lower energy costs as well.

Moving to POWER8 will help customers with older-generation Power systems reduce operating costs (according to IBM, as much as 50% over three to five years) and allow them to take advantage of digital transformation with such critical components as real-time analytics and open source environments. POWER8 should enable these customers to optimize their IT spend and apply it to digital transformation innovation, notably cognitive systems technologies, rather than to maintaining their older systems; this will allow customers to position their business for the future and avoid the angst of switching vendors.

Customers that are running enterprise-class POWER8 systems should evaluate the Power scale-out line as well. Running both in the datacenter will provide them with architectural advantages as well as the benefits of years of technology development in the enterprise-class systems that is embedded in the scale-out portfolio.

CHALLENGES/OPPORTUNITIES

For Organizations

- **Challenge:** Extending an organization's mission-critical enterprise-class systems and turning them into an engine for digital transformation may seem risky and complex.
- **Opportunity:** IT is facing executive demand to outsource large portions of its mandate to the cloud. IT teams that run the enterprise systems and that focus on consolidation, private and hybrid cloud, colocation of systems of record and engagement, and connecting next-gen app development to the core business data, as well as opex purchasing models, will be able to embrace digital transformation while maintaining a trusted on-premises environment. This includes leveraging IBM's cognitive-powered IT infrastructure solutions, which learn and understand what is normal behavior for applications and infrastructure; what, therefore, should be considered an anomaly; and what to expect based on predictive modeling.

For IBM

- **Challenge:** Explaining to the market that its enterprise-class POWER8 systems are ideal for the digital transformation journey while addressing all the traditional enterprise-class needs.
- **Opportunity:** IBM has all the required elements in place to help customers create a complete environment for digital transformation with cognitive capabilities in general as well as the cognitive infrastructure solutions described previously. The company has an opportunity to be seen in the industry as being able to solve every piece of the digital transformation puzzle, especially for large enterprises with enterprise-class systems that must make careful decisions as to how to embark on this journey without jeopardizing their core business systems. If IBM can transparently connect all the dots and ensure that its offerings are all part of an efficient, integrated whole, IBM should be able to energize and expand its customer base.

CONCLUSION

The enterprise-class systems in businesses are becoming vehicles of digital transformation. This was to be expected. For sure, they run and protect the business' database, execute the business-critical transactions, and perform the analytics. But IT has discovered that when connected to its distributed environment and the cloud, the enterprise-class system, with all its processing power, scalability, security, and reliability, can accelerate digital transformation while functioning as a powerful safeguard.

Businesses are learning how to combine the core data that is processed by the systems of record on the enterprise systems with the fluid data that is flooding in from the systems of engagement to perform sophisticated analyses using cognitive capabilities that can provide distinct competitive advantages. IT is also figuring out how to build next-gen apps that generate this fluid data in the cloud and how to give them access to the core data in the on-premises enterprise-class environment for new user experiences, new revenue-generating opportunities, and even new business models. And once these next-gen apps have matured to a point where the company's life depends on them, they can migrate to the enterprise-class system for protection and scalability.

IDC believes that IBM is at the forefront of these shifts with its new enterprise-class Power portfolio for the cloud. These new systems will help clients transform their IT infrastructure with OpenStack-based cloud management while lowering operating costs. In addition, the hybrid cloud capabilities and secure connections to IBM's Cloud will accelerate businesses' digital transformation.

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