Legacy z/OS Modernization with AWS - A Hybrid Approach for a Data Ingestion System

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Abstract: Legacy mainframe-based data ingestion systems face increasing challenges, including high operational costs, slow batch processing, and difficulties integrating with modern data platforms. Financial institutions must modernize these systems without disrupting critical data flows to ensure scalability, data accuracy, and regulatory compliance. This paper explores how AWS enables the seamless transformation of data ingestion infrastructure through a hybrid architecture, leveraging both AWS cloud services and in-house mainframes. A real-world case study illustrates how a financial institution successfully transitioned to AWS, optimizing data processing efficiency while maintaining business continuity. The paper concludes with a strategic roadmap for banks and financial enterprises to modernize data ingestion workflows.

1 Introduction

Legacy mainframe systems have long supported banking and finance, ensuring reliability, scalability, and security in trade processing, data management, and regulatory compliance [1]. Despite advancements in modern computing, mainframes remain essential for handling sizeable financial data volumes with accuracy and stability [2]. However, modernization is now critical due to evolving technology, regulatory demands, and the need for real-time data integration. This paper explores how AWS enhances mainframes by improving scalability, automation, and cost efficiency while maintaining system reliability.

A core component of financial mainframes is z/OS, IBM's enterprise operating system designed for mission-critical workloads with high security and uptime [3]. Financial institutions rely on z/OS for data ingestion pipelines, ensuring validation, transformation, and compliance [4]. Its ability to manage structured and hierarchical data at scale has made it essential for secure, high-speed trade processing [5]. Even today, mainframes process vast amounts of regulated trade data daily, ensuring accuracy and compliance [6].

However, mainframes face high maintenance costs, reliance on COBOL, and limited cloud integration, restricting scalability and AI-driven analytics [7]. They lack elastic scaling for processing surges and real-time data transformation capabilities [2]. Addressing these limitations requires a hybrid modernization approach that retains core strengths while integrating AWS [1].

AWS extends mainframe capabilities through hybrid cloud integration, enabling automated batch processing, scalable computing, and workflow orchestration [3]. AWS Batch, Fargate, and AWS Step Functions streamline data validation, processing, and ingestion while ensuring compliance, efficiency, and cost savings [6]. Financial institutions can leverage AWS for regulatory compliance, improved data accessibility, and AI-driven analytics, reducing operational costs while maintaining system resilience [7].

This paper explores modernization strategies through a real-world case study, demonstrating how financial institutions can adopt a hybrid cloud approach to enhance efficiency, scalability, and adaptability in a data-driven financial ecosystem.

2 Case Study

This section presents an example case of a legacy mainframe system that can be modernized using AWS. The system is the intermediary between external data providers and the platform's data repositories, handling continuous data growth and ensuring reliability. The system ingests data through mainframe flat files,

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primarily Physical Sequential (PS) files, which arrive from multiple sources. Each file corresponds to a specific table in the system's database architecture. The ingestion system is tasked with validating, converting, and uploading these files into the appropriate tables following the schema of the destination system while maintaining strict data integrity.

Additionally, the system processes data tailored to specific clients, applying distinct business logic as required for their trading operations. Data conversion to align it with the new schema is a key aspect of the system. Client-specific business logic is applied to the data before storing it in the relevant databases. This logic varies by client and may involve complex business logic based on their unique requirements. The system employs a batch-oriented workflow to process the input files, generating transformed/converted data for the destination system. These converted data are written in files for manual validation before being loaded to the actual DB. The ingestion system also includes mechanisms for handling data anomalies and generating alerts for invalid or incomplete data submissions. Given the constant influx of data, the system has been designed to support scalability and high availability. The architecture integrates with in-house DB2 databases, maintaining a robust and efficient pipeline for real-time ingestion. The system also incorporates mechanisms to ensure seamless conversion and loading of multiple clients' data simultaneously.

3 Road-map

Phase	**Objective**	**Time Estimate**
System Analysis & Requirements Gathering	Assess existing ingestion processes, file structures, and table dependencies. Define business rules and database connectivity requirements.	1–2 months
AWS Architecture Setup	Configure S3 for file staging, establish Step Functions for workflow orchestration, set up VPN for DB2 connectivity, and implement CloudWatch for monitoring.	2–3 months
Workflow Implementation	Migrate data processing logic into AWS. Develop batch jobs for file conversion and ingestion while ensuring correct execution sequences and dependencies.	3–4 months
Testing & Benchmarking	Validate data accuracy, workflow execution, and system performance under peak loads. Ensure fault tolerance and optimize database interactions.	1–2 months
Production Deployment	Deploy AWS workflows into production, activate real-time ingestion, enable monitoring, and optimize batch job performance for long-term stability.	1–2 months

Table 1: Hybrid Cloud Migration Plan

4 Proposed Solution

We've integrated AWS services [8] to develop this solution while retaining the in-house DB2 database as the central operational data store. This hybrid architecture ensures data residency compliance and leverages the scalability and efficiency of cloud-native services. Note: There are two assumptions: 1) the z/OS COBOL codes need to be compiled as micro-focus COBOL, and 2) the entire Job Entry Subsystem (JES) tasks have been replaced using AWS services (EventBridge, ECS, Fargate) for the workflow.

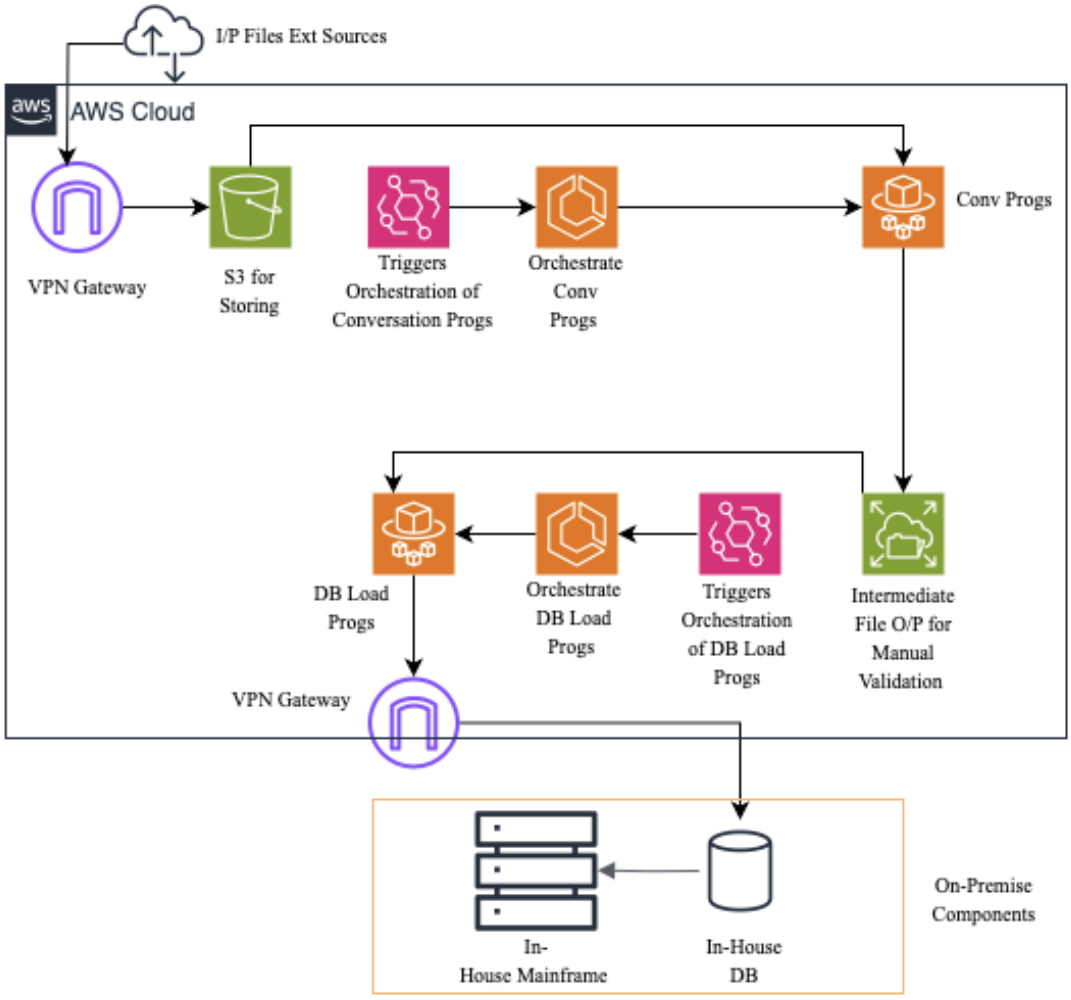

Figure 1: Solution Architecture

5 Cost Benefit

Aspect	**Current**	**Proposed**	**Sources**
Annual Costs	1M–1.5M h/w maintenance, licensing, energy.	Pay-as-you-go pricing (approx $50K–$80K annually, assuming infrequent on-boarding).	[9]
Billing Model	Fixed costs for infrastructure and resources regardless of usage.	Pay-per-use; costs incurred only when workflows are triggered during onboarding.	[9]
Maintenance Costs	Significant.	AWS takes care of it.	[9]
Migration Costs	None; system remains on legacy infrastructure.	One-time migration cost (estimated $100K–$200K for setup, configuration, and testing).	[9]

6 Conclusion

Legacy mainframe-based data ingestion systems have long been integral to financial institutions, ensuring structured processing, compliance, and data integrity. However, operational costs, scalability challenges, and integration limitations with modern cloud-native solutions necessitate strategic modernization. This paper has demonstrated how a hybrid approach leveraging AWS allows financial institutions to modernize data ingestion workflows while maintaining the stability and reliability of their existing mainframes.

By integrating AWS Batch, AWS Fargate, and Step Functions, institutions can automate batch processing, optimize compute resources, and enforce workflow dependencies—enhancing scalability and reducing manual intervention. Secure connectivity via AWS Site-to-Site VPN ensures seamless integration with on-premise DB2 systems, preserving regulatory compliance and minimizing disruption. The case study highlights a successful migration where AWS services streamlined ingestion, validation, and transformation processes, enabling a highly available and cost-efficient infrastructure.

The proposed roadmap outlines a structured migration strategy, from system analysis to full production deployment, ensuring a controlled and risk-mitigated transition. Performance benchmarks validate that AWS enhances processing speed, lowers infrastructure costs, and improves data accessibility while providing fault tolerance and compliance with industry regulations. Modernizing mainframe data ingestion systems is not about replacing legacy infrastructure but extending its capabilities with cloud-based automation and scalability. By adopting AWS as a modernization enabler, financial institutions can future-proof their data infrastructure, achieving greater agility, operational efficiency, and resilience in an increasingly complex and data-driven financial ecosystem.

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