Alliance and Technology Unit

A TCS Perspective on Mainframe Re-hosting

About the Authors

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Since 2007, he has been working extensively on IBM mainframe re-hosting. His responsibilities include legacy landscape assessment, target architecture definition, capacity planning, business case preparation, migration planning, and project delivery support. He has a Bachelor's degree in Electronics and Communication Engineering from Pondicherry University.

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Sujeet is a Solution Architect with the Alliance and Technology unit at TCS. He has been in the IT industry for over 16 years, and has worked extensively in mainframe-based application development and maintenance projects for customers in North America, Europe, and the UK. For the last six years, he has specialized in helping TCS customers with their legacy modernization initiatives, particularly related to IBM mainframe re-hosting. Sujeet holds certifications in DB2, SOA, ITIL, Six Sigma, Enterprise Architecture (TOGAF), Agile (IBM RUP), and General Insurance (from the Chartered Insurance Institute, UK). He has a Bachelor's degree in Electrical and Electronics Engineering from Bangalore University.

Abstract

Mainframes form the backbone of many core business processes in organizations worldwide. However, the total cost of ownership, platform flexibility, and administration and programming skills associated with them have been critical areas of concern in recent times. Banking solely on unsupported legacy systems might not just create reliability and performance issues, it could also lead to more revenue leakage due to the high cost of maintenance.

To leverage existing investments, CIOs and solution architects are increasingly looking at re-hosting mainframe applications on distributed platforms. Over the years, re-hosting tools and technologies have matured significantly, and re-hosting has emerged as a legitimate alternative to traditional modernization methods.

This paper outlines our observations on the use of tools and techniques for re-hosting of IBM mainframes. The observations and analysis in this paper have been derived from our customer engagements over the last six years.

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Contents

List of Abbreviations

BFSI	Banking, Financial Services, and Insurance
BMS	Basic Mapping Support
COTS	Commercial off the Shelf
CICS	Customer Information Control System
CIO	Chief Information Officer
GDG	Generation Data Group
IBM	International Business Machines
IDCAMS	IBM Access Method Services
IMS	Information Management System
IMS DB	Information Management System – Database
IMS DC	Information Management System – Data Communications
JCL	Job Control Language
MFS	Message Format Service
MIPS	Million Instructions Per Second
PDS	Partitioned Data Set
PL1, PL/I	Programming Language One
PoC	Proof of Concept
PS	Physical Sequential (file)
R&D	Research and Development
RDBMS	Relational Database Management System
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Quotation
RoI	Return on Investment
RUP	Rational Unified Process
TCS	Tata Consultancy Services
TCO	Total Cost of Operations
TOGAF	The Open Group Architecture Framework
Txn. Mgmt.	Transaction Management
UK	United Kingdom
VSAM	Virtual Storage Access Method

The Growing Need for Technology Simplification

Cloud, commodity hardware, and pay-as-you-go models have taken over the modern business landscape—and early adopters are already reaping the benefits. However, many enterprises have not been able to fully leverage digital technologies, as their mainframes have not been upgraded. This problem is further compounded by the fact that skills and resources required to maintain the mainframe platform are on the wane. Many organizations are looking to move the data and business logic—embedded in their legacy mainframe applications—to industry-standard platforms. The 'rip and replace' approaches of the past do not prove viable in a scenario of this kind, and moving to a COTS product is not always feasible. Therefore, mainframe re-hosting has emerged as an attractive alternative, since it offers a relatively simple and quick mainframe exit path. It also suits the needs of organizations that are not willing to eliminate their mainframes and lose their existing investments, but need to re-host them and reduce workloads that run on them—thereby, plugging revenue leakage. Our experience with clients indicates that mainframe re-hosting has gained traction in recent years.

Demystifying Mainframe Re-hosting

Mainframe re-hosting refers to the 'lift and shift' of mainframe applications and data to an alternate hardware platform. The alternate platform runs specialized re-hosting software that provides the development and execution environment required by traditional mainframe programming technologies (see Figure 1). These include COBOL, PL1, CICS, IMS, and JCL, and typical mainframe specific data stores such as VSAM and GDG. These suites also support databases such as IBM DB2 and IMS—and if required can also link to relational databases like Oracle and SQL Server.
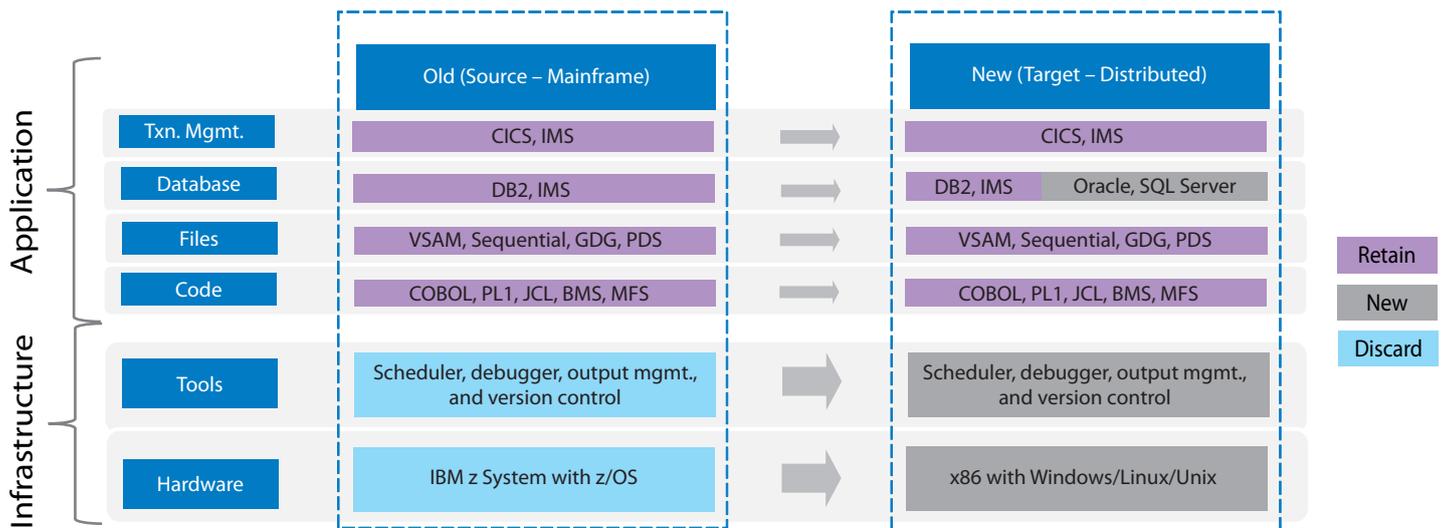

Figure 1. Re-hosting in a Nutshell

Once the mainframe application is re-hosted, it can continue to function with minimal code changes and the end user remains unaffected. This paper focuses specifically on IBM mainframes, since they are the most commonly used.

The Case for Re-hosting

Re-hosting may not always be the best option for exiting the IBM mainframe and the business case for this must be carefully considered. Figure 2 illustrates the broad categories of factors that influence the business case.
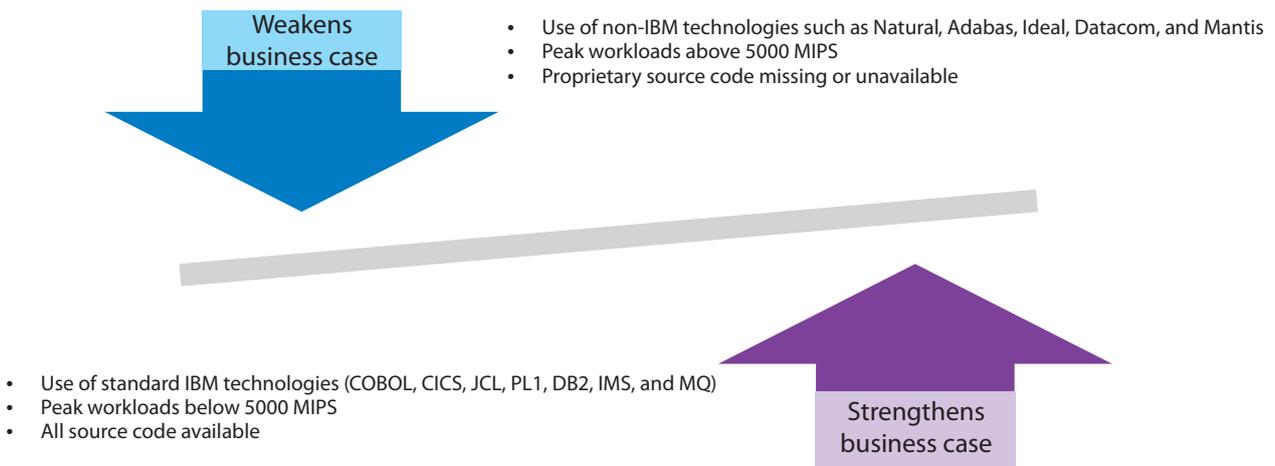
Weakens business case

- Use of non-IBM technologies such as Natural, Adabas, Ideal, Datacom, and Mantis
- Peak workloads above 5000 MIPS
- Proprietary source code missing or unavailable

- Use of standard IBM technologies (COBOL, CICS, JCL, PL1, DB2, IMS, and MQ)
- Peak workloads below 5000 MIPS
- All source code available

Strengthens business case

Figure 2. Best and Worst Fit Scenarios for Re-hosting

If re-hosting is difficult, partial mainframe exit is a viable option—where a well-defined portion of the mainframe landscape meets the requirements, and can easily be moved. The remaining elements can continue to reside on the original mainframe. Adopting this approach will provide incremental benefits related to mainframe MIPS cost avoidance.

Mainframe re-hosting can provide a new degree of flexibility to traditional IBM mainframe-based applications (see Figure 3). This applies to off-mainframe development, mainframe in the cloud, and DevOps.
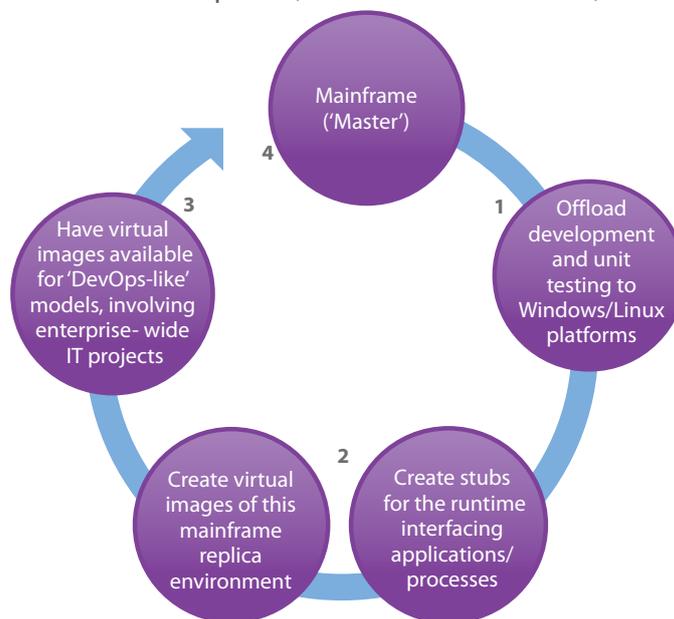
Mainframe ('Master')

4

3
Have virtual images available for 'DevOps-like' models, involving enterprise- wide IT projects

1
Offload development and unit testing to Windows/Linux platforms

2
Create stubs for the runtime interfacing applications/ processes

Create virtual images of this mainframe replica environment

Figure 3. Bringing Agility to Mainframe Application Development

Mainframe re-hosting can offer sequential rollout of the following activities:

- Offloading of development can take place through re-hosting solutions, which would provide a Windows/Linux-based development and unit test environment

- External interfaces to the mainframe should be replicated or suitable stubs created—this can be virtualized to form a 'mainframe image'

- These images can be easily provisioned or de-provisioned, and they allow developers to run quick validations against the 'mainframe'

- Code and test data can be synced back to the mainframe 'master' (if required) using custom scripts and utilities

An Overview of Re-hosting Vendors and Products

Key vendors that provide re-hosting products are Micro Focus and Dell (Clerity), while Oracle and other vendors also have competing solutions. IBM's Tx Series can enable a full-fledged mainframe implementation, though it is not exclusively a re-hosting solution. Table 1 provides an overview of the popular product offerings available in the market.

Product Vendor	Micro Focus[1]	Dell[2]	Oracle[3]	IBM[4]	TmaxSoft[5]
Product name	Micro Focus Enterprise Server (MFES)	Transaction Processing Environment (TPE) & Batch Processing Environment (BPE)	Tuxedo - Application Runtime (ART) for CICS and Batch	Tx Series for Multiplatforms	Openframe
Transaction processors supported	CICS and IMS DC	CICS and IMS DC	CICS and IMS DC	CICS	CICS and IMS DC
Batch support	Supports standard IBM features – sort, IDCAMS, and so on	Supports standard IBM features – sort, IDCAMS, and so on	Supports standard IBM features – sort, IDCAMS, and so on	Not supported	Supports standard IBM features – sort, IDCAMS, and so on
IMS DB support	Supported	Not supported	Not supported	Not supported	Supported
Language support – C, C++, COBOL, PL/I, Java	Supported	Supported; also supports Natural	Supported	Supported	Supported; limited support for Assembler
File system support – VSAM, GDG, PS, PDS	Supported	Supported	Supported	Only VSAM and PS supported	Supported
Emulation of supporting products – Scheduler, RACF, version control…	Not available, use third party products	Not available, use third party products	Not available, use third party products	Not available, use third party products	RACF/ACF2 emulation supported
Tooling – for easy code and data re-hosting	Available	Available	Available	Not available	Available

Table 1. An Overview of Leading Re-hosting Vendors and Their Products

[1] Micro Focus, Micro Focus Enterprise Server Product Review (2011), Accessed on 4 June 2016, https://www.microfocus.com/media/brochure/server-enterprise-edition-prod_tcm6-8233.pdf

[2] Dell, Mainframe Re-hosting Software Data Sheet (2012), Accessed on 4 June 2016, http://i.dell.com/sites/doccontent/shared-content/data-sheets/en/Documents/mainframe-rehosting-software-data-sheet.pdf;

[3] Oracle, Solution brief: Modernize IT Infrastructure: Oracle Mainframe Rehosting (PDF), Accessed on 4 June 2016, http://www.oracle.com/technetwork/middleware/tuxedo/overview/mf-rehost-solution-art-brief-1722399.pdf?ssSourceSiteId=ocomen;

[4] IBM, IBM TXSeries for Multiplatforms Version 8.2 Knowledge Center, Accessed on 4 June 2016, http://www.ibm.com/support/knowledgecenter/SSAL2T_8.2.0/com.ibm.cics.tx.doc/ic-homepage.html

[5] TmaxSoft, Product Datasheet- OpenFrame, Accessed on 30 September 2016, http://www.tmaxsoft.com/wp-content/uploads/2015/09/2015.07OpenFrame_v7_Datasheet_en.pdf

While the basic functions of re-hosting technology solutions are similar, they can be differentiated based on one or more of the following parameters:

- The level of support offered for various mainframe technologies
- The level of integration with third-party solutions like schedulers, output management, RDBMS, and so on
- Case studies of similar workloads and transaction profiles successfully re-hosted
- Alignment to customer strategic directions on hardware, operating system, and technologies

Most of these product vendors partner with third-party system integrators to deliver comprehensive re-hosting solutions. Typically, the system integrator provides analysis, design, migration, and assurance services, while the product vendor offers implementation, configuration, and training. Often, the system integrators also provide various tools and frameworks that accelerate project delivery.

TCS' Observations Based on Client Engagements

As a leading provider of mainframe re-hosting services, TCS has worked with leading re-hosting product vendors over the past six years. Based on this, we have noticed a few patterns.

A Shift from Exploration to Experimentation

We have analyzed 122 customer and prospect engagements from the last six years, and classified them into four buckets:

- **Presales:** RFQs, RFIs, RFPs, and capability presentations, including demos
- **Assessment:** Customer mainframe analysis and reports, re-hosting proposals, and business case or RoI projection
- **PoC:** Code and data from applications gathered to work in a re-hosted environment
- **Delivery:** Exiting mainframes entirely, and re-hosting applications

The last three-four years have seen a higher number of PoCs and assessments, signifying that our clients have moved beyond just exploration of re-hosting concepts and are now looking at the feasibility and suitability of re-hosting for their unique application landscapes.

Table 2 lays down the reasons why we are not seeing a higher number of clients looking to re-host their mainframe applications.

Reason	Detailed Description	Percentage and Number of Organizations
Research phase	• The organization is merely gathering information—this usually does not go beyond the initial RFI or product demo phases	34%
Project put on hold or abandoned because it is low priority or due to high upfront costs	• Misconception that re-hosting is always economically viable—however, there is an upfront capital expense for licenses and hardware • Emergence of other, higher priority business or regulatory changes	20%

Reason	Detailed Description	Percentage and Number of Organizations
Solution considered non-strategic	• Not favored by enterprise architects, as 'legacy' technologies like COBOL, JCL, CICS would continue to be used • Not considered a true 'open' solution due to dependence on an underlying proprietary mainframe emulation product	21%
Non-standard workloads in landscape, which weaken the business case	• The solution would reduce TCO for standard IBM workloads (COBOL, JCL, CICS, IMS, DB2), but technologies such as Assembler, Ideal, Datacom, Telon, and Supra are not supported. Unsupported technologies require rewriting, thereby adding to the overall time and cost	16%
Re-hosting leveraged only to reduce existing mainframe hosting costs	• Re-hosting option considered as a bargaining chip, used when dealing with the existing mainframe hosting provider, and on receiving better licensing deals, the re-hosting proposals are shelved	9%

Table 2. Key Reasons for Re-hosting Reluctance

Most of the organizations that did not go ahead with re-hosting have continued to remain on the IBM mainframe, that is, maintain the status quo.

The BFSI Industry and the North America Region Dominate

As depicted in Figures 4 and 5, engagements with clients in North America and from the Banking, Financial Services, and Insurance industries far outnumber those from other industries and geographies.

We see that clients from the Manufacturing industry have also shown an interest, followed by Telecom. This trend is not surprising, since these industries have traditionally been leading users of IBM mainframes, and are also mature outsourcing customers.

In terms of geographic distribution, the majority of clients that have shown an interest are based in North America, with Europe and the UK being a close second. Customers from other geographies together constitute less than 10% of all interest we have received in the re-hosting area. This is also not
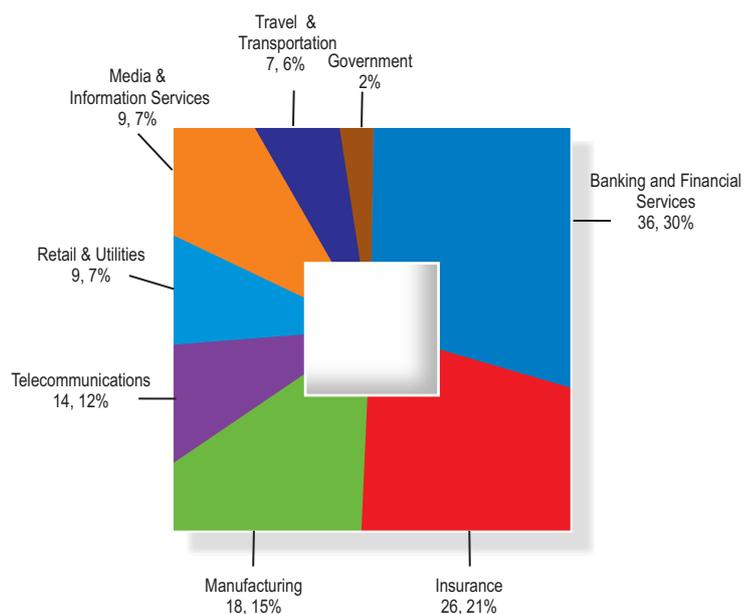

Figure 4. Industry-wise Distribution of Requests

very surprising, given that North America and Europe are the major markets for both mainframes as well as IT services outsourcing.

Workload Barriers for Re-hosting Have Been Pushed

Traditionally, mainframe workloads in the 0-1000 MIPS category were considered ideal candidates for re-hosting onto alternate hardware platforms. With advances in hardware design and improved availability metrics on distributed systems, this MIPS barrier no longer holds.
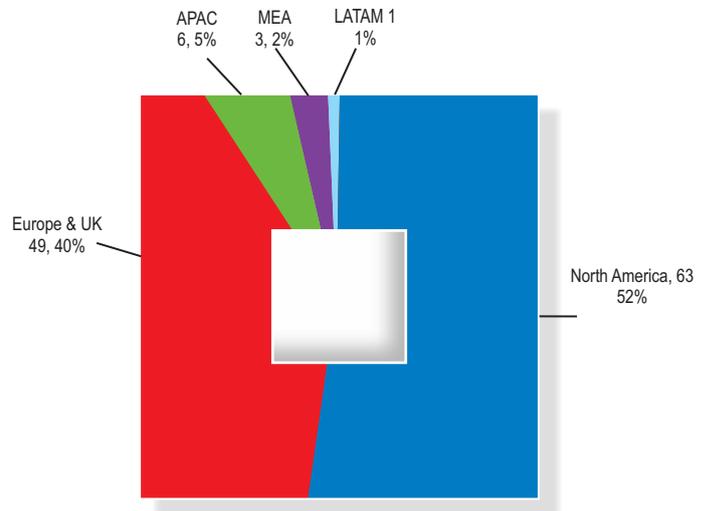

APAC 6, 5% MEA 3, 2% LATAM 1 1%

Europe & UK 49, 40%

North America, 63 52%

Figure 5. Geography-wise Distribution of Requests

Figure 6. Re-Hosting Request Distribution by MIPS

As Figure 6 indicates, requests for re-hosting workloads that are above 1000 MIPS have been steadily increasing. However, not all of these customers are looking for a complete mainframe exit. Several customers are only interested in reducing their overall MIPS consumption by offloading smaller workloads or by offloading development and unit test activities. Some of the reasons for this are:

- With advances in distributed computing hardware, non-mainframe servers and operating systems have increasingly become more stable and reliable, and can match the mainframe non-functional metrics

- Many smaller organizations with lower workloads (that is, mainframe installations in the 1000 MIPs range) have already re-hosted their mainframes

- Organizations with larger workloads do not want to risk eliminating their stable mainframe-based applications, and are looking at re-hosting as a means of reducing their MIPS usage

Mainframe MIPS Optimization is an Area of Critical Concern

The levers to achieve mainframe MIPS optimization have always relied upon tuning the various application and infrastructure components or replacing or consolidating various technologies—while still remaining on the mainframe. It is only recently that MIPS optimization levers have started utilizing off-mainframe development and unit test options made popular by offerings such as Micro Focus Enterprise Test Server™ and IBM Rational Developer.

The nature of non-traditional requests has changed significantly in recent years. We had not seen interest in DevOps or offloading of development till 2012. In 2013, we received a request for offloading test activities for a leading car manufacturer in the US. This led to a PoC and eventual implementation. In both 2014 and 2015, we received two requests for offloading development activities.

Some of the requests received have been for virtualization, and cloud and DevOps-related scenarios for mainframe-based applications. One of the paths towards achieving a cloud-based mainframe service is by first re-hosting the application on Windows or Linux and then making this image available via virtualization software such as VMware. The mainframe can thus form a part of a virtualized environment and be hosted in a cloud infrastructure if required. This mainframe instance can then be used for multiple iterations of unit or integration testing. Once the test cases are successfully proven, the changes can then be deployed in the physical mainframe for a final test.

The Way Forward for Mainframe Re-hosting

It is apparent that many critical workloads will continue to run on mainframes, since migration is sometimes an expensive and complex affair. Many installations still run on obsolete technologies, which require additional migration effort, and not all workloads are suitable for re-hosting. Service providers are therefore looking at bolstering existing mainframes through additional automation and re-hosting product capabilities.

However, even as some organizations are reluctant to commit to re-hosting, our experience indicates that re-hosting is here to stay, especially in certain industries. For example, re-hosting solutions that are tuned to meet BFSI requirements are likely to see better traction than generic solutions. Customers are now more aware and more specific about their re-hosting requirements—and with advances in R&D and technology, the demand for mainframe re-hosting solutions will rapidly increase over time. For the near future, it is safe to say that large mainframe installations will remain and hybrid approaches to managing MIPS will become the norm.

Acknowledgements

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TCS maintains its technology leadership through a continuous focus on architectural excellence, design rigor, and adoption of the latest technologies. Our integrated business solutions and continuous thought leadership leverage our state-of-the-art innovation centers, customer experience centers, and global solution labs. We focus on building and nurturing technology competencies that enable us to provide technology advisory services par excellence. Our clients benefit from the combined value of TCS' industry, technology, and service expertise, and the partner's products and services, all of which ensure faster deployment at reduced cost, complexity, and risk.

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