MAINFRAME MIGRATION TO AZURE – BATCH AND DATA PROCESSING

Abstract

As a predominant workload in mainframe, batch processing poses its own challenges to modernization. This white paper aims to simplify the approach to batch processing modernization using Infosys accelerators and our Microsoft partnership advantages. It also highlights the Infosys way of identifying the right solution by discovering the key issues in the current application. It further explains the Infosys-Microsoft solution strategy for successful mainframe migration.

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1. Introduction

Mainframe modernization helps transform the application portfolio into agile and efficient systems while mitigating risks and lowering costs. However, mainframe migration can be complex. It needs custom approaches depending on the requirements, workloads and risk profile of the enterprise. While there are some common challenges to most mainframe migration journeys, there are also different types of migration patterns from rehosting to re-engineering that must be considered.

For instance, there are a set of repetitive architectural patterns for mainframe applications. Each architectural pattern that emerges on the mainframe needs a unique strategy to host it on Azure/SQL data platform. The following sections describe how to map existing architectural patterns and components to their equivalent components on Microsoft Azure.

2. Mainframe challenges and cloud migration platforms

The common challenges of mainframe systems are high licensing cost, lack of technology experts and the evolving needs of the digital world. Today's enterprises need the right platform that can off-load mainframe batches and migrate data processing to the new cloud platform in a seamless and risk-free manner.

Microsoft Azure cloud computing platform is a successful and proven target environment for transitioning from mainframe workloads to the cloud. With robust security features and the ability to scale services on demand, Azure offers a complete operational environment to support mainframe workloads that have been migrated to the cloud. In addition, Azure drives innovation of application portfolios that previously resided within the inflexible mainframe computing models, thereby improving the productivity of application developers and support personnel.

As a strategic Microsoft partner for multiple years, Infosys leverages domain expertise and mature IPs for mainframe modernization. We have delivered more than 60 successful engagements for enterprise customers by helping them successfully rehost, re-engineer and re-platform mainframe workloads onto Azure and SQL/data platform.

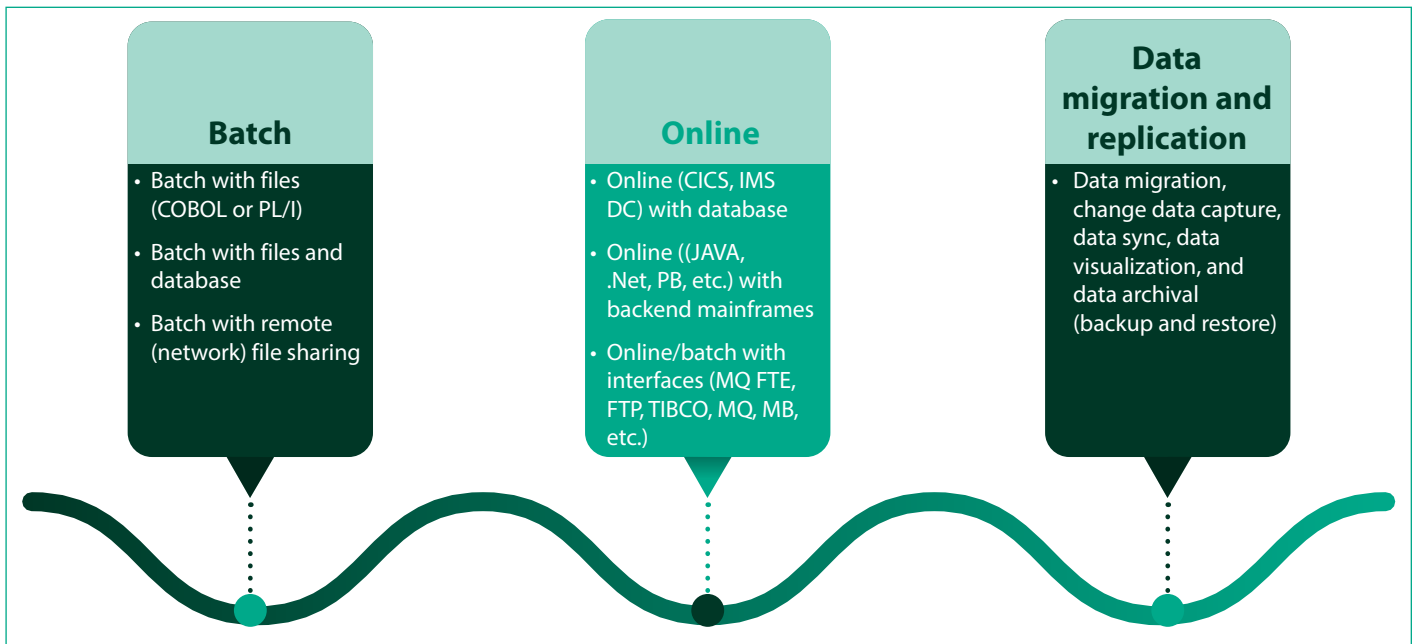# 3. Choosing the right modernization approach

Infosys has developed an application survey questionnaire that gathers key responses, which are then fed into the Infosys Portfolio Assessment Framework to determine the target disposition state. Based on the responses, four modernization approaches are applicable. These are:

- **Rewrite** – Here, applications are re-engineered to a different language for next-gen architecture such as cloud, DevOps, etc.

- **Retain** – Here, application functionalities and existing platforms are not modified/changed. However, in order to enhance application functionalities, features such as API or microservices can be enabled on top of the applications

- **Rehost** – Applications are migrated to an emulation platform in Linux/Windows without altering the user experience and application functionality

- **Retire** – Applications are shut down and business-relevant functionalities are moved to other applications

4. Understanding application patterns

The figure below illustrates the key mainframe application patterns along with the workloads and possible use cases. It is important to note that some applications may have a combination of these patterns.
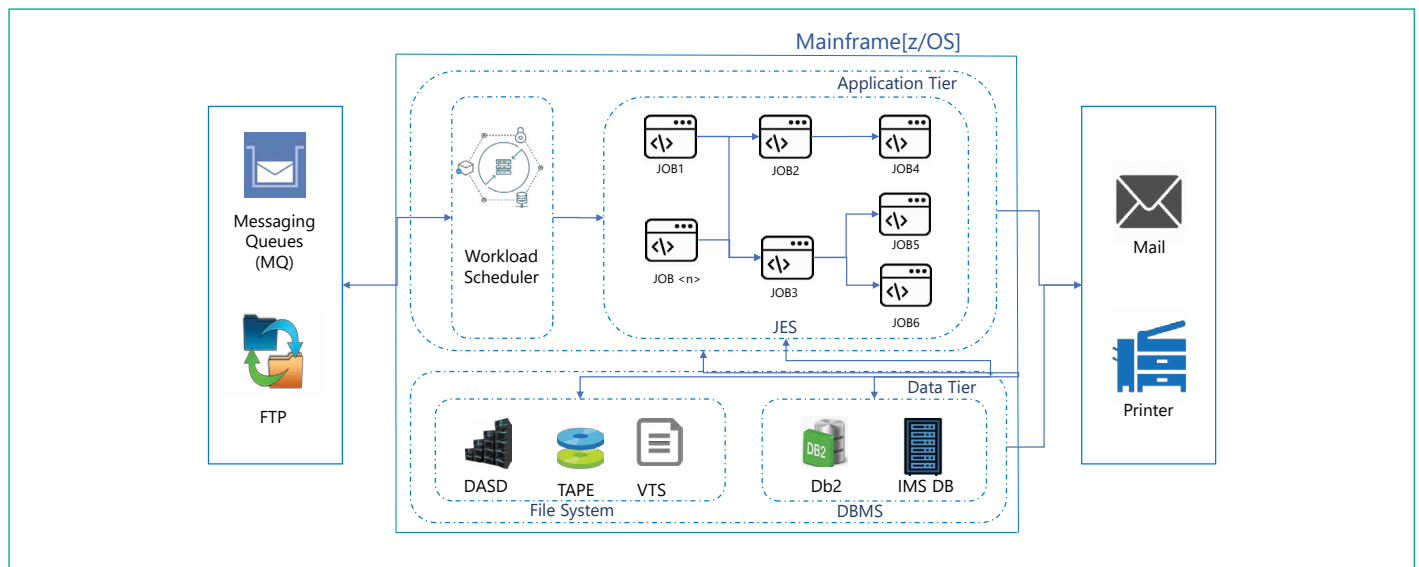

Batch
- Batch with files (COBOL or PL/I)
- Batch with files and database
- Batch with remote (network) file sharing

Online
- Online (CICS, IMS DC) with database
- Online ((JAVA, .Net, PB, etc.) with backend mainframes
- Online/batch with interfaces (MQ FTE, FTP, TIBCO, MQ, MB, etc.)

Data migration and replication
- Data migration, change data capture, data sync, data visualization, and data archival (backup and restore)

Fig 1: *Type of mainframe application patterns*

5. Batch with files and database

5.1 Architecture on mainframe: Batch with files and database

A typical batch workflow in mainframes involves components like:

- **Jobs** – There may be multiple jobs running on the mainframe. These jobs may have successor/predecessor dependency on each other

- **Scheduler** – This controls the job dependencies and triggers the flow based event/time/dependency

- **Data layers** – This includes direct access storage device (DASD) and TAPE

- **Integrations** – This includes:
  - File transfer protocol (FTP) to receive and send files in batch
  - MQ to send/receive data from other external systems in batch
  - Email as a communication channel
  - Printer as a physical print medium

Fig 2: *Mainframe pattern for batch with files*

5.2 Azure target state architecture

The key steps in reference architecture for batch with files and database are:

- **Re-engineering the app tier –** Application logic in mainframes can be re-engineered using Azure service like Azure logic apps, Azure functions etc.

- **Upload files to Azure storage** – Files are uploaded to Azure Storage through Azure Data Factory

- **Data load for processing** – Mainframe data from DB2/IMS DB is loaded into Azure data stores

- **Ingestion and orchestration** – Azure Data Factory is used to manage the data in Azure Storage

- **Data sync** – Data is synchronized between the mainframe and Azure

- **Download files** – The files from Azure Storage can be downloaded to the mainframe storage in the appropriate format using services/utilities
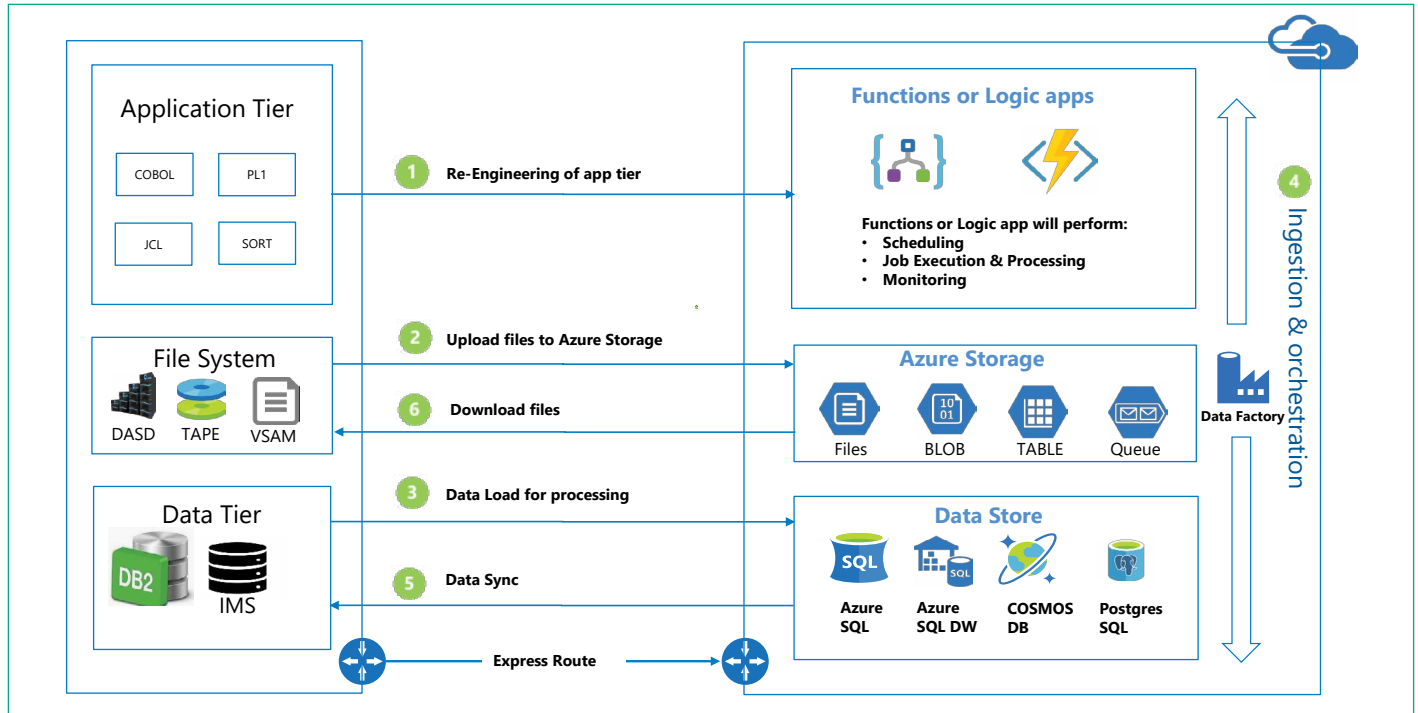

Fig 3: *Reference architecture for batch with files and database*

5.3 Data processing strategies for batch and real-time data

Data moves through the pipeline in the reference architecture through the following stages:

- **Data sources** – Data may reside in various on-premises source systems like sequential files, databases, applications, MQ, and logs

- **Ingestion** – Source data is ingested into Azure in Event Hub, Blob Storage and Azure Data Lake

- **Transformation** – Data is normalized and cleaned according to the transformation rules

- **Analysis** – Data is statistically analyzed to monitor logs and gain application insights

- **Data layers** – Data is loaded into Azure databases for consumption and business intelligence/visualization

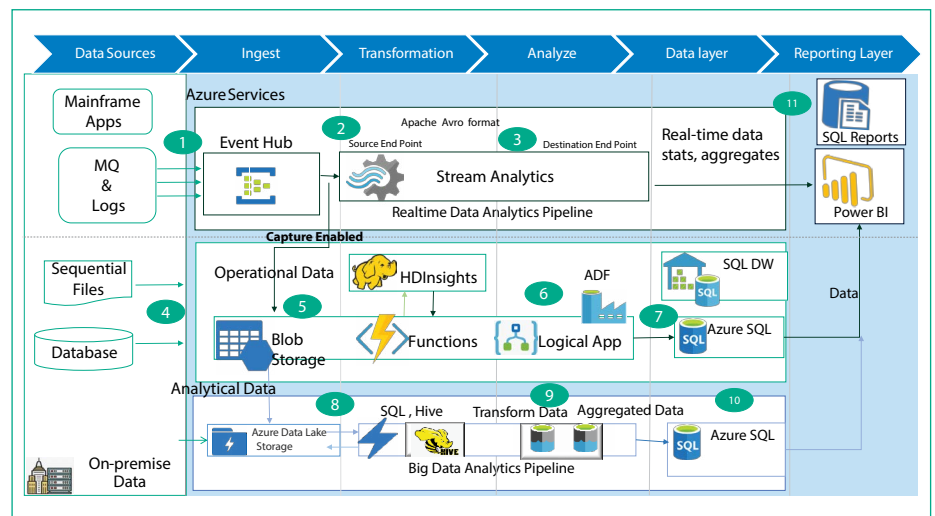- **Consumption** – Data is used to generate alerts, operational metrics, reporting, and visualizations

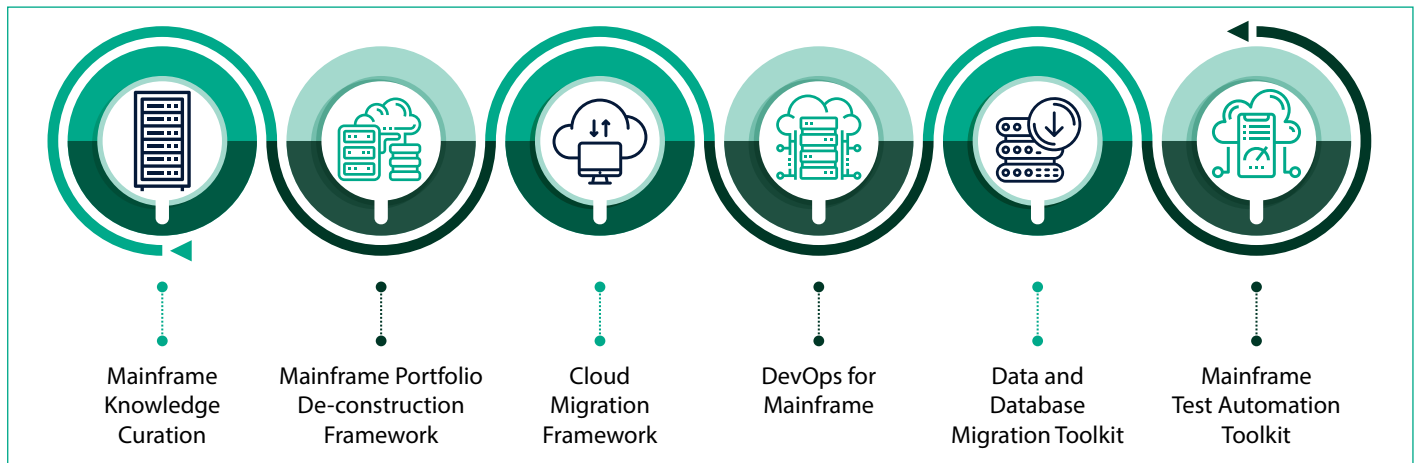***Fig 4:*** *Typical architecture for real-time and batch data processing*

Here is how Infosys leverages Azure to migrate data within the data pipeline:

1. Data from mainframe applications, MQ and logs is ingested into Azure Event Hub. Event Grid, an event routing service, can also be used to respond to events from apps and services

2. Users can define source and destination points for stream analytics. This aggregates event data in near real-time

3. Real-time data along with data at rest is captured and ingested into the storage layer

4. Once the data is in Azure, Infosys processes the data using logical apps, functions and HDInsight

5. Azure Data Factory is used to orchestrate the data pipeline, and schedule and monitor jobs

6. The target data is loaded into SQL DB or Azure SQL data warehouse

7. Analytical data is stored in the Azure data lake store

8. Raw data is transformed to aggregated data based on metrics and KPIs

9. The target data is loaded in SQL DB

10. Data visualization tools like Power BI are used for creating reports based on the processed data

6. Infosys accelerators

Infosys has invested in several tools and accelerators that streamline mainframe migration so clients can realize value faster with minimal effort.

| Mainframe Knowledge Curation | Mainframe Portfolio De-construction Framework | Cloud Migration Framework | DevOps for Mainframe | Data and Database Migration Toolkit | Mainframe Test Automation Toolkit |

7. Why choose Infosys?

Infosys possess several differentiators that make us the partner of choice for migrating from mainframe to Azure. Some of our differentiators are:

Reference architecture	Infosys has identified 10 mainframe patterns. Combined with Azure expertise, we have created proven architecture for all these patterns.
Identification of modernization candidates	Infosys Ki tool and our cloud questionnaire help identify the mainframe patterns for modernization during the assessment phase.
Benefit realization framework	Azure TCO Calculator has been incorporated with pattern sizing (small, medium and large) to provide an accurate cost-benefit analysis of mainframe migration.
Accelerated execution	Cloud templates have been created for all patterns to accelerate migration to Azure.
ISV partnerships	We have identified best-fit conversion tools from our partners that reduce migration effort when adopting cloud.
Awards and recognitions	• Infosys recognized as winner for 2019 Microsoft Global Alliance SI Partner of the Year. • Infosys recognized as finalist for the Application Innovation category at Microsoft 2019 Partner of the Year Awards.

8. Conclusion

Batch applications that are developed over time with a plethora of different patterns need to be analyzed in detail to find the right architectural approach to migration. The batch and data migration strategies outlined in this white paper will work for some of the patterns. Having delivered several successful cloud implementations on Azure, Infosys leverages the right approach to help mainframe customers accelerate their mainframe batch workload migration process onto the Azure platform. Clients also benefit from the lessons we have learnt across our many migration journeys.

In this white paper we have discussed one of these approaches – mainframe batch with files and database – along with the Azure target state architecture. We will continue with another predominant pattern in our next white paper Mainframe Migration to Azure - Online Application Re-engineering.

To know more about how to streamline your migration from mainframe to the cloud, reach us at Legacy.Mod@infosys.com

9. About the authors

Infosys contributors:

Ajay Jeswani: Principal Consultant, Legacy Modernization Practice, Infosys

Rajesh Kumar Vinukonda: Technology Architect, Legacy Modernization Practice, Infosys

Microsoft contributors:

Ashish Khandelwal: Senior Engineering Architect, Mainframe Modernization, Microsoft

Mukesh Kumar: Engineering Lead for Mainframe and Legacy Modernization, Microsoft

Pramod Vasanth: Principal Cloud Solutions Architect, Microsoft

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