IBM's Enterprise Storage Refresh Brings Strong New Storage Technologies to Mainframe Customers

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Eric Burgener
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IDC OPINION

Although most of the revenue in the enterprise storage market overall is driven by spend on distributed systems, most large enterprises still have mainframes that run mission-critical workloads. The mainframe hardware market, which includes mainframe servers as well as external storage and tape drive products, is relatively mature and exhibiting low but consistent growth rates. Mainframe platforms tend to be deployed for mission-critical workloads that require extremely high availability. For mainframe technology refresh cycles, which occur roughly every four years, IBM generally introduces the new System Z and LinuxONE servers as well as the new DS8000 family external storage and TS7700 family virtual tape libraries. With the move to much more data-centric business models that is happening as part of the digital transformation that so many enterprises are undergoing, mainframe workloads continue to grow. IBM mainframe customers depend on IBM being able to integrate new, higher-performance compute and storage technologies into its offerings as well as provide better cloud integration and support for new deployment options, like containers, on technology refresh.

IBM's mainframe refresh, launched with announcements in both September and October 2019, introduces important new capabilities for customers. New IBM POWER9 processor technology is used across the new servers and storage arrays and works together with the introduction of a new mainframe storage hardware building block, higher-bandwidth networking, and other software enhancements to drive significantly improved performance, storage density, and energy efficiency. New security features provide a number of additional options to protect systems and data from user errors, malicious destruction, and ransomware attacks – important capabilities in this era of heightened security awareness. New tiering capabilities help customers better optimize workload placement across both on-premise and off-premise (i.e., public cloud) environments, and the move to 19in. rackmount packaging technology across the server and storage lines helps streamline on-premise information technology (IT) infrastructure. All in all, this mainframe refresh cycle brings exciting new technologies and capabilities to help customers meet business requirements and manage their workloads more efficiently.

IN THIS WHITE PAPER

In September 2019, IBM announced new mainframe technology, including the new IBM Z and LinuxONE servers, as well as the next generation of IBM DS8000 enterprise storage systems designed for those platforms. In October, IBM followed this up with the announcement of new high-end virtual tape libraries for mainframe environments. This white paper provides a brief overview of the

mainframe market, and then turns to a quick analysis of the new IBM mainframe storage announcements, which include solid state disk-based external storage, mainframe tape subsystems, and integrated cloud tiering.

SITUATION OVERVIEW

In banking, finance, healthcare, insurance, utilities, transportation, government, and many other public and private enterprises, mainframes continue to comprise the foundation of large-scale business computing. Mainframe technology has a long-standing and well-deserved reputation for reliably servicing the industry's most demanding, mission-critical workloads in these areas. These platforms and their surrounding ecosystem of software, storage, and networking products are designed to handle massive amounts of I/O by leveraging significant parallelization in both the hardware and software architectures. While open systems solutions have matured to support "five-nines plus" availability in just the past several years, mainframe computing solutions have been consistently exceeding that bar for decades.

The mainframes' continuing popularity is driven by several factors. The inherent reliability and stability of mainframes, refined over 50 years of mission-critical usage, are buttressed by a continuing compatibility that spans decades. Many applications developed on mainframes in the past still run on those environments and continue to meet business requirements. Even as enterprises introduce new next-generation applications needed for digital transformation, there is little benefit to migrating many traditional COBOL-based workloads to other environments. And for customers concerned about security, mainframes are extremely secure and provide an excellent option for customers looking to protect themselves against cyberattacks. These customers continue to depend on mainframe technology refreshes to keep applications and services running reliably, safely, and securely as their businesses thrive.

While the mainframe market has been growing in the low single digits over the past several years, it exhibits somewhat cyclical revenue. Mainframe refresh cycles occur roughly every four years, and the market leader in this space (IBM) takes that opportunity to provide a coordinated refresh of not only mainframe server but also storage technology. IBM is the largest mainframe server provider in terms of market share by revenue and also owns 40-50% of the mainframe-attached storage market (depending on cyclical fluctuations). As the original developer of mainframe technology, this is not surprising. With the recent announcements, IBM has refreshed both the IBM Z and LinuxONE mainframe servers, as well as DS8000 external all-flash storage and TS7700 virtual tape libraries, introducing support for key new features and technologies that address critical requirements for mission-critical environments, regardless of whether they run on mainframe or distributed systems.

The new z15 mainframe server is based on the new IBM POWER9 processor technology and features performance enhancements, z/OS Container Extensions, better hybrid cloud enablement, improved recovery capabilities, and heightened security options. The announcement also includes two new all-flash array DS8900F models, the DS8910F and the DS8950F, as well as the next-generation TS7770 Virtual Tape Library. Just like the z15, these new storage solutions leverage the POWER9 processor platform and deliver improved performance, capacity, and functionality for the mission-critical workloads that drive business success today.

The DS8900F Enterprise Storage System

The DS8900F is an enterprise-class storage platform that supports both mainframe and distributed systems workloads. Based on a proven storage operating system (OS) that has been vetted in mission-critical environments for decades, the latest version of the platform features new solid state storage technologies for significantly higher performance and capacity density, improved security and disaster recovery capabilities, and seamless hybrid multicloud integration. There are two DS8900F models — the DS8910F and the DS8950F — and while the throughput, bandwidth, scalability, and cost of the two platforms differ, the low storage latencies, reliability, and functionality are equivalent. These arrays only come in all-flash configurations — there are no hard disk drive (HDD)-based options in them. Customers upgrading to one of these new systems can consolidate additional workloads, accommodate significant data growth in place, reap improved efficiencies in energy and floorspace consumption, and will enjoy lower operating costs through improved administrative productivity.

The flagship DS8950F can deliver over 2.3 million IOPS, 63GBps of bandwidth, and up to 5.9PB of physical capacity (using 15.36TB solid state disks). The smaller DS8910F can deliver 860,000 IOPS, 21GBps of bandwidth, and almost 3PB of capacity. The new IBM POWER9 processors in the storage controllers, along with storage OS and network bandwidth enhancements, help drive these new higher-performance numbers. The new DS8900Fs offer extremely low latencies — as low as 18 microseconds for mainframes (using FICON and zHyperLink) or 90 microseconds for distributed systems (using Fibre Channel [FC]). It is interesting to note that the FICON latencies are better than those of NVMe-based all-flash arrays (NAFAs) using remote direct memory access (RDMA)-based NVMe over Fabrics host connections and, in fact, are the lowest in the industry for a SAN-attached device. IBM has also significantly increased the write cache size on the DS8910F model from 256GB to 512GB.

Cyberattacks were called out by the World Economic Forum as a major global risk for 2019, and they are a major concern among CIOs looking to protect corporate data assets in this era of heightened privacy requirements. The DS8900Fs incorporate several new features that address these challenges. Data can now be encrypted both at rest and in flight with AES-256-compliant encryption. All the encryption is done in hardware to ensure that there are no noticeable impacts to the performance of latency-sensitive workloads. The new IBM Fibre Channel endpoint feature ensures that data is accessed only by trusted IBM Z, LinuxONE, and DS8900F arrays and enables encryption of data in flight. A Safeguarded Copy feature provides immutable snapshots to prevent sensitive point-in-time copies of data from being modified or deleted due to user errors, malicious destruction, or ransomware attacks.

The DS8900Fs include a variety of features that ensure data availability. RAID, snapshots, and various replication facilities provide a number of options for customers to configure a "defense in depth" approach for data protection. Synchronous replication supports two-site configurations within 186 miles of each other that ensure no data loss in the event of a site outage (and no noticeable application latency impacts during normal operation), while asynchronous replication is used to protect sites beyond the 186 mile limit. IBM's Geographically Dispersed Parallel Sysplex (GDPS) technology enables the creation of two-, three-, and four-site replication configurations with DS8900Fs (as well as earlier model DS8000 arrays) that enable very fast operations recovery. These configurations meet recovery point objectives (RPOs) as low as 2–4 seconds and recovery time objectives (RTOs) as low as 60 seconds in deployments that can span more than 1,000mi. These features all contribute to the DS8900Fs' ability to support "seven-nines" availability — that's about 3 seconds of downtime per year, providing 10x better availability than the former DS8880F (which supported "six-nines" availability).

The DS8900Fs support Transparent Cloud Tiering (TCT) to IBM Cloud Object Storage and IBM TS7700 Virtual Tape Libraries (including the latest TS7770) as well as public cloud environments like Amazon S3 and IBM Cloud. This TCT feature opens up hybrid cloud configurations as an additional storage tier for data archiving, long-term retention, and data protection.

Data can be moved to different tiers based on predefined policies, and this feature does not require an additional server or gateway, enabling simplified, less expensive configurations. TCT offloads the data movement responsibility from the mainframe to the DS8900F without any impact on performance, providing up to 50% savings in mainframe CPU utilization when migrating large data sets compared with other traditional archiving methods. Artificial intelligence and machine learning (AI/ML) are being harnessed by many vendors to help reduce administrative overhead, ensure that systems run more efficiently, and improve overall system availability. IBM Storage Insights provides for comprehensive telemetry and leverages AI/ML-driven predictive analytics to streamline trouble ticket creation and management and resolve issues faster through more proactive response. IBM Storage Insights is a cloud-based application (SaaS) that also manages systems for more predictable performance with evolving workloads, enables better capacity planning, and provides for tiered storage recommendations to help systems run more efficiently at lower cost.

Both the new storage systems and the new IBM Z and LinuxONE servers are now packaged into standard 19in. rack frames.

Taken together, all these new features make this a high-performance, highly scalable, and easy-to-manage storage platform for the consolidation of mainframe and/or distributed workloads that demand the highest levels of availability and recovery. The new DS8900Fs provide the features to meet the highest service-level agreement (SLA) requirements in bare metal, virtualized, and/or containerized environments as enterprises continue their digital transformation journeys.

The TS7770 Virtual Tape Library

The TS7700 Virtual Tape Libraries provide a high-performance, cost-effective disk-based backup target that looks like a standard physical tape library to backup applications. The TS7770 is the latest version of this platform. The new virtual tape library TS7770 features higher data ingestion and mobility performance, better efficiency using mainframe resources, improved availability, increased storage density, and new security options.

The new system supports two 10-core POWER9 processors, 2.3PB of usable capacity, up to eight 16Gb FICON connections, and up to four 10GbE Grid Network connections. Just like the prior TS7760, the TS7770 is supported in Grid Network configurations of up to 8 nodes for disaster recovery and/or data distribution purposes. Grid Networks support data mobility between IBM Z and LinuxONE mainframes, DS8900F Storage Systems, TS7770 used as an object store target (a new feature with the TS7770), TS7760/7770 Virtual Tape Libraries, and TS4500 physical tape libraries — all of which can be mixed and matched in any configuration. Data movement is managed by a combination of IBM's Transparent Cloud Tiering (the same software used to manage data mobility on the DS8900F arrays) and the company's Data Facility System Managed Storage Hierarchical Storage Management (DFSMShsm), depending on mobility requirements.

Software optimizations, combined with the new higher-performance IBM POWER9 processor technology and increased bandwidth, improve efficiency when moving large data sets. This improved efficiency enables up to a 50% reduction in IBM Z CPU utilization during data mobility operations, freeing those cycles up to focus on revenue-driving mainframe transactions. The TS7770 moves data

faster (at up to 2.5GBps per library), provides a larger landing pad for rapid data ingest, and delivers higher availability and better security than ever before. An individual tape library provides "five-nines plus" availability (99.9996%), and Grid Network configurations can provide nearly instantaneous failover with no operator intervention across up to eight grid-linked TS7770s using IBM's automated grid cloud failover capabilities.

Support for new 10TB SAS hard disk drives significantly increases the storage density of the tape subsystem – a single drawer can hold up to 79TB, a base frame up to 789TB, and a fully expanded system up to 2.3PB of usable capacity. Using the built-in, hardware-driven compression, a single system can support roughly 11.85PB of effective storage capacity (assuming a very achievable 5:1 data reduction ratio). In an eight-node Grid Network configuration, TS7770s enable customers to manage almost 95PB of backup, archive, and other long-term retention data from a single console, and that network can move data at up to 20GBps.

The TS7770 features SP800-131A-compliant strong encryption for both data in flight (over Ethernet) and at rest (both in on-premise infrastructure and in the public cloud). This capability complements IBM Z pervasive encryption to provide end-to-end security across all scenarios, regardless of data mobility requirements, and imposes no performance hit during data ingest (all encryption is done in hardware).

CHALLENGES/OPPORTUNITIES

Given IBM's dominant position in mainframe technology, the company's challenges are more around effectively meeting evolving customer requirements in a mature, slow-growing market. IBM is the dominant player in mainframe servers, the company owns 40-50% of the mainframe-attached storage market (competing primarily in this space with two other vendors, Dell EMC and Hitachi), and it owns roughly 80% of the mainframe tape subsystem market. While almost all large enterprises have at least some mainframe servers, they are also at the same time managing the digital transformation of their organizations. CIOs in these enterprises are tasked with simultaneously maintaining critical legacy workloads while bringing on next-generation applications and looking to improve the efficiency of IT infrastructure through both public and private cloud technologies. IBM offers a strong portfolio of solutions for both legacy and next-generation workloads, but how these two facets of IT infrastructure integrate to meet growth, flexibility, availability, and security requirements of today's much more dynamic business models is becoming an increasingly important purchase criteria as IT organizations implement and evolve their hybrid cloud strategies.

IBM's challenge will be how to continue to implement newer technologies on top of the solid mainframe foundation while providing a compelling hybrid cloud strategy for its customers. These announcements significantly improve IBM's mainframe hybrid cloud integration story. Given the company's market position, the opportunity is to retain all of its existing mainframe installed base while capturing as much of the new IT spend as possible as existing customers maintain existing mainframe-based applications, refactor some workloads, develop and deploy entirely new next-generation workloads, and add new distributed systems to its on-premise infrastructure.

CONCLUSION

With the September and October 2019 announcements, IBM has refreshed its entire mainframe platform offering, including both servers and storage. These new offerings should make IBM mainframe customers happy – they will benefit from improved performance, higher storage density, increased energy efficiency, easier administration, better cloud integration, and enhanced container support. They also include other changes, such as the move to standard 19in. rack configurations and 100% data encryption, that raise the competitive bar for other vendors in the mainframe storage market. For those mainframe customers looking for a technology refresh that will support ongoing digital transformation efforts, these new offerings build on IBM's strong reliability reputation while adding important new features and technologies.

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Global Headquarters

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