**Case Study: Transaction Hub Modernization: From Legacy Infrastructure to Cloud-Native Architecture**

***(Migrating a Centralized Transaction Hub from MarkLogic to Azure Cosmos DB)***

**The Problem Statement**

Northern Trust, a leading financial institution, sought to modernize its centralized transaction routing hub. The transaction hub, a critical internal platform, had been running on legacy infrastructure for over a decade. Rising licensing costs, outdated technology, and a growing need for cloud migration and data security catalyzed the initiative to transition from MarkLogic to Azure Cosmos DB.

**Industry:** Banking and Financial Services

**Domain/Department:** Shared Services Information Technology

This project sits at the core of Northern Trust’s internal systems, specifically a centralized message routing hub that processes and enriches financial transactions before routing them through platforms like SWIFT or proprietary networks.

**Person Interviewed:** Glenn Drong, Technical Engagement Manager (Lead Engineer).

**Business Objectives**

* **Cost Optimization:** reduce the high annual licensing costs associated with MarkLogic as an on-perm provider
* **Cloud Migration:** transition of the transaction hub to a secure, scalable Azure cloud-first architecture
* **Technology Modernization:** eliminate security risks posed by aging infrastructure by adopting newer technologies
* **System Improvement:** enhance the performance, maintainability, and scalability of the internal transaction hub
* **Improve Security:** by eliminating technical debt tied to outdated software
* **Enable Agile DevOps Practices:** with updated tools and test automation

**The Challenge**

* Migrating over 10 years of transaction data
* Replacing a deeply integrated MarkLogic NoSQL database across numerous microservices with Azure Cosmos DB
* Migrating data from Archaeologic to Cosmos DB using Azure Data Factory
* Ensuring data integrity during migration
* Upgrading legacy microservices from Java 1.8 to Java 21 and supporting libraries without disrupting existing workflows
* Challenges faced during the cleansing of JSON files
* Designing a migration strategy that would minimize downtime and risk
* Produce a monthly cost analysis based on the future expected transactional load ranging from typical and excessive loading

**The Approach**

* Conducted a thorough technical assessment with two architects to identify possible migration paths
* Evaluated three migration strategies before selecting the most viable option
* Segregated responsibilities into specialized roles to manage parallel streams: application refactoring and data migration
* Ensured integration between new database systems and existing internal applications and services
* Automated QA and UAT testing scheduled to ensure the new implementation is going to work properly

**The Implementation**

1. **Database Migration Strategy:** Visali Dole (another Creospan Associate) focused on migrating data from MarkLogic to Azure Cosmos DB using a multi-stage Extract Load and Transform (ELT) process:
   * Extracted data from MarkLogic using MLCP (MarkLogic Content Pump)
   * Stored data in JSON format. Initiated JSON cleanup and removed legacy metadata and unnecessary artifacts for future-proofing
   * Cleansed and transformed data using Azure Data Factory, eliminating non-essential artifacts
   * Loaded clean data into Azure Cosmos DB
2. **Application Layer Refactoring:**
   * Replaced all MarkLogic-specific dependencies in the application codebase
   * Implement dual-writing to MarkLogic and Cosmos DB to mitigate rollout/rollback risks
   * Refactoring application code to support Cosmos DB APIs
   * Refactored and redeveloped integration and unit tests for Cosmos DB compatibility
   * Upgraded Spring-Boot framework and supporting libraries
3. **Microservices Upgrade:**
   * Migrated all Spring Boot microservices from Java 1.8 to Java 21 to align with modern standards and supported runtimes, as well as for enhanced performance and maintainability

**Tech Stack**

* **Old Tech Stack:** MarkLogic, Java 1.8, Spring Boot 2.3.12, Kotlin 1.6.21, Pivotal Cloud Foundry
* **New Tech Stack:** Azure Cosmos DB, Azure Data Factory, MarkLogic Content Pump (MLCP), Java 21, Spring Boot 3.4.1, Kotlin 2.1.0, Spring Cloud 2024, CI/CD Pipelines, Azure DevOps
* No AI component is being used in this project.

**The Impact**

While the project is still ongoing, the projected impact includes:

* **Migration to Azure Cosmos DB:** Will **e**nhancemulti-region replication and improve scalability, uptime, and compliance. Improved scalability allows better load management for peak transaction times. Upgraded microservices and optimized architecture are expected to reduce processing latency and up-to-date technologies reduce exposure to vulnerabilities.
* **Cost Savings:** The migration from MarkLogic to Azure Cosmos DB is a strategic cost-saving measure with long-term financial benefits across Northern Trust’s shared services ecosystem.
* **High MarkLogic Licensing Cost:** Northern Trust is spending approximately $1 million annually on its enterprise-wide MarkLogic license. The MarkLogic license is not tied to a single application, it supports eight critical internal applications, including the transaction hub, under a centralized license agreement. This meant the licensing cost and technical debt was being multiplied across the enterprise.
* **Improvement in Scalability:** Based on usage projections, the transaction hub alone is expected to process 4–5 times more data within the next 3 years. The existing MarkLogic licensing model poses a scalability and cost-efficiency challenge. To ensure long-term cost efficiency, Creospan and Northern Trust’s architecture team conducted a detailed cost analysis of Azure Cosmos DB under future data transaction loads considering both realistic and stress-test scenarios. The **lower bound** of the cost bracket used for planning is based on **expected transaction growth,** while the **upper bound** modeled an **unrealistically high load** to test the limits of cost scalability. This approach ensures that the projected savings were **conservative and achievable,** reinforcing Cosmos DB as a cost-efficient choice under likely future conditions.
* **Results of the Cost Analysis:**
* Projected monthly cost of Cosmos DB for Transaction Hub: less than $10,000/month
* Annual cost: less than $120,000
* Compared to MarkLogic enterprise licensing, the Cosmos DB model offers a significant reduction in total cost of ownership (TCO), especially as transaction volume grows
* Enterprise-wide potential savings: If all eight apps migrate, Northern Trust could retire the $1 million/year MarkLogic spend entirely, realizing up to $880,000/year in savings (Exact MarkLogic figures are confidential)

**Project Timeline**

* The project is ongoing and is likely to continue for 3-5 years
* The project began in November 2024
* Testing (QA & UAT) is slated for July 2025
* Go Live is planned for December 2025 or January/February 2026

**Team Composition**

* Glenn Drong (Creospan) – Lead Engineer
* Craig Newlander (Creospan) –Lead Engineer
* Visali Dole (Creopsan) – Managed data extraction, transformation, and loading using Azure tools
* Sindhu Kotha (Creospan) – Assisting Visali with error handling, logging, and recovery
* 2 Architects: Designed cloud migration strategy
* QA Engineers: (Planned) Testing post-development
* Other: Northern Trust employees
  + Sowmya Sama (NT) – Lead Engineer
  + Alagaraja Ramasubramanian (NT) – Architect
  + Casey Wood (NT-Contractor) – Azure Cloude Engineer
  + J Robert Bullington (NT-Contractor) – Azure Cloud Lead Engineer
* No Off-shore component

**Key Stakeholders**

* Internal Users: Various internal banking systems interacting with the transaction hub
* Shared Services IT Department
* IT Architects and Engineering Teams
* Northern Trust Leadership

**Conclusion**

The modernization of Northern Trust’s centralized transaction hub from MarkLogic to Azure Cosmos DB is a strategically significant project that aligns with the organization’s broader cloud transformation objectives, reduce operating costs, and future-proof their transaction systems. While invisible to end users, this infrastructure backbone plays a critical role in internal operations, positioning the company for a more agile, secure, and scalable future. By modernizing just one of the eight systems (Transaction Hub), Northern Trust is expected to see measurable cost containment. As additional apps are migrated off MarkLogic, the cumulative enterprise-wide savings are expected to grow substantially, making this one of the most financially strategic modernization efforts in recent years. This shift not only optimizes the transaction hub but also sets a replicable blueprint for modernizing all eight applications, maximizing ROI on cloud transformation.

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