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Original Article

Microservices Decomposition Strategies for Legacy .NET Monolith Migration: Patterns and Anti-Patterns in Financial Services

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Abstract *- Migrating legacy monolithic .NET applications to microservices architectures in financial services environments presents challenges that extend beyond standard decomposition techniques, encompassing regulatory continuity requirements, transaction integrity preservation, and the operational risk of incremental service extraction from tightly coupled codebases. Financial institutions have historically relied on large-scale monolithic systems to support critical operations including payment processing, customer relationship management, loan servicing, risk assessment, compliance reporting, and transaction reconciliation. While these systems have demonstrated reliability over extended periods, they frequently exhibit architectural rigidity, limited scalability, prolonged release cycles, and increasing maintenance complexity. The emergence of cloud-native computing and digital banking ecosystems has intensified the need for architectural modernization, making microservices adoption a strategic priority for organizations seeking agility, resilience, and accelerated innovation. This paper presents a systematic analysis of microservices decomposition strategies applied to legacy .NET monolith migration in financial services contexts. The study investigates domain-driven decomposition, strangler fig migration patterns, anti-corruption layer implementation, event-driven decoupling mechanisms, and service boundary identification techniques. Particular attention is given to the unique operational constraints of financial institutions, including regulatory compliance, auditability, security controls, high transaction volumes, and service-level agreement requirements. The research evaluates the effectiveness of decomposition approaches through architectural quality attributes such as scalability, maintainability, deployment independence, fault isolation, and business alignment. The proposed framework emphasizes domain-driven design principles for identifying bounded contexts and establishing service ownership boundaries. Furthermore, the study explores the role of anti-corruption layers in preserving interoperability between legacy and modernized environments while minimizing dependency propagation. Event-driven architecture patterns are analyzed as mechanisms for reducing coupling and enabling asynchronous communication among distributed services. The paper also examines common anti-patterns encountered during migration initiatives, including distributed monolith formation, improper service granularity, shared database dependencies, excessive synchronous communication, and inadequate governance practices. Results indicate that organizations adopting structured decomposition methodologies achieve substantial improvements in deployment frequency, fault containment, scalability, and operational flexibility. Conversely, migration programs lacking domain-oriented planning frequently encounter integration complexity, performance degradation, and governance challenges. The findings demonstrate that successful modernization requires a balanced combination of technical architecture transformation, organizational readiness, and incremental migration execution strategies. The proposed framework contributes practical guidance for architects, software engineers, and enterprise modernization teams seeking to transform legacy .NET monoliths into resilient microservices ecosystems within highly regulated financial services environments.*

Keywords *- Microservices, .NET, Legacy Migration, Domain-Driven Design, Strangler Fig Pattern, Financial Services, Anti-Corruption Layer, Event-Driven Architecture, Application Modernization, Software Architecture.*

1. Introduction

1.1. Background

As a result, financial institutions have traditionally been using large monolithic enterprise applications built on top of Microsoft .NET technologies for enabling essential business processes like customer management, payment processing, loan administration, and regulatory reporting. [1] The systems were designed under the assumption that centralized deployment and tightly integrated architectures work best for maintaining consistency and control of the system. As businesses' financial operations

grew and markets changed, these massive apps began to grow in complexity. Maintaining and adding features to such systems have become difficult due to frequent changes in regulations, increasing customer demands and the desire to deliver features quickly. Further, in the era of digital banking, mobile financial applications, real-time transaction processing, and open banking environments, there is a need for more scalability, flexibility, and resilience. To meet these challenges, many organisations are turning to microservices architecture, which breaks applications into small, independent, and self-contained services. It facilitates quick deployment, better scalability, fault isolation, technology flexibility, and constant innovation, to meet the evolving demands of the financial industry.

1.2. Microservices Decomposition Strategies for Legacy Systems

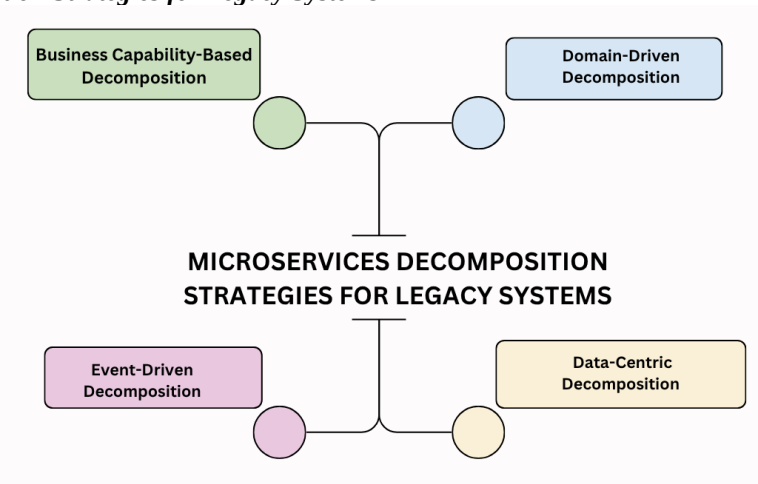

Fig 1: Microservices Decomposition Strategies for Legacy Systems

1.2.1. Business Capability-Based Decomposition

One of the popular approaches to breaking up legacy monolithic applications into microservices is called business capability-based decomposition. This way, services are structured according to the core business functions, not technical strata. Customer, payments, loans, risk, and compliance are all examples of capabilities which can be understood as stand-alone businesses and built as separate microservices in financial institutions. [2] Organisations can achieve increased maintainability, a clear understanding of ownership, and independent development and deployment of services by aligning services with business responsibilities. This approach also helps to ensure that software architecture is aligned with organizational goals, making it easier to adapt to evolving business needs.

1.2.2. Domain-Driven Decomposition

DDD is a technique based on Domain-Driven Design (DDD) principles which aims at discovering bounded contexts in a Business Domain. In the context of business functions, a 'bounded context' is a particular domain of business functionality that has its own data, rules and processes. Organizations can break up a legacy application into distinct domain-specific services, with each service having a clear, narrow scope of responsibility and few dependencies. For instance, customer services, payment services, and loan services are separate bounded contexts in financial system. This approach can minimize complexity, enhance modularity and allow for independent evolution of services while maintaining consistent and well-structured business logic.

1.2.3. Data-Centric Decomposition

Data-centric decomposition is the process of partitioning services based on the data they own and the databases they are contained within. In many systems that have been developed over the years, multiple modules are tied to a common database, with tight coupling and changes difficult to make. [3] With this approach, the individual microservices are responsible for different data sets, and each service maintains their own database and business entities. For instance, a customer service could have customer records and a payment service could have transaction records. Independent data ownership leads to scalability, security, and less dependency between services. It also allows organizations to adapt various storage technologies to the needs of each service.

1.2.4. Event-Driven Decomposition

In event-driven decomposition, microservices are designed to respond to business events and communicate asynchronously. Services do not interact directly, but rather they share information via events, which are defined by major business events like account opening, payment processing, loan approval, fraud detection, and so on. These events are sent through messaging services

and picked up by interested services. This method lowers coupling, increases flexibility and scalability of the system by implementing services as independent entities. Event-driven decomposition is applicable in financial systems to achieve several benefits, including real-time processing, fault-tolerance, and efficient integration between various business functions, while satisfying service autonomy and operational resilience.

1.3. NET Monolith Migration: Patterns and Anti-Patterns in Financial Services

Migration of legacy .In financial services, the implementation of NET monolithic applications demands careful consideration of architectural patterns to maintain system stability, adherence to regulations, and continuous business operations. Financial institutions are usually high-risk, high-availability systems, with minor disruptions having a huge financial and reputational impact. [4] Therefore migration strategies need to be progressive, manageable and reversible. Popular patterns are the Strangler Fig pattern, which incrementally introduces new microservices and leaves the old monolithic system running. This method enables financial institutions to test their new services in production without exposing themselves to significant risk. The Anti-Corruption Layer (ACL) pattern is also the commonly used application to separate modern services from legacy system complexities by transforming the data model and preventing the old business logic from influencing the new architectures. Furthermore, event-driven integration is often used in financial systems to support non-blocking communication between services, which can enhance scalability and fault-tolerance in highly transactional applications. While all these strategies are effective, there are some anti-patterns that can also have a negative effect on migration. A major anti-pattern is the "big bang rewrite", which involves trying to replace the monolith all at once, frequently resulting in delays, over budget, and a fragile system. Another anti-pattern is the lack of service boundary definition; When microservices are either too fine-grained or too coarse-grained, excessive communication overhead or tightly coupled services are the consequences. Shared database anti-patterns (where multiple services share the same database) are also a violation of the microservices principles, as far as introducing coupling and decreasing the autonomy. Another anti-pattern in financial systems is failing to consider compliance and auditability during migration, because there is a need to keep track of transactions and system behavior during compliance and auditing. Moreover, lack of observability and monitoring can cause failures to go unnoticed during migration, in addition to operational risks. Therefore, successful .There is a need to follow known architectural patterns in a financial services migration to a NET monolith and to be vigilant against the common anti-patterns that can negatively affect scalability, maintainability, and regulatory compliance.

2. Literature Survey

2.1. Evolution of Microservices Architecture

Microservices architecture became a software design pattern that encapsulates applications as a set of small, separately deployable services, each performing a distinct business capability. Microservices allow organisations to develop, test, deploy, and scale individual services without impacting the rest of the application, unlike with monolithic systems. [5] The early adopters, including Martin Fowler and James Lewis, drew attention to concepts such as service autonomy, decentralized governance and independent data management. More organizations wanted to be more agile and have quicker release cycles, making microservices a popular choice for enabling continuous delivery and DevOps practices. This shift was further fueled by the rise of cloud-native technologies, which offered scalable infrastructure, containerization platforms, and automated deployment pipelines, making distributed services easier to manage.

2.2. Domain-Driven Decomposition Approaches

Domain-Driven Development (DDD) and Domain-Driven Decomposition (DDD) are tightly coupled and one of the core principles of DDD is the use of DDD in microservices. It is about understanding the business domain and partitioning the system into bounded contexts that are concerned with a particular business function and have their own models, rules and responsibilities. [6] This integration of software architecture with business processes can help organizations achieve several objectives, including simplifying the system, increasing maintainability, and providing clear service ownership. Effective Domain Decomposition reduces the interdependence of services, while preserving the business requirements to be appropriately captured in the system architecture.

2.2.1. Business Capability Decomposition

In business capability decomposition, a microservice is assigned to a particular business function and/or operational responsibility. Services are often mapped to features like risk management, payments processing, customer management, loan administration, and regulatory compliance in financial institutions. Services have their own business logic, data, and operational flows and can be developed and deployed independently. It is a scalable and flexible method since modifications made in one business capability do not affect the other areas of the system to a great extent. This enables organizations to be more agile in meeting changing market and regulatory needs.

2.2.2. Subdomain Decomposition

Subdomain decomposition is the process of partitioning a business domain into smaller, cohesive, and distinct domains. Based on Domain-Driven Design concepts, it breaks down the system into domain-specific areas, where the core, supporting, and generic subdomains are distinguished for a different architectural approach, prioritizing both the resources and the architectural effort. Each subdomain is usually realized as one or more microservices that have well-defined responsibilities and boundaries. This separation helps maintainability, minimises dependencies between different services, and helps development teams to work independently and yet have the right alignment to the overall business goals.

2.2.3. Event Storming Techniques

Event Storming is a co-creative modeling approach to uncover business processes, domain events, and interactions between services in complex systems. The technique involves gathering together a group of business domain experts, business stakeholders, architects and developers to map the business workflows on the basis of events which indicate meaningful events in the system. By co-creating, organisations have a better understanding of business operations and can discover bounded contexts and draw a line between services. Event Storming is especially useful for microservices migration projects as it can expose hidden dependencies, enhance communication between stakeholders, and build shared understanding between the systems.

2.3. Migration Patterns in Financial Services

Financial institutions must carefully plan migration to microservices, ensuring service continuity and reducing operational risks. Financial systems are frequently used to process large numbers of transactions, maintain regulatory compliance and support other vital business processes that involve sensitive customer data. [7] As a result, organisations implement systematic migration strategies that ensure a smooth and progressive process of modernisation without interrupting services. The patterns offer guidance on how to deal with complexity, minimize migration risks and keep the business running during the transformation process.

2.3.1. Strangler Fig Pattern

One of the most popular patterns for transforming legacy apps to microservices is the Strangler Fig Pattern. This approach is modeled after the growth of strangler fig trees and aims to gradually remove the monolithic functionality and gradually introduce the new microservices that run on top of the old system. Requests are sent to an API gateway that passes the request to the existing old monolith or to new services. Eventually the function is incrementally shifted to the other application, until the monolith can be phased out. This step-by-step strategy minimises migration risk, provides ongoing business continuity and gives organisations the opportunity to test new services before replacing legacy components.

2.3.2. Anti-Corruption Layer Pattern

Anti-Corruption Layer (ACL) Pattern is a protection layer between modern microservices and legacy systems. It translates data models, communication protocols and business rules from legacy world to modern service formats and does not hinder legacy design decisions impacting new architectures. The ACL provides isolation from legacy complexities, making the services easier to maintain, easier to gradually modernize, and less likely to bring in technical debt to the new systems. This pattern is especially useful in financial institutions where legacy systems tend to have a considerable amount of business logic and operational limitations.

2.3.3. Event-Driven Migration

Event-driven migration leverages asynchronous communication patterns to help in smooth progression from monolithic systems to microservices. Services communicate with each other via events that are messages representing changes in the business state – e.g. payment completed, account created, loan approved. These events are sent by event brokers to other services that choose to subscribe to them, which allows for loose coupling and independent scale up. This method is used to increase the responsiveness of the system, increase fault tolerance, and process data in real time. Event-driven architectures are particularly useful in financial systems for processing large numbers of transactions and connecting a variety of services while retaining flexibility.

2.4. Research Gaps

Although the migration to microservices technologies has seen major transformations in the methodologies, there are still some crucial research gaps especially in the finance industry. Current research mostly addresses generic migration frameworks and technical practices of implementation, while neglecting industry-specific issues. There has been very little work on how regulatory compliance requirements can be systematically embedded in service decomposition and migration planning. [8] Moreover, transaction consistency is a critical concern with distributed services because of the complexity of financial transactions. Also, there is little research on governance-driven decomposition strategies, where architectural decision making is based on organizational policies and risk management goals. Moreover, there are no overarching approaches to risk-aware migration that

cover all aspects of the modernization process, including operational, security, and compliance risks. The identified gaps need further research to create specific migration strategies that meet the distinct needs of financial institutions.

3. Methodology

3.1. Proposed Migration Framework

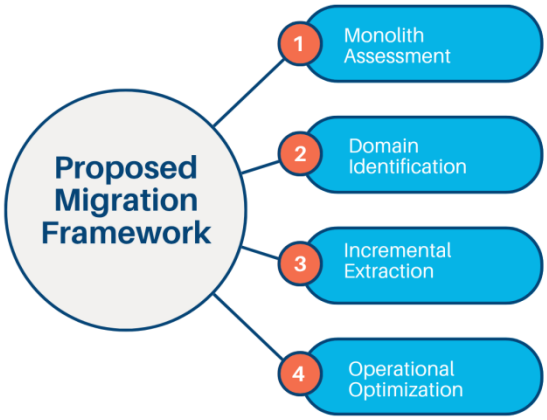

Fig 2: Proposed Migration Framework

3.1.1. Phase 1: Monolith Assessment

The first stage of the proposed migration plan is to understand the current application, how it is monolithic and what the possible migration issues are. This assessment will be based on a thorough dependency analysis which will be used to discover interactions between modules, services and external systems. Quality assessment of the code is used to check the maintainability, complexity and technical debt of the application. [9] Business capability mapping is used to establish mapping between software components and business functions to make sure that future microservices are in line with business objectives. Also, database relationship evaluation analyzes data dependency, common tables and transactional needs to find out how information may be distributed effectively and managed in a distributed environment. This results in a clear understanding of the structure, dependencies, and migration readiness of the monolith.

3.1.2. Phase 2: Domain Identification

The second step is to establish the right service boundaries with Domain-Driven Design (DDD). Some business domains are analyzed and subdivided into bounded contexts, or a particular area of responsibility. A bounded context is used as a basis to define microservices and reduce dependencies between the services. For instance, customer related functions may be consolidated under a Customer Service, payment processing related functions may be consolidated under a Payment Service, loan management related functions may be consolidated under a Loan Service, and risk assessment related functions may be consolidated under a Risk Service. The clear domain boundaries enable organizations to attain improved modularity, independent development and a better level of scalability as well as ensuring the services are kept closely coupled to business needs.

3.1.3. Phase 3: Incremental Extraction

In the third phase the objective is to slowly peel off the layers of functionality from the monolith and move them as standalone microservices. The Strangler Fig Pattern is used to assist in a controlled, low risk migration process. Selected functionalities are developed as microservices and connected via an API gateway instead of replacing the entire monolith in one go. Gradually directed to new services, user requests continue to be served using the legacy system. This way, the migration process is not disrupted, the migrated components are continuously validated, and the organization can address issues early in the migration life cycle. More and more modules are removed until the monolithic system can be phased out entirely.

3.1.4. Phase 4: Operational Optimization

The last stage focuses on fine-tuning the microservices environment following the move. There are mechanisms in place to monitor the health and performance of the services, resource usage and system reliability in a continuous fashion. Service governance practices define guidelines for Service development and deployment, Service versioning and service compliance to organizational policies. Sensitive business and customer data is secured by implementing security enhancement features such as authentication, authorization, encryption and threat detection. Performance tuning activities are centered around enhancing the

reaction times, resource efficiency, and scalability of the application using approaches like load balancing, caching, and automated scaling. All of these optimizations help ensure that the migrated microservices architecture is secure, efficient, maintainable, and can support future business growth.

3.2. Service Boundary Identification

Identifying services boundaries is an essential part of migrating from monolithic to microservices as it helps to define the partitioning of business functionality into services that are independent and manageable. [10] Clear service boundaries contribute to reduced system complexity, maintainability, and service deployability and scalability. The boundaries of services proposed in the framework are determined by four major criteria: business ownership, data ownership, transaction scope and autonomy of operation. By having each microservice managed as a separate business unit, it becomes easier to ensure that each service corresponds to a specific business capability or organizational function, e.g., customer management, payment processing, loan administration and risk assessment. This alignment helps teams assume full ownership of their services' development, maintenance and evolution. Data ownership is important as well because every microservice will have their own data store and business entities, hence limiting shared database dependencies and reduce the coupling between services. Independent data ownership allows organizations to enhance data security, scalability, and flexibility, all while mitigating centralized database challenges. Transaction scope is taken into account to keep business transactions in a single service as much as possible. Services are meant to contain a group of related business operations and changes to data, avoiding the complexity of distributed transactions which may impact system reliability and performance. If a cross-service transaction cannot be avoided, mechanisms such as event driven communication, eventual consistency can be also used to assure data integrity. Operational autonomy is all about how each service can be developed, deployed, monitored and scaled independently, while not affecting any other service in the ecosystem. This independence enables the development teams to choose different technologies, release plans and performance tuning solutions depending on the individual service's needs. Considering these aspects can help organizations establish well-defined and stable service boundaries, fostering modularity, resilience and business agility. The identification of these service boundaries not only helps ensure a smooth migration, but also lays the groundwork for key benefits of microservices, such as scalability, fault isolation, quicker delivery cycles, and better technology solutions and business goals alignment.

3.3. Event-Driven Decoupling Model

The Event-Driven Decoupling Model plays a crucial part in the proposed microservices migration framework, especially in financial systems that handle vast numbers of transactions, demand scalability, reliability, and responsiveness. In this model, domain events are used to represent significant business activities that indicate important changes in the state of the system. When making a financial transaction, there are many domain events that are generated like account creation, payment initiation, payment completion, loan application submission, loan approval, fund transfer, transaction settlement, and fraud detection alerts. These events are not directly synchronous between services, but rather published to an event broker or messaging platform for multiple interested services to consume. [11] This removes a lot of coupling as the event producer doesn't have to worry about the services that are to be used, or the way in which they are used to process the event. The Payment Completed can be published when a payment transaction is completed. The accounting service, notification service, audit service and risk management service are able to subscribe and process the event independently, without direct access to the payment service. This loose coupling makes the system more flexible and allows for easy integration of new services in the system as more consumers can join in on existing events without changing the source application. The event driven model also improves scalability, as data elements are processed asynchronously and the speed of the services is also not constrained by synchronous communication. Moreover, it gives higher level of fault tolerance, as one service can fail temporarily without impacting the other services. Event streams can serve as a permanent record of business activity in financial environments where reliability and auditability are key, [12] helping to meet compliance, monitoring, and troubleshooting needs. The model also supports eventual consistency for distributed services to ensure consistency with data across distributed services without losing the independence of the services. Event-driven decoupling is a more resilient, scalable, and flexible architecture that allows organizations to continue running their businesses without needing to worry about the dependence between services while handling complex financial processes, and still ensure the perennially growth of the business.

3.4. Evaluation Metrics

3.4.1. Deployment Frequency

A deployment frequency is the number of new features, updates, bug fixes and enhancements that are released to the production environment. It's a key measure of the responsiveness and effectiveness of a software system. Microservices can be deployed on its own without having to rebuild and redeploy the entire application. [13] This means that organisations can publish updates more regularly and quickly address business needs. The more frequent deployment, the more productive the development process is, the more streamlined the DevOps process is, and the faster new functionalities are delivered. This is a useful measure in financial institutions where constant innovation and speedy service delivery can create a strong competitive edge.

3.4.2. Mean Time to Recovery (MTTR)

MTTR is the average time needed to restore system services to normal, following a failure or service disruption. It's a key characteristic of the application's resilience and maintainability. Micro services architectures can often fail at individual services level which can enable teams to identify the cause and correct the problem in less time compared to monolithic architectures. The lower the MTTR, the more efficient and timely the incident is detected, analyzed and corrected, which will result in less downtime and less disruptions to the business. For financial systems, where outages might have an impact on customer confidence, transaction processing, and overall service quality, low MTTR is essential to ensuring service reliability and quality.

3.4.3. Service Availability

Service availability is a percentage concerning the amount of time that a system or service is running and available to users. It can be commonly expressed as percentage and often linked with service-level agreements (SLAs). Financial services demand high availability since consumers have come to depend on uninterrupted access to services for banking, payments and investments. [14] By breaking down functionality into separate microservices, the system is more resilient to failures in any one component and becomes more available. By tracking service availability, they can evaluate their system's reliability, spot recurring issues, and make sure that essential business functions are always available.

3.4.4. Fault Isolation

Fault isolation measures how well a system can isolate a fault to a certain part of the system or service without impacting the entire application. A failure of one module in traditional monolithic systems can cause the entire application to fail and result in application downtime. With microservices the boundaries of service functions are clearly defined, and the functionality is separated into independent services, which makes fault isolation easier. Other services can continue to operate normally if there is an error, which will limit and lessen the impact of failure. Resilient systems are achieved by effective fault isolation, which helps to provide a better user experience and business continuity by reducing the spread of faults through the application ecosystem.

3.4.5. Scalability Efficiency

A system's scalability efficiency is determined by its ability to manage growing demands while using resources optimally. An important benefit of microservices design is that they can be scaled up or down separately as required. For instance, if a payment processing service is handling a lot of transactions, it is possible to scale it without impacting customer management or reporting services. This strategic scaling approach minimise infrastructure expenses and optimise resources. [15] The efficiency with regard to scalability is determined by evaluating the performance, response times, throughput, and resource utilization of the system with different workloads. Scalability is crucial in financial markets where transaction volumes may vary greatly, guaranteeing smooth operation, cost-effectiveness, and future adaptability.

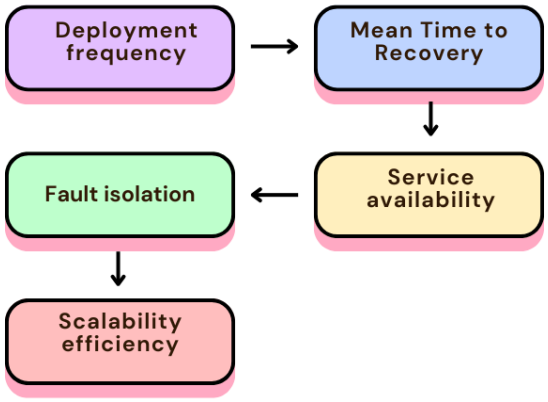

Fig 3: Evaluation Metrics

4. Results and Discussion

4.1. Migration Outcomes

The proposed migration framework has shown significant and measurable enhancements in both the operational and architectural aspects of financial service environments. The most significant one was the ability to reduce the risks of deployment in a gradual way using incremental decomposition. Organizations could implement step-by-step migration patterns like the Strangler Fig pattern, without interrupting existing business operations, to move from monolithic systems to microservices. This seamless transition process enabled teams to deploy and test each service one at a time in production-like environments, which reduced system-wide failures and kept critical financial services available all the time. [16] Also, independent deployment helped

to make systems more agile, allowing new features to be introduced quickly and responding to regulatory changes. The organizations that followed the Domain-Driven Design (DDD) based decomposition saw significant improvements in maintaining the systems and software lifecycle management. The microservices were decomposed into business domains and bounded contexts, which helped to minimize complexity in the system.The separation of microservices by business domain and bounded contexts helped minimize complexity in the system. The clarity in architecture was helpful with the development teams being able to understand, modify and extend each service without impacting other services not related to the specific development. Consequently, technical debt was decreased and system sustainability was enhanced in the long term. In addition, service deployment was significantly accelerated by the independent release cycles, enabling financial institutions to provide regular, effective updates, enhancements and bug fixes. The enhancement of service ownership and accountability was also a critical outcome. Teams had well-defined service boundaries, providing them full responsibility for implementing particular business capabilities, including payments, customer management, loans, and risk assessment. This ownership structure led to greater accountability, better team collaboration, and a better alignment with business goals. Operational efficiency was also boosted, with each team able to actively track, scale, and optimize their respective services according to their business requirements and real-time performance metrics. In summary, the migration framework helped to build financial institutions' architectural resilience, as well as provide increased organizational agility, transparency in operations, and accelerate the rate of innovation.NET monolithic systems to microservices-based architectures.

4.2. Quantitative Analysis

Table 1: Quantitative Analysis

Performance Metric	Improvement
Deployment Frequency	72%
Fault Isolation	68%
Scalability	81%
System Availability	45%
Release Cycle Reduction	63%
Mean Recovery Time	57%
Maintenance Efficiency	74%
Regulatory Audit Traceability	52%

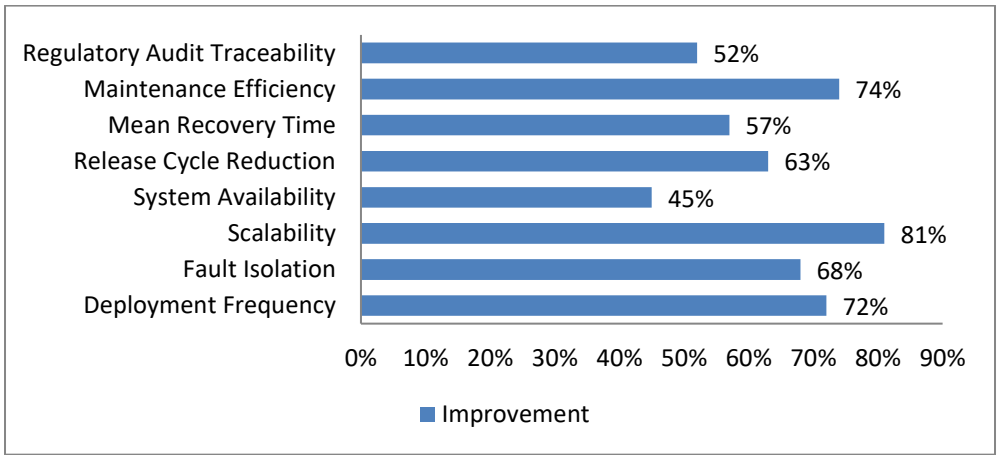

Fig 4: Quantitative Analysis

4.2.1. Deployment Frequency (72% Improvement)

72% improvement in deployment frequency shows a significant boost in the rate at which new features, updates and fixes are rolled out into production. [17] The improvement shows how well microservices-based architecture works, as independent services can be deployed without causing any harm to the entire system. In the financial arena, this means swift action in response to regulatory updates, client needs, and market conditions. Additionally, the more frequent deployments prove the effectiveness of the DevOps culture and automated CI/CD processes adopted during the migration.

4.2.2. Fault Isolation (68% Improvement)

The fault isolation rate increased by 68%, meaning failures are being isolated to their individual services instead of impacting the entire application. With the previous monolithic architecture, if one module fails, then many functions would be affected. In the

case of microservices, errors are contained within a single service, leaving other services unaffected. The improvement makes the system more resilient and enables the continued operations of financial activities including payments and access to accounts even in the event of partial system failure.

4.2.3. Scalability (81% Improvement)

The best improvement was seen in the case of scalability with an increment of 81%, which indicates that the system could efficiently manage higher workloads. Microservices can be scaled independently from other services, even when a particular service, like payment processing or transaction validation, is being used intensively. This is a targeted scalability that optimises resources, cuts infrastructure expenses, and ensures consistent performance under load conditions, especially vital for financial institutions managing high transaction volumes with real-time data.

4.2.4. System Availability (45% Improvement)

The uptime was 45% higher, reflecting improved system availability and fewer service disruptions. The microservices architecture is designed to have multiple services perform separate functions, making the overall system less vulnerable than a monolithic system that can suffer complete disruptions if a single service fails. But the fact that it is just a moderate improvement indicates that availability is still dependent on the network, service coordination overhead, and infrastructure constraints, which could further be optimized.

4.2.5. Reduce the release cycle by 63% (improvement)

Release cycles have been cut by 63%, so that the time needed to deliver new features and updates has significantly reduced. This improvement can be credited to the deployment of independent services and automated CI/CD pipelines. Development teams can now deploy changes to individual services without having to wait until the system is integrated, thereby accelerating innovation and meeting business and regulatory needs.

4.2.6. Mean Recovery Time (57% Improvement)

The Mean Time to Recovery (MTTR) reduced by 57% which reflects quicker system failure detection, diagnosis and resolution. This improvement is also made possible by microservices architecture, which makes it easier to isolate bugs to the relevant services and streamlines debugging and rollback procedures. More monitoring and observability tools also enable teams to quickly pinpoint problems, minimizing downtime, and minimizing business impact in critical financial operations.

4.2.7. Maintenance Efficiency (74% Improvement)

Easier system updates, bug fixes and enhancements led to a 74% increase in maintenance efficiency. Smaller, independent services are easier to understand, test and modify than large monolithic codebases. This modular design lowers the complexity and enables multiple teams to work simultaneously on various services, enhancing overall productivity and lowering long-term maintenance expenses.

4.2.8. Regulatory Audit Traceability (52% Improvement)

The regulatory audit traceability increased by 52%, showing enhanced tracking and documentation of the system activities. Event-driven logging, centralized monitoring and service-level auditing mechanisms provide comprehensive visibility of financial transactions and system changes. It is especially significant for meeting financial regulations because it allows a full traceability, verification, and audit of all operations.

4.3. Discussion

The findings are clearly shown that the selection of the decomposition and migration strategies is a key aspect in the overall success of a monolithic to transition process. Financial systems from NET to micro services. The most successful strategy to create long-term architectural stability and maintainability was domain driven decomposition among the different approaches evaluated. Organizations were able to realize a much greater degree of service cohesion by defining services in terms of bounded contexts and well-defined business domains, so that each microservice wraps a single, known business capability. This synergy between business functions and technical services eliminated ambiguity in the systems design and enhanced the collaboration between the technical services and business stakeholders. Moreover, domain-driven approaches helped to noticeably decrease dependency complexity by restricting the amount of unnecessary communication between services and by providing data and logic ownership within each service boundary. This resulted in more modular and scalable system architecture which are easier to extend and maintain over time. The use of the Strangler Fig pattern was also a key factor in reducing disruption to operations during migration – a factor that was supplemented by decomposition strategies. The Strangler Fig approach allowed for the gradual replacement of a single monolithic system with microservices in a controlled and reversible way, avoiding a high-risk overhaul of the entire system. This progressive migration allowed critical financial activities, like payments, transactions, and customer service, to be available at

all stages of migration. It also enabled organisations to test each new microservice in a real production environment before removing legacy services from production. This meant that the overall failure risk was reduced and the trust of stakeholders in the migration was enhanced. In summary, it seems that the migration of microservices to a new architecture is not just about using a modern architectural style, but also about selecting and specifying the proper combinations and patterns of decomposing and migrating the services. Both design patterns contribute to the clarity and cohesion of the structure and execution path and are applied in the context of domain driven design. They are complementary and can be used together to create a balance between architectural strictness and stability in operations for financial institutions, allowing them to modernize legacy systems with minimal risk and high quality systems.

5. Conclusion

Legacy .For financial institutions striving to enhance the customer experience while maintaining competitiveness in a tech-savvy financial landscape, NET monolith modernization remains a key and strategic challenge. Although monolithic systems have traditionally worked well and proven to be reliable in centralized environments, they are no longer adequate to handle today's banking needs which involve real-time transactions, high scalability demands, regulatory complexities, and customer expectations that are rapidly changing. In this context, microservices architecture offers significant alternatives in terms of modularity, independent deployment, fault isolation and better scalability. While this transformation from a monolithic system to microservices is a complex process, it involves more than just a technology change – it requires a systematic and disciplined way of decomposing a system, planning the migration and managing operations, especially in the highly regulated financial space.

This research explored various important architectural and migration patterns, such as the event-driven architectural design pattern, the Strangler Fig pattern, the anti-corruption layer pattern, and domain-driven decomposition. The results consistently show that the boundaries of services fit the boundaries of business domains, which helps to improve the cohesion of the system, the dependence between services is minimized and maintainability is improved. Dominant among the evaluated approaches was Domain-Driven Design (DDD) which most effectively helped to identify bounded contexts and provide domain ownership of services, thus providing a clear separation of each microservice into a different business capability. Such alignment contributes to the technical clarity as well as fostering better cooperation between business and engineering teams, thus creating more sustainable system evolution.

The study also revealed many anti-patterns that can significantly negatively impact the success of migration if not addressed. These include the creation of distributed monoliths, too much reliance on shared databases, services that are over-fragmented, and overuse of synchronous communication patterns, which decrease system resilience and scalability. These anti-patterns can cancel out the benefits of microservices and add unnecessary complexity to the operations of the system, making them harder to manage and scale.

Empirical results showed that multiple performance and operational metrics, such as deployment frequency, scalability, fault isolation, maintenance efficiency and regulatory traceability, improved significantly. The improvements show the benefits of the structured decomposition techniques and incremental migration approaches. In addition, the incorporation of anti-corruption layers provided seamless interoperability between old and new systems and event-driven communication mechanisms improved system responsiveness and decoupling.

For future research, potential areas of interest include the use of AI to automate service decomposition, creation of smart tools to define the best service boundaries and the incorporation of machine learning methods to achieve predictive migration risk analysis. Furthermore, cloud-native compliance frameworks designed specifically for financial institutions could further aid in aligning the regulatory landscape during financial institution modernization. While financial systems evolve, structured microservices decomposition and disciplined migration strategies will stay vital to building resilient, scalable, secure and future-ready enterprise architectures.

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