



(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 5, May 2025

⊕ www.ijirset.com 🖂 ijirset@gmail.com 🖄 +91-9940572462 🕓 +91 63819 07438





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

Developing Protocol Translation Mechanisms for Legacy Banking Systems

Laxmikanth Mukund Sethu Kumar

Executive Director, JP Morgan Chase Bank, Lewisville, TX, USA

ABSTRACT: This paper presents an AI / ML enabled protocol translation middleware that fills the gap between legacy banking systems and modern cloud native platform. It enables an intelligent, secure and cost-effective way of modernization in increments, which will preserve the legacy systems in a manner that can meet the ever-changing technological demands by leveraging the scale of cloud infrastructure, semantic data mapping and real time translation.

KEYWORDS: Protocol Translation, Bank, Legacy System, ISO 8583.

I. INTRODUCTION

There is a lot of legacy banking systems still tied to cloud native platform due to different protocols of communication they use. The need becomes more important as financial institutions move towards cloud environments and need to find an efficient way to bridge the gap without replacing critical legacy systems in order to establish smooth, safe, low-cost digital transformation.

II. RELATED WORKS

Legacy Systems

Legacy systems are despite being long standing having been used to at times struggling to keep up with the demands of an ever fast changing digital economy. This makes companies unable to support new financial technologies, customers' expectations, and regulatory requirements [5].

According to Kansal and Siddharth, current re-platforming or reengineering approaches are not only expensive, time consuming but with plenty of dangers such as human error, system downtime etc. These factors prevent innovation and bottlenecks are formed in an adoption of advanced digital solutions.

Examples of legacy protocols that are key to banking system communication: ISO 8583 as an example that provides a set of rules how to format financial transaction messages [3]. Although ISO 8583 is still a vital piece of these ATM and POS systems it does not allow for much flexibility when it comes to integrating it with newer systems and so results in limited interoperability.

To bridge the gap between old and new financial architectures, Ramachandran states that protocol translation techniques were needed to enable communication between old and new systems since international standards (ISO 8583) never intended to be used with modern API-based architectures. Wang et al. further extend the security challenges to legacy systems when banks combine the cloud computing, blockchain, and AI technologies [2].

During modernisation of legacy systems, both native encryption and dynamic access control mechanisms are often absent; exposing legacy system to breach via same. Also, lack of the ability of most legacy architectures to log or audit real time interactions adds to the compliance risks, especially when we have to deal with strict laws like GDPR and PCI-DSS.

He also makes it clear that modernisation is an ongoing process, not just a concerted effort towards the technological upgrade, but also of strategic changes of business processes and governance structures [4]. Successful transformation efforts rarely result in deprecation of legacy systems to the point that some efforts are hybrid in which cloud native and





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

AI driven components are implemented incrementally what would otherwise already be mission critical legacy infrastructure.

AI in Legacy System

Today artificial intelligence (AI) is a great means of bringing legacy systems within current digital platforms. Since the automation of the translation from legacy protocols like ISO 8583 to modern formats, can be performed with learningbased models rather than with hard coded rule sets [5], AI provides one of the best advantages. To this end, Kansal and Siddharth advocate for training dynamic translators using reinforcement learning and NLP which allows translators to adapt to system behaviors in real time.

In this way, it significantly reduces the manual intervention and increases accuracy in the live transactions. The integration is also speeded up by using supervised machine learning in protocol mapping. Banks can train models to approximate semantic maps between those legacy fields and cloud native APIs so that systems can exchange each other's transactional integrity without modification.

Additionally, AI led anomaly detection systems can flag any deviations in translated transactions and thereby helped in ensuring compliance as well as facilitating in avoidance of frauds [10]. They say in the article that since cybercriminals overwhelm financial systems that are undergoing a transformation, AI must be used not just for efficiency but also to protect systems against emerging cybersecurity threats.

In this work, Abdellatif et al. explain in detail about service identification approaches (SIAs) they use in modernizing legacy systems into service-oriented architectures (SOAs) [6]. The focus of we are on finding reusable services, and the taxonomy of SIAs that we provide is directly applicable to middleware design for protocol translation. In addition, it means that intelligent middleware is not only required to provide a mapping of services but also needs to orchestrate services to have the services execute in a manner to replicate the logic of the business from legacy environments.

Therefore, the use of such machine learning and intelligent orchestration can make legacy systems behave as microservices. Additionally, predictive analytics also contributes from another aspect of AI i.e. allow banks to watch over transaction patterns as well as foretell performance bottlenecks on real time integrations.

According to Ezechi et al., AI models can also compliment customer experience through pre-emptively recognising lags and errors of systems, especially when legacy systems interface with new applications aimed at customers [9]. Intelligent middleware design for banking modernization consists of the combination of semantic (and anomaly) translations, predictive performance monitoring.

Cloud-Native Transformation

With banks moving to cloud native platforms, it has become paramount to be able to integrate the legacy systems keeping the regulation satisfied. However, cloud migration promises cost savings, real time data access, and enhanced cybersecurity, but it is difficult to attain what all the benefits of cloud migration implies without dealing with the conflicts between changeless and cloud systems [8].

Based on the argument of the success of cloud adoption in banking, Nawaz et al. write that successful adoption of cloud mandates middleware to facilitate secure translation of data as well as real time synchronization of legacy cores and cloud hosted front ends.

Such transformations continue to cause top concerns for security and compliance. As image 2 points out, Wang et al. identify cloud adoption as one of the most disruptive for banks, but only when banks have legacy systems and those do not have the necessary security mechanisms for the modern regulations. Middleware is needed to bridge the compliance gap and to ensure end-to-end encryption, data masking and access control, and to translate the communication protocols.

Kandepu suggests merging ECM tools such as IBM FileNet with core banking systems in order to manage compliance risk [1]. Since these tools then offer structured documentation, transaction recording and audit trail capabilities that are all necessary to issue for an internal or external audit, this definitely has been an improvement over the paper trail. The





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

support that middleware provides in supporting ECM integration allows banks to keep their legacy systems while at the same time meeting more modern regulatory standards.

With the application of business process management (BPM) tools, as is de Luzi [4], it supports the role of the BPM tools in navigation regulatory complexity. By adopting BPM frameworks, modernization initiatives receive standardized workflows and ensure that every step is conducted efficiently and in line with compliance. It is particularly important in jurisdictions with fast changing financial regulations.

Cloud migration is also an operational risk for banks downtime, vendor lockin, cross border data compliance to mention a few. Thus, middleware systems have to be designed to be applicable to multi cloud environments, and provide failover capability to legacy systems in case of outages or regulatory intervention.

Technologies in Banking

Legacy systems are being altered by the emergence of new technologies which determine how they fit into the future ready architecture. In particular, blockchain has the potential to improve the security of transactions, transparency, as well as the settlement efficiency. Cucculelli and Recanatini claim that DLT could decrease IT costs and facilitate both post trading processes [7].

Blockchain systems tend to operate degenerate of core banking platform and their integration into enterprise systems will need a middleware to handle distributed and traditional protocols. With this in mind, it needs that the middleware bridging between the legacy and the blockchain environment provide data integrity, timestamping and transaction traceability; critical features for compliance with regulations and operational audits.

Further, Kandepu considers ECM platforms as indispensable means for facilitating secure and auditable communication between legacy databases and contemporary blockchain systems [1]. Through blockchain, these platforms enable banks to have some control over document and process workflows, whilst distributing them to some degree.

With banks moving to a hybrid IT environment, so too is the need for cybersecurity. Due to its high attack surface area, digital transformation, particularly when involving legacy systems, is a very big issue, as George et al. caution [10]. As such, they call for a cybersecurity by design approach in which all of the system components, legacy, cloud Native and middleware would be secured through multi layered controls such as real time monitoring, automated threat detection and role-based access. However, the use of AI-enhanced intrusion detection can integrate into middleware solutions so they can identify unusual patterns in translated transaction data, providing a very important defense.

Nawaz et al. conclude that distributions of edge computing and AI enabled infrastructures that manage real time banking applications are only growing. [8] Middleware to perform the legacy to modern integration must be future proof so that it can be autonomous in the distributed computing environment by utilizing load balancing and latency prediction models based on AI in order to optimize system performance.

III. FINDINGS

Legacy System Constraints

The research found that legacy systems are still the backbone of banking institution's operating systems. Nevertheless, their inflexible architectures and based on ISO 8583 outdated protocol, it becomes increasingly difficult to be integrated with the modern cloud native and AI driven infrastructures [3]. Table 1 presents the figures by medium banks among surveyed banks, where 82% of banks pointed out the protocol translation and system interoperability as their main challenge of modernization. Moreover, 74% of firms also notify that outdated encryption methods still create a significant security vulnerability during integration phases [2].





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

Table 1: Bank Challenges

Challenge	Banks
Protocol Translation	82%
Security Vulnerabilities	74%
High Costs	68%
Downtime	59%
Regulatory Compliance	53%

We not only developed an analysis of transaction throughput, but also discovered that in general, legacy architectures only achieved 700 TPS while hybrid system leveraging hybrid cloud native APIs can get up to 2,400 TPS. These results are in line with previous literature, which implies the necessity of hybrid modernization approach by means of adaptive middleware layers that handle the old as well as the new transaction formats in parallel [5].



Among other things, poor documentation, siloed IT teams, and inability to work agilely all contributed to delaying modernization efforts [4].

Protocol Translation

Legacy system modernization is becoming enabled by the AI integration. The results show that machine learning models can offer significantly better performance than traditional complex rule engine that turns ISO 8583 messages into modern API format. Over 1 million transactions, the accuracy of AI based translators lay at 96.3% whereas the manually coded translators can only be 84.5%.

Labic 2. AL vo Manual	Table	2:	AI	vs	Manual
-----------------------	-------	----	----	----	--------

Approach	Translation Accuracy	Error Rate
AI-Based	96.3%	3.7%
Manual	84.5%	15.5%





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

In particular, reinforcement learning models had advantages in dynamic environments where real time transaction patterns generated dynamic environments. 92 percent precision in identifying the fraudulent or invalid protocol translations were learnt on the anomaly detection models trained on historical transaction data.



It is crucial that anomaly detection mechanisms be integrated in the middleware systems so transaction integrity can be achieved. The following is a minimal Python code snippet of how an anomaly detection model can be embedded within middleware translating ISO 8583 transactions:

```
import joblib
import pandas as pd
# Load trained anomaly detection model
model = joblib.load('anomaly_detector.pkl')
# Simulated transaction data
transaction_data = pd.DataFrame({
    'MTI': [1100, 1200, 1400, 1800],
    'Amount': [100, 9999999, 50, 700],
    'TransactionType': ['purchase', 'refund', 'balance_inquiry', 'withdrawal']
})
# Predict anomalies
predictions = model.predict(transaction_data)
# Flag and print anomalies
transaction_data['AnomalyFlag'] = predictions
print(transaction_data[transaction_data['AnomalyFlag'] == -1])
```





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

This base implementation would still allow middleware to filter and reject unwanted transaction formats before translation or processing, and to make transactions more secure while being compliant [10].



Regulatory Compliance

It also found that cloud-native migration strategies, when used in conjunction with AI driven middleware, had very positive effect on the operation. On average, banks using cloud-based middleware responded 35 percent faster when customers initiated a transaction on cloud-based middleware than on-premises legacy only systems.

Table 3:	Transaction	Response	Time

System Type	Response Time
On-Premises	550 ms
Hybrid	360 ms
Cloud-Native System	280 ms

During transition period financial institutions faced difficulty to ensure the consistency of encryption, data masking and audit trail logging around 65%. [2][4].

3D View of System Response Time



3D Plot: Response Time Trends







www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

Integration of the Enterprise Content Management (ECM) systems such as IBM FileNet will mitigate the many compliance risks (as Kandepu suggests [1]). Structured storage, retrieval and auditability of transaction records was possible in hybrid environments through ECM platforms. 95 percent of banks that had ECM integrated with their AI middleware passed regulatory audits as opposed to 76 percent for those without.

An additional layer of security audits indicated that block chain enabled transaction trails when directed to ECM platforms enhanced traceability and non-repudiation qualities that are crucial for the GDPR and PCI-DSS conformity [7].

Just as 48 percent of CIOs cited vendor lock-in as a risk related to multi-cloud architecture, the study observed that financial institutions supported with intelligent middleware could reduce or, at least, minimize that risk.

Emerging Trends

One more proclaiming tip refers to the part played by the blockchain and the edge computing in next generation banking systems. Despite early adoption, blockchain employed post trading and real time transaction checking have strong performance benefits in pilot projects.

According to comparative performance benchmarks, the mean time it takes for a blockchain-backed system to settle cross border transactions was 48 percent faster than SWIFT's average cross border settlement in the SWIFT arena [7]. Other than that, another notable trend was the integration of AI enhanced edge computing. Edge AI nodes deployed by banks to do local pre-validation of transactions stayed 29% lower during peaks the reduce core load.

These future proofed middleware designs need to also be modular so as not to force the expensive rewrites required for new fintech integrations to plug and play with new functionality.



Flowchart: Transaction Flow via Middleware

By means of predictive modeling, banks projected to adopt modular, AI augmented and blockchain aware middleware architectures were expected to save 14–19% of their operational costs in five years compared to those banks that would stick to legacy-centric infrastructure strategy.

The simple patchwork solution does not suffice in modernizing the legacy banking systems. The fundamental components of such a system is middlewares based on AI to support protocol translation, security monitoring and cloud native integration. Future of the banking resiliency, the scaling and the compliance is a combination of AI, blockchain, ECM, and edge computing.





www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405004|

Instead of the complete replacement by the gang offence that is fast coming in short order, the future path forward for banking institutions that have to contend with heavy regulatory scrutiny and increasing digital customer expectations, calls for modernization, strategically phased in, in support of intelligent automation.

IV. CONCLUSION

The proposed protocol translation middleware based on the AI/ML driven protocol translation middleware provides a secure and scalable solution to integrate the legacy banking systems with the modern cloud native platforms. The approach reduces the risk and cost associated with the wholesale system overhaul so that the financial institutions can modernize and innovate on the increment basis while maintaining continuous service delivery and regulatory compliance.

REFERENCES

- [1] Kandepu, R. (2023). Leveraging FileNet technology for enhanced efficiency and security in banking and insurance applications and its future with artificial intelligence (AI) and machine learning. International Journal of Advanced Research in Computer and Communication Engineering, 12(8), 20-26. https://doi.org/10.17148/ijarcce.2023.12803
- [2] Wang, S., Asif, M., Shahzad, M. F., & Ashfaq, M. (2024). Data privacy and cybersecurity challenges in the digital transformation of the banking sector. Computers & security, 147, 104051. https://doi.org/10.1016/j.cose.2024.104051
- [3] Ramachandran, K. (2021). ISO 8583 deep dive: Powering transaction tech. International Journal of Science and Research (IJSR), 10(1), 1639-1643. https://dx.doi.org/10.21275/SR24430153028
- [4] De Luzi, F. (2024). Digital transformation in a hyper-connected world. Transforming legacy systems through blockchains, IoT and AI. https://hdl.handle.net/11573/1734041
- [5] Kansal, S., & Siddharth, E. (2024). Adaptive AI Models for Automating Legacy System Migration in Enterprise Environments. International Journal of Research Radicals in Multidisciplinary Fields, ISSN, 679-694. https://www.researchgate.net/profile/Saurabh-Kansal/publication/389323022_Adaptive_AI_Models_for_Automating_Legacy_System_Migration_in_Enterprise _Environments/links/67be8f1696e7fb48b9cde48a/Adaptive-AI-Models-for-Automating-Legacy-System_ Migration-in-Enterprise-Environments.pdf
- [6] Abdellatif, M., Shatnawi, A., Mili, H., Moha, N., El Boussaidi, G., Hecht, G., ... & Guéhéneuc, Y. G. (2021). A taxonomy of service identification approaches for legacy software systems modernization. Journal of Systems and Software, 173, 110868. https://doi.org/10.1016/j.jss.2020.110868
- [7] Cucculelli, M., & Recanatini, M. (2022). Distributed Ledger technology systems in securities post-trading services. Evidence from European global systemic banks. The European Journal of Finance, 28(2), 195-218. https://doi.org/10.1080/1351847X.2021.1921002
- [8] Nawaz, H., Sethi, M. S., Nazir, S. S., & Jamil, U. (2024). Enhancing national cybersecurity and operational efficiency through legacy IT modernization and cloud migration: A US perspective. Journal of Computing & Biomedical Informatics, 7(02). https://www.jcbi.org/index.php/Main/article/view/536
- [9] Ezechi, O. N., Famoti, O., Ewim, C. P. M., Eloho, O., Muyiwa-Ajayi, T. P., Igwe, A. N., & Ibeh, A. I. (2025). Service quality improvement in the banking sector: A data analytics perspective. International Journal of Advanced Multidisciplinary Research and Studies. 2025a, 5(1), 958-971. https://doi.org/10.62225/2583049X.2025.5.1.3749
- [10] George, A. S., Baskar, T., & Srikaanth, P. B. (2024). Cyber threats to critical infrastructure: assessing vulnerabilities across key sectors. Partners Universal International Innovation Journal, 2(1), 51-75. https://doi.org/10.5281/zenodo.10639463









INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY





www.ijirset.com