IBM's Mainframe50: The Future of the Mainframe

EXECUTIVE SUMMARY

This year marks the anniversary of one of the most significant events in the IT industry, as it was 50 years ago that IBM introduced the IBM 360, the first modern mainframe. In honor of this occasion, IDC is taking the opportunity to reflect on the significance the mainframe has had on the IT industry, business, and society; the degree to which this technology remains a core foundation of today's global infrastructure; and the extent to which companies are using it to find new ways to drive business innovation.

The mainframe has reinvented itself many times, with a steady stream of technical innovations enabling businesses to adapt to the market demands of the day while providing the foundation to address opportunities of the future. In many ways, the mainframe reflects the march of information technology.

The mainframe, far from being a relic from a bygone era, remains an essential component of many organizations' IT infrastructures. Mainframes are used as the platform of choice for mission-critical applications in a variety of organizations and industry verticals. And while information technology has passed through successive revolutions – IDC refers to these as the 1st Platform, 2nd Platform, and 3rd Platform (we are currently in the early stages of the 3rd Platform) – the mainframe has adapted its role and continued to drive unique and differentiated value.

To this day, IBM continues to work with its customers to understand their requirements and develop new innovations and technology to ensure the mainframe environment remains a critical enabler of 3rd Platform technologies: Big Data analytics, cloud computing, and enterprise mobile enablement. This collaboration and cocreation of the technology with customers has helped secure the mainframe's role in the world of IT and the future of business. As information technology continues to cement its role as the underlying fabric of nearly all business transactions, IDC believes there will always be a role for highly efficient, economical, scalable, reliable, and securely accessible platforms such as the mainframe. IBM realizes this and is putting investments and plans in place to continue to realize IBM's vision for the mainframe, which plays a critical role not only in today's enterprise but in driving business progress and innovation in the future.

THE HISTORY OF THE MAINFRAME AND THE THREE PLATFORMS OF COMPUTING

The world of IT is changing. Today, we are in the early stages of what IDC describes as the 3rd Platform of computing, in which Big Data, cloud computing, mobile, and social technologies are fundamentally transforming the computing and business landscape. This 3rd Platform is enabling enterprises to find new ways to drive business value and serves as a source of competitive differentiation. Organizations that fail to incorporate 3rd Platform technologies into their business processes risk being left behind.

The 1st Platform, dating back to the dawn of computing, was defined by the use of early-generation mainframes and terminal servers. It touched millions of users, with applications numbering in the low thousands. The 2nd Platform came about with the birth of the PC in the 1980s and was defined by the client/server model, Ethernet, RDBMSs, and a new class of business applications decoupled from the underlying hardware. The 2nd Platform touched hundreds of millions of users and tens of thousands of applications. Today, we are in the early stages of a whole new platform, with mobile devices and apps extending the edge, cloud taking the place of client/server at the core, Big Data enabling analytics that provide deeper insights much faster, and social technologies enabling effective collaboration and bringing human brains into digital, automated processes.

But even as the mainframe more or less defined the 1st Platform, it continued to remain relevant during each of next two phases of computing. It evolved and adapted, adding new capabilities and staying true to its strengths. Within the client/server model, mainframes were used to support mission-critical applications and other workloads, and today it continues to be the system of choice when the highest levels of security, scalability, and reliability are required (e.g., for large-scale cloud computing and Big Data applications). It provided a platform to provide both backward and forward compatibility, allowing organizations to extend their IT investments. And the mainframe brings levels of efficiency that for many workloads make it the lowest total cost of computing. Figure 1 shows a timeline of innovations – released by IBM and other mainframe vendors – that enabled the mainframe to remain relevant to the computing needs of the day.
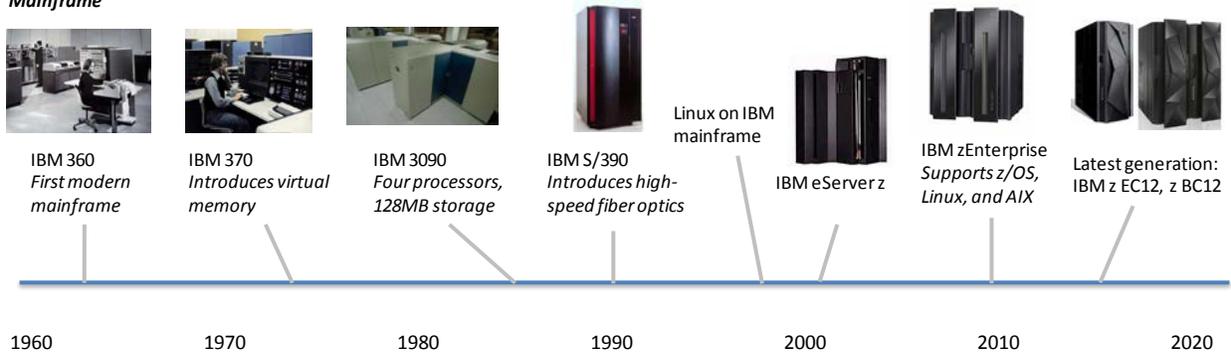
FIGURE 1

Key Milestones in Information Technology, 1960–2020

General Computing

Apollo 11 [1969]
Supported by IBM S/360

IBM PC [1981]
Mainframes used in client/server role

Deep Blue [1997]
Defeats Gary Kasparov, world chess champion

iPhone [2007]
Mainframes used as systems of record for mobile apps

Fortran [1954]

ARPAnet [1969]
IBM 360/75 one of four computers first connected

Emergence of Internet/ecommerce [1995+]
Mainframes support secure online transactions/payments

Hadoop [2006]
Mainframes support Big Data/analytics workloads

IBM SmartCloud [2011]

Mainframe

IBM 360
First modern mainframe

IBM 370
Introduces virtual memory

IBM 3090
Four processors, 128MB storage

IBM S/390
Introduces high-speed fiber optics

Linux on IBM mainframe

IBM eServer z

IBM zEnterprise
Supports z/OS, Linux, and AIX

Latest generation: IBM z EC12, z BC12

1960   1970   1980   1990   2000   2010   2020

Source: IDC, 2014

THE MAINFRAME IN TODAY'S IT ENVIRONMENT

Handling the Explosion in Applications, Data, and Transactions

Even as compute costs are dropping, the burden on most IT organizations is increasing at an exponential rate. While IDC shows compute costs being cut in half every two years, data volumes double every 18 months and the number of apps doubles every four years. IDC expects that by 2017, the number of mobile devices and the number of applications in the world will double and the amount of information in the Digital Universe will expand by six times. IDC has also observed that datacenter administration costs double about every eight years, as automation adoption in distributed IT environments typically lags in many enterprises as a result of the slow pace of change for people and process. And this is just during the next several years; consider what will happen in 10, 20, or even 50 years. For these reasons, IDC believes that enterprise IT will continue to realize economic benefits from the centralization and consolidation of IT assets, particularly when core applications supporting critical business processes are involved.

This relentless growth in data, applications, and devices has placed a huge burden on many enterprise IT organizations. These organizations have been saddled with growing administrative and staff costs to the point where 75% of typical budgets now go into maintenance activities required just to "keep the lights on," and this has crowded out most other areas of IT spending. In 2014:

- There will be more than 1 million intelligent systems shipped every day to manage more than 9 billion smart connected things (also known as the Internet of Things).

- The Digital Universe will reach almost 8ZB (or 8,000EB).

- There will be 87 million virtual machines (VMs) installed, managed by 1.1 million systems administrators, costing IT $97 billion in management costs. Depending on the size of the enterprise, IT organizations today manage hundreds or even tens of thousands of virtual machines.

One of the best approaches to managing this complexity is to simplify the IT infrastructure, and one of the best ways to do this is consolidating and integrating workloads and applications onto a smaller server footprint. Implementing a centralized, virtualized compute architecture capable of supporting mixed workloads in an efficient manner goes a long way toward solving the problem of massive growth in applications and data. It can free up a significant amount of IT budget and administrative staff time, which can be used on more strategic, mission-critical tasks and activities to grow the business.
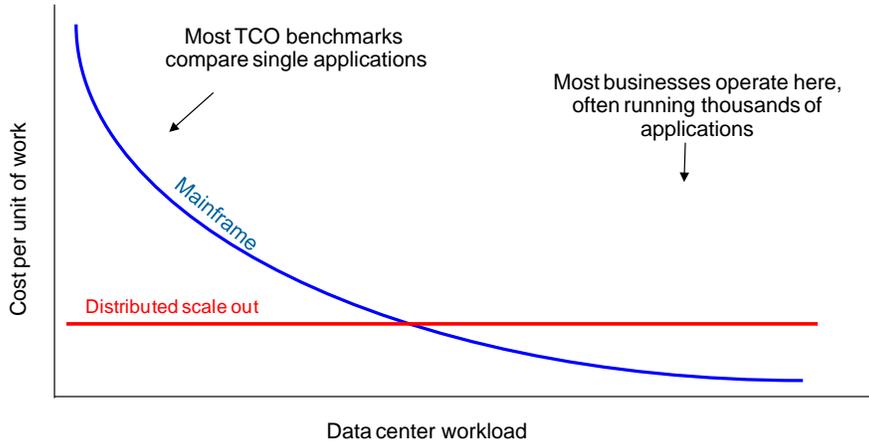
But as more workloads are consolidated onto single servers, it becomes more important to choose a server architecture that not only provides a large amount of computational power but also has the highest levels of reliability, availability, and serviceability. For this reason, the mainframe remains an attractive solution for application consolidation. In fact, no other systems today surpass the mainframe architecture when it comes to pure computational capabilities, and only the mainframe can economically support business growth on such a massive scale (see Figure 2).

Finally, mainframes often provide a large amount of headroom compared with organizations' current computing needs. This means that they not only are more than capable of handling the tasks at hand but often provide the ability to scale, potentially even exponentially, to handle organizations' growing compute demands in the future.

FIGURE 2

IBM System z Performance Benchmarks

Mainframe cost/unit of work decreases as workload increases

Most TCO benchmarks
compare single applications

Most businesses operate here,
often running thousands of
applications

Cost per unit of work

Mainframe

Distributed scale out

Data center workload

Top ten reasons for lower costs with mainframes

1. Higher utilization
2. Better consolidation ratios
3. Multiple diverse workloads
4. Better labor productivity
5. "Free" workloads during off peak

6. Lower cost accelerators
7. Technology upgrade vs. replace
8. Disaster recovery
9. Disaster recovery testing
10. Temporary capacity

Source: IBM, 2014

The Mainframe Supports 3rd Platform Technologies

As we move further into the 3rd Platform, businesses are increasingly relying on mobile devices, Big Data, and cloud computing, and we are seeing fundamental shifts in the way users interact with technology. The 3rd Platform is the basis for the next generation of enterprise business innovation, and organizations across all industries need to stay at the forefront to remain competitive. IBM understands this and has been placing strategic emphasis on innovating the mainframe to support 3rd Platform technologies including cloud, Big Data, and mobile.

Cloud

Cloud computing provides a number of technical and business benefits. It gives organizations greater flexibility in their IT consumption, spending, and deployments and offers the promise of greater scalability and agility. But successfully deploying cloud – whether in a public, private, or hybrid model – requires support for large numbers of VMs, application isolation for multitenancy, workload density/utilization, and the ability to scale rapidly.

Approximately half the respondents in a recent IDC workloads survey reported average server utilizations below 30%. These organizations are not only stranding IT capacity but increasing their administration costs and driving up the percentage of their IT budgets associated with IT maintenance. This reduces an organization's ability to allocate resources to areas of innovation necessary to help transform the business at a critical time. By moving to the cloud, customers no longer need to worry about low server utilization rates, and cloud providers can better level load to improve efficiency.

Security is another key requirement. Since organizations are now entrusting cloud service providers with critical data they used to keep behind their own firewall, cloud providers must provide the confidence that they have deployed the highest security standards and technologies available.

Whether for running an internal cloud or for cloud service providers, the mainframe provides support for virtualization at the chip level and enables service organizations to spin up multiple VMs quickly while reducing the performance overhead associated with typical instances of virtualization. IBM benchmarks show that virtualization features instantiated in zEnterprise's firmware enable superior service at a lower cost than legacy x86 hardware, particularly as the number of virtual servers scales above 200 and into the thousands. And when it comes to security, resilience and security have long been hallmarks of the mainframe platform. zEnterprise has been awarded the Common Criteria Evaluation Assurance Level 5+ (EAL 5+), one of the highest security ratings for any commercially available server.

Big Data

Big Data is transforming the enterprise, enabling businesses to better understand their operations, target customers' needs, and personalize relationships with customers, suppliers, and partners. But Big Data comes at a cost as the volume of data enterprises must support is doubling every 18 months. This is creating huge challenges for the IT organization, not only in terms of hosting all this data but also in terms of managing and using it effectively. Further, data on System z is more than twice as likely to be associated with high-value business processing (ERP, CRM, OLTP, batch) and decision support (data warehousing, data analytics) than the market as a whole.

Big Data includes structured repositories that are housed on systems of record in the database tier, usually on very large high-end servers, and unstructured data that is typically kept on scale-out server volumes. Truly leveraging these Big Data systems and providing real-time response require staging data appropriately and housing analytics applications like Hadoop close to the systems of record, and not downloading the data to be analyzed on separate siloed servers in a different portion of the organization or infrastructure.

With zEnterprise, organizations can deploy these different workloads across a single platform architecture, along with a comprehensive data management solution and an integrated set of analytic and data management tools, all on a system with leading scalability and throughput to handle very computationally intensive workloads. By driving analytics directly against transactional data, organizations can drive more timely insights (integration with Hadoop), incorporate text and non-traditional data sources, reduce or eliminate ETL (extract, transfer, and load), improve security, and streamline data governance and life-cycle management. And eliminating the need to download copies of the data against which to run analytics can help eliminate the problem of organizations having multiple "versions of the truth."

Mobile

The mainframe is often the platform of choice to host companies' systems of record data, but as the world goes increasingly mobile, organizations must extend these systems to support tablets and smartphones. Organizations are enabling users to access transactions and real-time and historical data located on mainframes via mobile devices, and in many cases, the mainframe is the most logical place to enable mobile access by bridging systems of record with systems of engagement.

IBM has been placing strategic emphasis on mobile over the past several years and has been ramping its mobile enterprise capabilities. IBM has made 10 corporate acquisitions in mobile since 2006, doubled its investment in mobile solutions in 2013, and currently provides more than 200 IBM software apps in app stores. As part of this push, IBM has been placing significant emphasis on tools, technologies, and services to enable mainframe customers to extend those environments to support mobile computing.

IBM currently offers a wide variety of tools, technologies, and service offerings designed to make it easier to develop and manage secure mobile interfaces to the zEnterprise environment. This is on top of a series of investments that IBM has been making "under the hood" to ensure smooth operation of the mainframe in the mobile environment. These include integrating CICS with JSON, the preferred payload for mobile apps, as well as modifications to DB2, IMS, MQ, and z/OS itself.

THE FUTURE OF THE MAINFRAME

Businesses often find the need to adapt, evolve, and transform, and businesses around the world have exploited the unique capabilities of the mainframe to reinvent themselves as they strive to maintain their competitive edge and become industry leaders. This spirit extends to IBM itself, as it sees the mainframe as both a symbol and a core part of its own continuous reinvention. IBM plans to continue to invest in the mainframe today and into the future to enable breakthrough leaps in technology that can create possibilities that were never before thought possible.

IBM has developed and is investing in a number of efforts to continue to expand the mainframe's role. Initiatives include:

- **Expanding its cloud ecosystem.** IBM is reinforcing strategic investments to help customers accelerate adoption through new System z Linux and cloud competency centers and to grow its network of partners and ISVs.

- **Leveraging customer input.** IBM actively includes customers to shape requirements and design future technologies. In just one example, IBM meets with a core group of approximately 50 mainframe customers several times per year to "cocreate" future technology directions based on their needs and requirements.

- **Making ongoing technology investments.** IBM is continuously reinventing and extending the role of the mainframe to help customers unlock new opportunities for their business.

And while no one could credibly claim to foresee everything that the future of computing will entail, IBM continues to push the boundaries in innovative ways, enabled in no small part by zEnterprise mainframe technology. Notable initiatives include:

- **IT analytics.** Like the IBM Watson platform, IBM mainframes today are being used to help with the sort of pattern-recognition problems that were previously not possible to do with a computer.

- **Smart cities.** IBM zEnterprise is being used to leverage cross-agency data, anticipate problems to proactively resolve them, and coordinate resources and processes to efficiently accelerate agency responses. This is enabling city agencies around the world to better serve citizens and businesses.

- **Millennial program.** In this academic initiative, IBM is working with 68,000 students at more than 1,000 participating universities to recruit, train, and cultivate the next generation of the mainframe talent pool.

OPPORTUNITIES AND CHALLENGES

IDC sees several opportunities and challenges for IBM as it looks to the next 50 years of the mainframe.

Opportunities

- **Migrating platforms for demanding workloads.** As IDC continues to track the migration of mission-critical, transaction-oriented workloads away from traditional Unix servers, mainframes could continue to be an attractive landing place. Features such as specialty engines help users expand the use of mainframes to new workloads. zAware enables operational analytics, while zManager extends the type of governance capabilities available in Power Platform and x86-based server nodes to the mainframe.

- **Enabling reduced IT operating costs through server consolidation.** Housing application and data layers on a single mainframe enables reduction in the hardware footprint, enabling enterprises to achieve higher IT staff productivity, increased resource utilization (CPU, memory, and network), reduced software licensing costs, reduced energy consumption, reduced IT infrastructure costs, and extended datacenter life. IDC's business value research shows that consolidating workloads onto fewer hardware systems can reduce IT operational costs for IT staff by 50% or more, power/cooling by up to 20% or more, and use of datacenter real estate by 30% or more, freeing up spending for more strategic investments.

- **Providing support for 3rd Platform technologies.** The emergence of the 3rd Platform has resulted in IT organizations that are increasingly focused on delivering value to the business by leveraging a mixture of on-premise and off-premise IT. This shift toward an IT brokerage model will result in additional focus on IT economics and business value at the workload level. This could bolster the mainframe's position in many enterprises and help the platform land important new mobile and analytic workloads that have unique 3rd Platform business value.

Challenges

- **Difficulty maintaining the skill set of the broader community.** Mainframes require unique IT skill sets. These skills are not widely distributed across the marketplace but are instead concentrated in fairly large private enterprises and governments around the world. IBM needs to continue to invest in developing mainframe awareness and operational and programming skills in order to ensure a healthy ecosystem for the platform in the future. IDC notes that this continues to be an area of considerable investment for IBM with its academic initiative.

- **Ability for IBM to build and maintain a robust ecosystem.** To maintain a viable, healthy ecosystem requires other partners – ISVs, systems integrators, VARs, and resellers – to support and invest in that ecosystem. While IBM itself continues to invest heavily it its architecture, it is not clear that it will be able to continue building the critical mass among other critical players to support a full ecosystem for its mainframe environments. That said, IBM has expanded the number of ISVs in the zEnterprise ecosystem, which now supports more than 7,600 applications across Linux and z/OS.

CONCLUSION

As IBM marks the 50th year of the mainframe, it is looking forward, not backward. Building on a track record of innovation, the mainframe remains relevant today in a variety of areas, including application consolidation, which leads to greater efficiencies and alleviates the IT burden. IBM has introduced a number of innovations, making the mainframe an attractive platform for many of today's critical technologies, including cloud computing, Big Data, and mobile.

IBM is equally committed to keeping the mainframe relevant in the future. There will always be a strategic position in the datacenter for efficient, scalable, secure, and cost-effective computing platforms such the mainframe. And through multiple efforts and initiatives, including working directly with customers to understand and define next-generation requirements, investing in both its ecosystem and its new technologies and nurturing the next-generation mainframe talent pool, IBM is laying the groundwork for relevance over the next 50 years.

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

Global Headquarters

5 Speen Street
Framingham, MA 01701
USA
508.872.8200
Twitter: @IDC
idc-insights-community.com
www.idc.com