

## White Paper



### Legacy Re-hosting onto Microsoft Platform

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#### Abstract

Technical developments and advancements in the IT industry such as Service Oriented Architecture (SOA) have made businesses more flexible and agile. Adoption of the SOA framework, along with new tools and technologies, has increased enterprise agility and enabled businesses to gain a competitive edge. However, enterprises that are bound to legacy systems are often constrained by the lack of flexibility of the legacy platform and are thus unable to adopt new tools and technology.

Apart from the lack of flexibility, other factors like prohibitive costs and the lack of integration capabilities of legacy business applications are key business drivers for a legacy modernization program. Re-hosting is a technique of modernizing legacy systems that enhances the adoption of modern technologies like SOA while retaining their locked-in business value. Typically, re-hosting involves minimal changes to application code.

This paper discusses the relative strengths of Microsoft technology vis-à-vis mainframes and provides an overview of the Infosys' legacy re-hosting solution to ensure smooth migration of mainframe applications onto the Microsoft platform.

# Microsoft Technology vs. Mainframe Technology

## Mainframe Technology

Mainframe technology has evolved into a robust computing environment over the last 30 years. Information access and processing on the mainframe are accomplished using proprietary OLTP and batch systems. IBM mainframes dominate the market and continue to provide high value to businesses through mission-critical applications written in COBOL or PL/I, and through software such as CICS, DB2, IMS and MQ. Mainframes were traditionally assumed to be a robust and powerful computing environment. They were embedded within IT environments of many organizations as businesses made huge investments in applications, skills and data. However, despite the capabilities of mainframes, organizations – small, medium and large – have been keenly interested in other evolving platforms and technologies.

Costs associated with the mainframe, its limitations with respect to integration/connectivity to open-system platforms, non-availability of a graphical user interface (GUI) and the lack of user friendliness are some of the factors that have led several organizations to evaluate and adopt other evolving technologies. The shrinking resource pool of experts for mainframe systems is an alarming issue. Lack of resources inhibits business from adopting the latest upgrades and technology advancements. To stay competitive, businesses need a more cost-effective and agile alternative to the mainframe, it is important that their computing environment provide the necessary flexibility to respond to rapid business changes.

## Microsoft Technology\*

Although Microsoft technology (MS technology) is not as old as the mainframe, it has a history of evolution from DOS to the current Windows 2003 Server family. The Microsoft platform is a flexible and scalable technology that ranks favorably on parameters such as performance, reliability and availability. The total cost of ownership on a Microsoft platform is substantially lower than the mainframe.

Microsoft has a variety of user-friendly products to support application development, maintenance and deployment with full GUI support. A good example is Microsoft's Visual Studio Team System that provides tools and techniques to support the entire application development life cycle: it provides collaboration and integration mechanisms to teams/roles working on different modules during all phases of application development.

Microsoft technology enables modern technology adoption and rapid application development. Organizations can leverage Microsoft technology to implement SOA and take advantage of emerging technologies such as web services.

At the core of its infrastructure technology, Microsoft has its Windows Server family. The Windows Server System is an integrated server infrastructure designed to help in the development, deployment, and management of the system. It is designed to interoperate with other data and applications within an IT environment, reducing the cost of ongoing operations, and delivering a highly reliable and secure infrastructure.

Windows Server System features are designed and developed in accordance with business and technology needs and opportunities, and with a vision to support operational efficiencies by simplified and robust deployment, management and security. It ensures high levels of dependability, performance, and productivity for application development and seamlessly connects information, people, and systems.

Once the applications are successfully migrated to MS technology, i.e. Windows Server systems in clusters, businesses can reap the benefits of cutting-edge technology and low cost of operation. The resulting computing environment is reliable, manageable, offers high performance and robust security:

### *Flexibility*

Microsoft technology can be easily integrated with any other platform which provides flexibility to choose from a broad range of other business partners to create the best possible solution.

### *Reliability*

The Windows Server System was designed to deliver high availability and reliability through:

- **Protected application memory space:** The Windows Server guarantees that no other application can violate an application's protected memory space. The .NET framework also imposes constraints on rogue processes and includes mechanisms to proactively validate the correct behavior of processes.
- **Support for failover processing:** The Windows Server supports server clusters of up to eight nodes for any server application, with failure or maintenance requirements triggering other nodes to immediately provide failover service. Windows Server 2003 also supports network load balancing (NLB) that balances incoming Internet Protocol (IP) traffic across nodes in a cluster.
- **Economically feasible redundancy:** Although fully redundant processing configurations are often not economically feasible in the mainframe environment, substantially low cost of Windows Server Systems means that redundant configurations are often a viable option.
- **Automated Deployment Services (ADS):** ADS allows for the automated and remote distribution of software and patch upgrades, minimizing the amount of individual downtime and reducing the risk of human error in maintenance processes.
- **Policy-based management:** This feature enables one-to-many management, allows management of very large distributed systems environments on a policy or profile basis, instead of individual system or user.
- **Windows Management Instrumentation (WMI):** WMI provides access to more than 10,000 system objects through application, scripting, and command line interfaces, and allows them to be monitored, controlled, and reported.
- **Troubleshooting features:** These features include built-in performance monitoring, logging, tracing, and system recovery capabilities to enable quick troubleshooting and resolution of abnormal operating conditions.
- **Microsoft Operations Manager (MOM):** MOM provides knowledge packs for specific Windows Server components and for other Microsoft server products that use knowledge about product-specific and component-specific events to filter, determine severity, identify causes and develop solutions for these events.

### *Security*

The Windows Server focuses on security for enterprise computing. Today, Windows Server has exceptional core security features such as Federal Information Processing Standards (FIPS) certification and industry-standard Kerberos authentication services. Windows Server also provides Credential Manager, which allows for secure storage of user credentials, including passwords and X.509 certificates. This provides a consistent single sign-on experience for users.

### *Performance and Scalability*

Increased power is available by either building up, acquiring a more powerful Windows Server System, or by building out, adding additional parallel systems. This applies not only to application processing, but also to database serving and utility applications such as firewall and proxy serving. Windows Server with the .NET Framework can not only support a multitude of users, but also offers many options for how users connect to computing resources.

Windows Server 2003 improves scalability on large enterprise-class multiprocessor systems. Significant improvements have been made in scalability on large x86-based and 64-bit systems with eight or more processors. A number of different workloads have been used to analyze scalability, such as Transaction Processing Performance Council TPC-C and the SAP Sales and Distribution workload. In addition, the scalability of several other Windows Server 2003 features and components have been improved, such as IIS, Active Directory, and various networking components.

## Cost Saving

Windows solution presents significant cost savings when compared to a mainframe environment. Specifically, cost is low due to reduced mainframe MIPS usage (charges for a leased mainframe is in \$/MIPS arrangement); licensing fees and reduced cost of hardware, such as Random Access Memory (RAM) and Direct-Access Storage Devices (DASD).

## Resource and Skill

The popularity of Microsoft technology has attracted a lot of developers and hence a huge resource pool exists compared to mainframe technology. Since training on MS technology is easily available with access to technical education on the latest product developments, acquiring a skill-base and expertise on Microsoft technology is easier as compared to mainframes.

*\* Source: Introduction to the Microsoft Enterprise Platform for Mainframe Professionals*

## Legacy re-hosting

Legacy re-hosting, as the name suggests, implies moving an application portfolio – code, data, scripts, et al – with minimal changes from the legacy mainframe to alternative platforms such as Microsoft Windows.

Legacy re-hosting is distinct from re-engineering and subsequent re-platforming as a pre-requisite for re-hosting is the availability of environment(s) on the target platform with compilation and run-time support for mainframe source and data. Micro Focus, Sun Microsystems and Fujitsu are some of the key players in the re-hosting tools and products space. Re-hosting achieves the execution of mainframe applications within a new environment with a high degree of automation (80%). Re-hosting addresses the high costs of maintenance of outdated platforms. However, it does not address the challenges related to application code.

## Suitable candidates for legacy re-hosting

Not all legacy applications are suitable for re-hosting. The decision to re-host an application should be based on availability of re-hosting support for the constituent technology of the application. Business criticality of the application should also be an important consideration in the phased movement of mainframe legacy applications to re-hosted environments.

The applications satisfying either one or more of the below mentioned features are best suited for the re-hosting approach:

- Constituent technologies are supported by re-hosted environment – CICS, COBOL, DB2, JCL, VSAM, Flat files
- Not business critical but has a high MIPS usage
- Sunset by LOB but still needs high maintenance and flexibility

## Infosys Legacy Re-hosting Strategy

Infosys undertook a legacy re-hosting proof-of-concept (POC). An application that was deployed on an IBM Mainframe zOS was successfully re-hosted on Microsoft Windows Server 2003 Enterprise Edition with minimal changes. The Customer Information Control System (CICS) application and Batch Jobs were re-hosted on the Enterprise Server with Mainframe Transaction Option (ES MTO) environment provided by Micro Focus and the DB2 database was migrated to MS SQL Server.

Infosys' internal tools were leveraged throughout the entire POC lifecycle along with third-party tools. Performance testing metrics such as average transaction response time, elapsed scenario time and number of concurrent users were measured. The metrics were shared with the mainframe application developers and users, the figures were comparable to the performance on the mainframe. The entire re-hosting process for this medium-sized application was completed in about 50% of the time it would have taken to re-engineer the same application on Windows. The tools and techniques used helped in reducing the risk, migration time and hence the cost.

Re-hosting is a solution technique of the 'legacy modernization strategy'. Solution techniques under legacy modernization are recommended after an application portfolio assessment. A detailed commentary on Legacy Modernization is available in the Infosys Legacy Modernization Point of View document.

Legacy re-hosting solution steps are depicted in Figure 1:

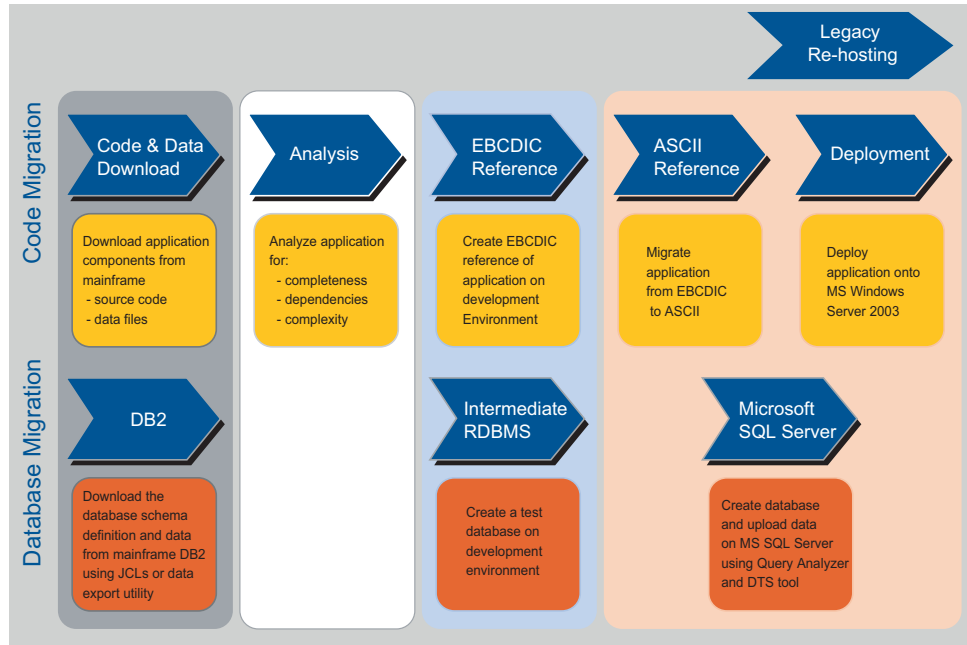


Figure 1: Migration stages for legacy re-hosting

The various phases of the migration stage in legacy re-hosting are:

### Code and Data Download

The application inventory – code and data – that needs to be re-hosted is downloaded onto the target MS platform.

### Analysis

The application is studied and analyzed using tools, techniques and Infosys' expertise to identify issues and complexities (and resolution/ mitigation approaches) that could arise while re-hosting the application. This analysis helps create a roadmap for re-hosting the application onto the MS platform. The application is also analyzed for its completeness and dependencies.

### EBCDIC Reference

An EBCDIC reference of the application is built and the application is executed in a 'mainframe-emulator' environment. The application executes on the EBCDIC character set similar to that on the mainframe. This ensures that handling of hex data and mainframe-specific data types (like TIMESTAMP) are handled without requiring any changes to the code. Once the application is running, it is ensured that it behaves the same way as on the mainframe by performing functionality testing.

### ASCII Reference

An ASCII reference of the application is created. This conversion is fully automated. All the data files having alpha-numeric field/record are converted to ASCII character set from EBCDIC. The application executes on the ASCII character set which is native to windows platform. Prior to this all the unsupported components for re-hosting have to be either re-written or converted using third-party tools to supported components. The database is created fresh on an identified relational database such as MS SQL Server, Oracle and DB2 etc. Application is built and tested to make sure the application behavior is same as that of the original application after re-hosting.

Re-hosting steps, from code and data download to Building the ASCII reference form the Development Environment as represented (Figure 2):

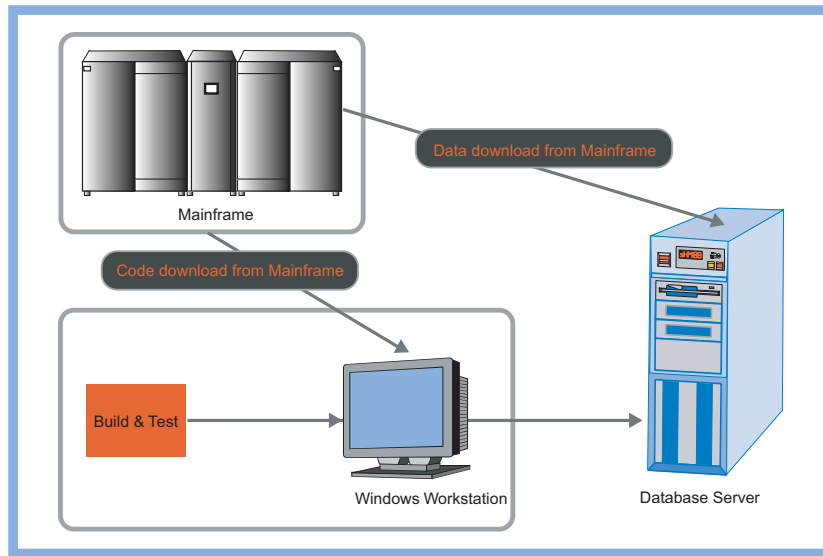


Figure 2: Development environment setup for re-hosting

### Deployment

The application executables are deployed on Enterprise Server (with Mainframe Transaction Option) and the database is deployed on to the identified database server such as MS SQL Server in the production environment. Depending on the performance and the infrastructure available the Enterprise server and the database server can be either on one Windows server or different servers.

The deployment environment is represented in Figure 3.

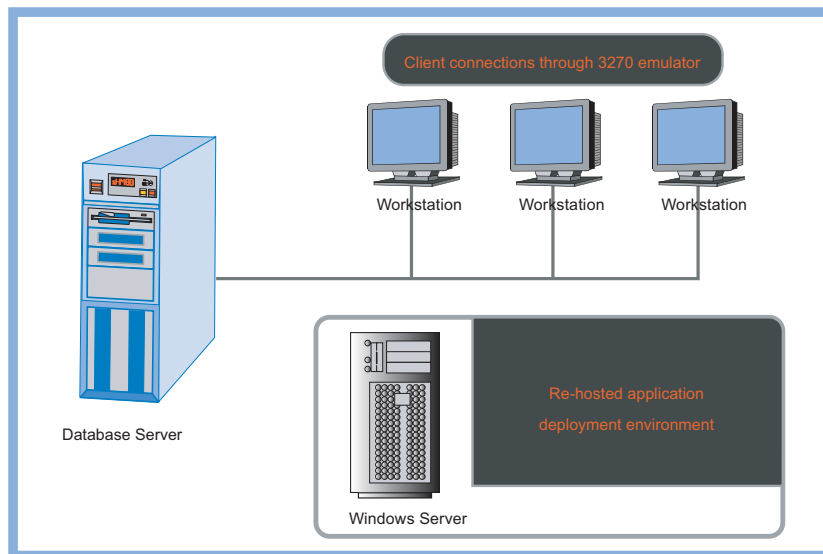


Figure 3: Deployment environment setup for Re-hosting

## Re-hosting challenges

The challenges encountered during re-hosting were:

### *Code and data download Issues*

While downloading source code and data files from the mainframe environment to Windows platform, the following issues were identified:

- Difference in the character set environment on mainframe and windows platform
- Size of the source and data files to be downloaded
- Data files downloaded in wrong format

### *Database migration Issues*

Database migration is an important task of the legacy re-hosting solution. As data is moved from DB2 to relational database (MS SQL Server) running on Windows, issues arise due to the differences of the target database with DB2. The issues consist of incompatible data types (e.g. TIMESTAMP), difference in the SQL syntax (e.g. the “not equal to” syntax), etc.

### *Unsupported components Issues*

Since the mainframe has developed over a long period of time and supports many versions of legacy languages, components and sub systems running on it, there are components that are unsupported by the re-hosting environment; also some components have either been sunset or on the verge of being sun set. Unsupported components have to be either converted using tools or rewritten manually to the technology supported by re-hosting.

### *Deployment issues*

Deployment issues such as security of the application. Application security is taken care of by following the security guidelines provided by Microsoft for the Windows 2003 platform.

All the challenges encountered during re-hosting were successfully addressed with the help of Infosys expertise, in-house tool set as well as third party tools and technology.

## Conclusion

Legacy re-hosting solution onto Microsoft platform is certainly a viable solution to address legacy modernization. This solution is built around proven and industry standard tools and technology. The target platform being Microsoft Windows Server 2003 makes this solution robust, reliable and secure. Migration/ modernization drivers, benefits provided by the legacy re-hosting solution and the credibility of Microsoft platform make this the right time for enterprises to assess and strategize their legacy modernization programs.

With vast experience in executing legacy modernization and migration engagements across various industry verticals, Infosys can provide its clients the ability to deliver a complete end-to-end solution – starting from portfolio and business case analysis to solution implementation and deployment. Along with strong partners, Infosys provides the best-of-breed solutions to meet the client's specific needs. The Infosys Legacy Re-hosting Solution combines its framework, technology expertise, robust set of tools and strong program management skills to assist clients in modernizing their mainframe legacy systems.

## Acknowledgement

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<http://supportline.microfocus.com>

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## About the Authors

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