Re-Hosting Mainframe Applications on Intel® Xeon® Processor-based Servers

A Proven Methodology for Mainframe Migration

The mainframe has been around for decades and is considered by many to be the ultimate legacy platform for scale-up computing. These monolithic systems have proven their ability to deliver the performance, scalability, security, manageability, and high availability large businesses demand for their core transactional and database applications. Yet the high costs associated with scaling and adapting mainframe environments have many companies looking for ways to extend or replace their mainframes with alternative platforms that improve agility and reduce costs without sacrificing quality of service (QoS).

Since moving workloads off a mainframe often represents a fundamental shift in IT strategy, a comprehensive and systematic approach is needed to minimize cost and risk. This paper describes a methodology (Figure 1) that has been used successfully for mainframe migrations. It offers a useful starting point for business and IT decision makers looking for ways to improve IT capability and agility, without sacrificing QoS and without incurring the high cost of expanding an existing mainframe environment.

Getting Started

To ensure business and technical issues are thoroughly explored, an interdisciplinary approach is necessary. The initial project team should include business managers, business analysts, system and application architects, and IT operational staff. Support from executives is also imperative because a mainframe migration will impact multiple business units.

Unless the team has experience with mainframe migrations, engaging with a consultant is highly recommended. Many system integrators, independent software vendors (ISVs), and hardware suppliers have proven sets of tools and extensive experience with mainframe migrations.

A technical and planning workshop from suppliers should be a first step. It will provide a solid foundation for an efficient and effective migration. Outsourcing some or all of the migration may also be a good choice, depending on time constraints and the availability of internal resources.

Figure 1. Following a proven migration methodology helps to reduce cost and risk and accelerate time to benefits.
Establishing Goals

Establishing clear goals is important to keep the project on track and aligned with business priorities and needs. Goals should be specific and, when possible, quantitative to provide a framework for weighing alternatives throughout the planning process. Issues to consider include business growth, cost reduction, IT efficiency and agility, and governance, including risk management. A mainframe migration of modern applications, such as Java-based solutions, can deliver significant value across all these areas. Understanding business and IT priorities is critical to ensure that projects remain aligned with the needs of the business.

Assessing the Current Environment

Once goals are established, a comprehensive assessment of the current business, technical, and operational infrastructure environments must be performed (Figure 2). This assessment should be comprehensive and thorough because it provides the foundation for understanding end-to-end solution requirements. It should include physical, logical, and solution architectures across all systems. It should also include production, staging, disaster recovery, quality assurance, and development environments, as well as key mainframe interfaces, system interdependencies, and performance bottlenecks. Future requirements should also be evaluated with respect to the current solution.

The IT industry has developed a number of infrastructure assessment and inventory tools to help with hardware and application migrations. These tools range from simple spreadsheets to advanced programs that may include automated data center discovery. Depending on the selected tool, it may measure system workloads, resource utilization, and dependency mapping. It may also discover physical and virtual IT assets, applications, and the relationships between them. The resulting assessment typically includes detailed reports and graphs, and can be useful for system design and for identifying opportunities to virtualize infrastructure and reduce overall costs.

Figure 2. A comprehensive and integrated assessment of the existing infrastructure provides a foundation for planning an efficient, low-risk migration.
**Creating the Proposal**

Creating a proposal will typically require evaluating multiple options for meeting current and future needs. Should custom applications be rewritten, re-factored, or replaced? Should new infrastructure be scaled up, scaled out, or virtualized? Should a private cloud architecture be considered? Technical feasibility should be evaluated for each option, including the challenges associated with transitioning to the new solution. If some applications will remain on the mainframe, it will be necessary to explore options for integration, including hardware, software, and operational issues.

Once technical feasibility is confirmed, return on investment (ROI) and total cost of ownership (TCO) analyses should be performed for the solutions that are most feasible and have the highest business migration priorities. This will help quantify the decision-making process. Technical and financial assessments should include sufficient detail to identify significant risks that could potentially impact the success of the project.

**Developing the Solution Architecture**

An interdisciplinary approach is required to develop a detailed solution architecture and migration plan. The team should include system architects, application architects, data center IT operations personnel, database administrators, and quality assurance staff. It should also include business unit representatives to ensure the proposed architecture is well aligned with current and projected business needs.

IBM and other mainframe vendors offer detailed and proven design options for deploying both horizontally and vertically scaled solutions. In many cases, a two-tier or three-tier architecture will be optimal. Selecting best-fit Intel® Xeon® processor-based servers for the new solution will depend on specific workloads, performance requirements, and solution architectures. The following guidelines will be helpful in many scenarios.

- **Web Servers.** Web requests can be distributed efficiently across multiple two-socket Intel® Xeon® processor 5600 series-based servers. Performance has increased substantially in the two-socket server space in recent years, and today’s systems are well suited for processing large numbers of concurrent user requests (Figure 3).

- **Application and Database Servers.** Four-socket, eight-socket, and larger servers based on the Intel® Xeon® processor E7 family provide scalable performance per system to support heavy application and database workloads. With up to two terabytes of memory and a high-speed, point-to-point interconnect system, these servers support exceptionally fast processing for high-volume transaction workloads (Figure 4). The tightly-integrated interconnect system also provides reliability, availability, and serviceability (RAS) for mission-critical environments through features such as advanced error correction and automated link recovery.
Unless the mainframe is being decommissioned, it may be necessary to access mainframe data and manage transactions across the new systems and solutions and the mainframe environment. Many options are available, such as IBM CICS® Transaction Gateway and IBM MQ® Series message-oriented middleware. These and other options are easily deployed on Intel Xeon processor-based servers. They provide flexible, scalable, and secure options for accessing information and managing transactions and applications on distributed systems.

**Figure 4.** Four-socket, eight-socket, and larger Intel® Xeon® processor-based servers deliver scalable performance for demanding Java applications, as demonstrated by published results on the SPECjAppServer2004 and SPECjbb2005 benchmarks.!
Proof-of-Concept (PoC) Testing
When migrating custom applications, PoC testing will help technical teams identify and address potential design and operational issues early in the design and migration processes. For example, targeted PoCs may be appropriate to validate performance, scalability, transaction management, and data access for the new solution. However, extensive PoCs may not be necessary when migrating commercial applications. ISVs can often provide reference designs and sizing guides, as well as best practice recommendations that have been proven worldwide across numerous customer implementations.

Moving to Production
In moving to production, a staged and phased transition is generally preferable. A pilot deployment using a subset of applications can allow IT to identify and address problems before they affect the broader business environment. It can also provide IT with a good opportunity to integrate the new solution into the broader development and quality assurance environments and to integrate and test new operational tools, scripts, utilities, and processes. A successful pilot may require considerable collaboration among multiple groups and teams, and time and dedicated resources should be allocated accordingly.

Conclusion
Migrating modern workloads from a mainframe to Intel Xeon processor-based servers can deliver fundamental advantages, including better performance and scalability, improved business and IT agility, and lower capital and operating costs. Businesses have been migrating mainframe applications onto distributed, horizontally scalable solutions for years. Newer eight-socket and larger servers based on the Intel Xeon processor E7 family deliver high-end scalability and advanced reliability for both vertically and horizontally scalable solutions, and are well suited for a broad range of workloads currently running in many mainframe environments.

A successful migration requires detailed planning, commitment, a team effort by multiple business and technical teams, and direct support from senior management. Applying a comprehensive, step-by-step approach using a proven migration methodology is essential for coordinating business and IT efforts to deliver desired benefits, while managing costs and risks. Professional services and support are available from leading system integrators, ISVs, and hardware suppliers around the world, many of whom have extensive experience in mainframe migration.
### ASSESSING THE CURRENT ENVIRONMENT

Perform a comprehensive evaluation and documentation of:

- Backup for one Windows Small Business System
- Physical, logical, and solution architectures
- Performance and functionality across operational, development, staging, disaster recovery, and quality assurance infrastructure
- System interfaces, interdependencies, networking, and storage
- Software solution compatibility, business applications and solutions, OS, middleware, Java* Virtual Machine (JVM), database, and database connections
- Application, database, and transaction performance, including current bottlenecks
- Future performance requirements with projected growth, workloads, transactions, and new services
- Security, compliance, and IT management and operational framework

### DESIGNING THE NEW SOLUTION AND SYSTEM ARCHITECTURE

Develop the solution architecture, including physical and logical systems that account for:

- Software stack, including business applications and solutions, Enterprise Service Bus (ESB), application server and JVM, database systems, and OS
- Compute, network, and storage systems, including topology for load balancing and for horizontal and vertical scaling
- Performance and scalability for current and projected workloads
- System availability and maintainability
- Security, compliance, and integration with IT management framework

Establish solutions for connecting to the mainframe environment, including:

- Java database connectivity (JDBC) between the application server (IBM WebSphere* Application Server, JBOSS, Oracle WebLogic* Server, and so on) and mainframe databases
- Transaction management (CICS Client Gateway, and so on)
- Message passing connectivity (IBM WebSphere MQ Client, IBM WebSphere MQ Server, and so on)

### PLANNING FOR MIGRATION, DEPLOYMENT, AND IT OPERATIONS

Develop detailed plans for migration, including:

- A comprehensive functional design
- Systems and solutions for production, development, test, and staging environments
- Detailed migration timelines, schedules, and resources
- Disaster recovery and failover solutions
- Proof-of-concept testing
- Application migration, including tools and utilities
- Final deployment and go-live
- Developing thorough and detailed cut-over plans

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**Sample Mainframe Migration Checklist**

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**Selecting testing tools and procedures for:**
- Performance testing and infrastructure validation
- Stress and end-to-end system functionality testing

**Create plans for deployment and operations, including:**
- On-going support and maintenance
- Integration with IT management, operational tools, and procedures
- On-going security and governance

**ASSESSING AND MITIGATING RISK**

**Identify essential resources and potential risks to the success of the project, including:**
- Key stakeholders, collaborators, and resources
- Internal and external team dependencies and requirements
- Developing contingency plans, including roll-back plan

**QUANTIFYING COSTS AND BENEFITS**

**Create detailed reports of benefits, costs, and risks, including:**
- Business and cost benefits, including license, systems, maintenance, and operational costs
- TCO, ROI, CAPEX, and OPEX analyses, including projected cost savings
Learn More

HSBC, one of the world's largest banks, used the methodology described in this paper to re-host a suite of mission-critical Java* loan applications on Intel Xeon processor-based servers. Read a detailed technical overview at www.intel.com/content/www/us/en/mission-critical/mission-critical-meeting-todays-it-challenges.html.

For more details on the Intel Xeon processor family, visit www.intel.com/go/xeon

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**Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to http://www.intel.com/performance.**


**Server configurations for Java* performance on the SPECjbb®2005 benchmark. SPECjbb is a trademark of the Standard Performance Evaluation Corp. (SPEC). Comparison based on best published/submitted results on www.spec.org as of September 21, 2010.**


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