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Enterprise Architecture Design for the Transformation of Online Financial Services

Bayu Yasa Wedha[1)*], Michael Sagar Vasandani[2)], Alessandro Enriqco Putra Bayu Wedha[3)]
[1)]Prodi Informatika, Fakultas Teknologi Komunikasi dan Informatika, Universitas Nasional, Jakarta, Indonesia
[2)]University of California San Diego
[3)]Prodi Informatika, Universitas Pradita, Tangerang, Indonesia
[1)]bayu.yasa.wedha@civitas.unas.ac.id [2)]mvasandani@ucsd.edu, [3)]alessandro@ichthus.xyz

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Abstract: In the ever-expanding digital era, online financial services have emerged as a significant component of the global financial ecosystem. Digital transformation has altered the operations and consumer interactions of financial services companies. By implementing Enterprise Architecture design, financial services companies can adapt, flourish, and compete in an increasingly competitive environment. This article examines the essential function of Enterprise Architecture in the evolution of online financial services. We explore how Enterprise Architecture provides a strategic framework for driving change and innovation in financial organizations. We examine the primary elements of an Enterprise Architecture, such as the business model, technology infrastructure, and data. Then, we investigate how Enterprise Architecture improves operational efficiency and decreases risk in digital financial services. In addition, the significance of security and conformance in Enterprise Architecture for online financial services is examined. Enterprise Architecture is crucial in integrating security solutions and ensuring regulatory compliance in light of rising cybersecurity threats, strict regulatory compliance, and consumer demands for data privacy. We discuss how Enterprise Architecture facilitates improved consumer experiences in online financial services. By designing solutions with the consumer in mind, businesses can meet customer expectations, increase customer retention, and build a sustainable market share. Enterprise Architecture has become an indispensable instrument for successfully transforming online financial services. Through strategic planning, technology integration, data management, and a focus on security and customer experience, financial institutions can meet the challenges and seize the opportunities presented by the digital era**.**

Keywords: Business Model; Digital Transformation; Enterprise Architecture**;** Technology Infrastructure; Strategic Planning, Technology Integration; Data Management;

INTRODUCTION

The financial services industry has undergone fundamental specifications due to the rapid expansion of information and communication technologies. Online financial services such as digital banking, online investments, and electronic payments are central to this transformation. In an era where consumers increasingly value convenience, speed, and accessibility, online financial services are becoming a defining element of the industry's future. However, providing efficient and secure online financial services requires a solid enterprise architecture. Today, artificial intelligence (AI) (Balsano et

*name of corresponding author

al., 2023), (Lukić et al., 2023), (Wang & Li, 2023) technology has become an integral element of online financial services companies' operations. In this context, artificial intelligence employs machine learning and deep learning techniques to optimize various business aspects. One of the most prominent methods is deep understanding, which employs algorithms such as Convolutional Neural Networks (CNN) (Hindarto & Santoso, 2021) and Multi-layer Perceptron (MLP) to address complex problems. CNN has been utilized for image analysis and pattern recognition, which can be used for document verification, digital signature verification, and risk management. By analyzing suspicious transaction patterns, CNNs (Hindarto & Santoso, 2022) are also helpful for identifying fraud. On the other hand, multi-layer Perceptron (Hindarto & Djajadi, 2023) is utilized for more general data analysis, including the prediction of consumer behavior, sentiment analysis, and investment portfolio optimization. MLP enables more in-depth data processing and accurate modeling for improved decision-making. By utilizing deep learning, online financial services providers can increase operational efficiency, enhance customer service, and more rapidly identify risks. Additionally, AI can provide valuable insights to make wiser strategic decisions in today's highly dynamic financial world.

The financial services industry has dramatically transitioned from conventional business models to a digital ecosystem. Customers no longer need to visit a bank branch or fill out paper forms to conduct financial transactions; everything can be accessed and completed swiftly via mobile device or computer. Nevertheless, this transformation poses several challenges that must be addressed with discretion. The technological complexity of online financial services includes artificial intelligence, blockchain, big data analytics, and cybersecurity, among others. Integrating these technologies into an effective and consistent architecture takes time and effort. Security: The sophistication of cyber threats to personal financial data and transactions is increasing. The protection of customer data is a high priority. The financial services industry is subject to numerous regulatory and statutory requirements that are subject to change. The enterprise architecture must accommodate these regulatory changes to maintain creativity. Customer Experience: While technology enables more efficient financial services, customer experience remains crucial in customer retention and acquisition.

The primary issue in this context is how to design an enterprise architecture that facilitates the transformation of online financial services. This architecture must address complex technical and non-technical concerns like data security, system interconnection, scalability, and regulatory compliance. The author hypothesizes that online financial services can surmount their challenges by designing and implementing the appropriate enterprise architecture and undergoing a successful transformation. Our hypothesis is: "A well-planned Enterprise Architecture design will improve efficiency, security, and customer experience in online financial services while enabling companies to comply with regulations and adapt to market changes."

To verify this hypothesis and design an effective enterprise architecture, we must consider the following essential solutions:

1. The architecture should be modular, allowing system components to be updated or replaced relatively quickly. This facilitates scalability and adaptability despite rapid business and technological expansion.
2. Implementing cutting-edge technologies, such as artificial intelligence and extensive data analysis, will enhance the ability to analyze consumer data and predict their behavior.
3. Data security and consumer privacy must be of the utmost importance. The latest cybersecurity solutions must be incorporated throughout the architecture to protect sensitive data.
4. Compliance with regulations: The architecture must be designed to accommodate regulatory changes without requiring significant updates. This enables businesses to comply with ever-changing laws and regulations.
5. Focus on Customer Experience: The interaction with customers should be the focal point of architecture design. Services must be user-friendly, responsive, and beneficial to consumers.

By designing an enterprise architecture that considers the solutions mentioned above, online financial services can surmount the challenges of the digital transformation era. This architectural design is not only concerned with technology but also with the creation of an environment that promotes business scalability and consumer satisfaction. In subsequent chapters, we will investigate the architectural design's specifics and verify our hypotheses through case studies and in-depth analysis.

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In an era of dynamic digital transformation, this study aims to investigate how to design enterprise architecture that facilitates the integration of cutting-edge technologies, such as artificial intelligence and extensive data analysis, to alter the landscape of online financial services. Along with that, the following is the research question for this research.

How can an enterprise architecture be designed to facilitate incorporating big data analysis technology in transforming online financial services? (first research topic)

How can online financial services implement a modular enterprise architecture design that prioritizes operational efficiency, competitiveness, and customer satisfaction? (second research topic)

LITERATURE REVIEW

The literature review "Enterprise Architecture Design for Transforming Online Financial Services" emphasizes the need for a solid architecture to support digital financial services transformation. Previous study has stressed the need for well-planned strategies to accommodate technical developments and changing client expectations in online financial services.

Digital disruption in telecom is indicated by a 75% drop in text and voice services. A BPM-based customer-centric IoT model is investigated to adapt. The report predicts telecom success and IoT collaboration to avoid bankruptcy (Dachyar et al., 2020). In the era of rapid e-commerce growth, organizations are turning to Enterprise Service Bus (ESB) to streamline and improve service delivery. This study analyzes Enterprise Service Bus (ESB) within the context of Service-Oriented Architecture (SOA) and service models to improve business performance in a dynamic environment (Bhadoria et al., 2017). IT systems that support business operations are crucial to Industry 4.0 and intelligent manufacturing. This study highlights the significance of aligning an organization's IT architecture with its business objectives and strategies. By integrating the TOGAF architectural development method and the IEC 62264 standard for manufacturing operations management (Oberle et al., 2023). This research combines group decision making (GDM), cooperative artificial neural networks (CNN), multi-agents, and service-oriented architecture (SOA) with data warehousing in order to develop a multiple criteria-based decision making (MCDM) method for supply chain financial cooperative systems company. This study has three primary components and illustrates the effectiveness of the MCDM method with the example of the shoe manufacturing industry (Liu, 2009). This study proposes a framework-based method for designing architectural transformation strategies, emphasizing modernizing obsolete enterprise systems. This strategy prioritizes business value, practical IT support, and quicker application launch times. Logistics transportation management case studies successfully implemented in several significant corporations (Yu & Madiraju, 2014). Rapid technological advancements motivate businesses to contend for business profits. The Enterprise Architecture Planning Method is one of the adopted strategies for planning and enhancing information technology strategies using Value Chain analysis (Riku & Setyohadi, 2017).

METHOD

Financial Industry

The financial industry (Jitmaneeroj, 2023), (Zheng et al., 2023) is an economic sector related to financial management, investment, and fund intermediation. It consists of various institutions and corporations that manage and allocate financial resources for individuals and business entities. In the financial industry, banks, non-bank financial institutions, insurance companies, and investment management firms play a crucial role in providing various financial products and services. This includes lending, investing, risk management, and investment management to attain financial objectives. Financial markets, where financial instruments such as stocks, bonds, and derivatives are transacted, are also part of the financial industry. To protect consumer interests and preserve the financial system's stability, regulation and compliance with government regulations are also essential components of the financial sector. The emergence of fintech and digital financial services that facilitate more accessible and innovative access to financial products and services has also altered the financial industry's landscape. The financial industry (Chrysafis et al., 2024) plays a crucial role in the economy, facilitating economic growth, investment, and risk management. Constant changes and innovations in the industry affect how we manage our personal, business, and investment finances; therefore, it is essential to comprehend the most recent financial industry developments to make sound financial decisions.

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Enterprise Service Bus

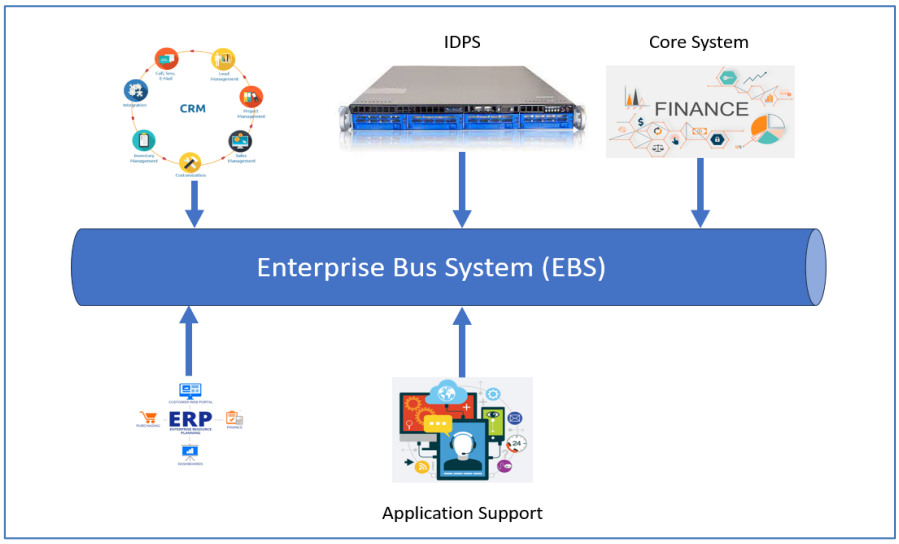

Fig. 1 Enterprise Service Bus (ESB)
Source: Researcher Property

Fig. 1, The Enterprise Service Bus (ESB) is a conceptual framework and technological solution employed within enterprise software architecture to streamline communication and integration across diverse applications and systems inside a business. The Enterprise Service Bus (ESB) is an intermediary component that facilitates standardized and efficient communication between various applications. One of the primary features of the Enterprise Service Bus (ESB) is its capacity to facilitate the integration of applications that employ diverse protocols and data formats. ESB enables enterprises to achieve application integration, even when the apps have been developed using disparate technologies or by separate vendors. The Enterprise Service Bus (ESB) facilitates the translation and transformation of data to ensure that the data transmitted between applications adheres to the predetermined format. In addition to its core functionality, the Enterprise Service Bus (ESB) offers various supplementary services, including message routing, monitoring, security, and management. This enables enterprises to enhance their control and management of data flow throughout their infrastructure. The Enterprise Service Bus (ESB) can also facilitate the implementation of intricate integration patterns, like publish-subscribe and request-response.

In addition to its role in application integration, the Enterprise Service Bus (ESB) can also serve as a facilitator for deploying service-oriented architecture (SOA). Within the context of a Service-Oriented Architecture (SOA) framework, the constituent elements of applications and services are decomposed into reusable components with seamless integration capability. The Enterprise Service Bus (ESB) is an intermediary facilitating seamless communication and interaction between various services. One primary benefit of utilizing a corporate Service Bus (ESB) is the enhancement of flexibility and responsiveness inside corporate systems. Implementing a standardized intermediary layer enables businesses to seamlessly include or substitute apps without disrupting the current infrastructure. Moreover, the utilization of an Enterprise Service Bus (ESB) can facilitate the expeditious creation of novel applications through the facilitation of service reuse.

Nonetheless, the successful implementation of an Enterprise Service Bus (ESB) necessitates substantial investments in hardware, software, and skilled personnel. Furthermore, meticulous strategic planning and meticulous design are essential to guarantee that the enterprise service bus (ESB) can fulfill the company's intricate integration and communication requirements. The Enterprise Service Bus (ESB) is an essential element within contemporary enterprise architectures, facilitating the integration of applications, enhancing organizational flexibility, and optimizing data flow within intricate contexts.

The Open Group Architecture Framework

The Open Group Architecture Framework (TOGAF) is a widely adopted architectural framework used to design, develop, and manage enterprise architecture. The TOGAF framework (Hindarto, 2023) is widely adopted by businesses globally and is recognized as a prominent architectural framework. The

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objective is to assist enterprises in enhancing their architectural management and transformation processes, encompassing small-scale and large-scale initiatives. The TOGAF framework offers complete methodologies and guidance to support architectural professionals in the strategic planning and execution of information, business, and technological architecture. The architecture life cycle in TOGAF encompasses four primary stages: architecture development, architecture implementation, architecture use, and architecture change management. Organizations benefit from the ability to develop designs that align with their business requirements, incorporate appropriate technology, and effectively oversee the management of these architectures in the long run.

TOGAF offers a range of tools and techniques that architectural practitioners can utilize. These include an architectural management framework known as the Architecture Governance Framework, a modeling approach referred to as the Architecture Development Method (ADM), and practical guidance for effectively integrating architecture with pre-existing business processes. This facilitates the attainment of an organization's strategic vision through efficient and effective means. The framework incorporates various interconnected architectural levels, namely business architecture, application architecture, data architecture, and technology architecture. This enables firms to comprehend the interconnections among different architecture components and guarantee coherence throughout the enterprise. Furthermore, TOGAF promotes the implementation of effective architectural management methodologies, encompassing the diligent monitoring and evaluation of architectural performance and the necessary adjustments to the architecture in response to shifts within the business and technological landscape. This facilitates organizational adaptability and enables them to optimize the advantages derived from their architectural framework.

RESULT

The findings from the analysis research on the installation of the Enterprise Service Bus (ESB) have yielded significant insights that have substantial implications for operational efficiency and decision-making processes inside an organization. The successful integration of the Enterprise Service Bus has enabled enterprises to establish a technologically advanced infrastructure that facilitates seamless collaboration among diverse systems and applications. This phenomenon leads to a decrease in integration obstacles among distinct systems and thus yields a more seamless flow of data. One such discovery entailed a significant enhancement in operational efficiency. Implementing an Enterprise Service Bus (ESB) (Bhadoria et al., 2017) facilitates expedited and precise data interchange among diverse departments and units within a company. The automation of business processes leads to a reduction in labor-intensive and error-prone manual tasks. As a result, there has been a notable rise in productivity and substantial reductions in costs.

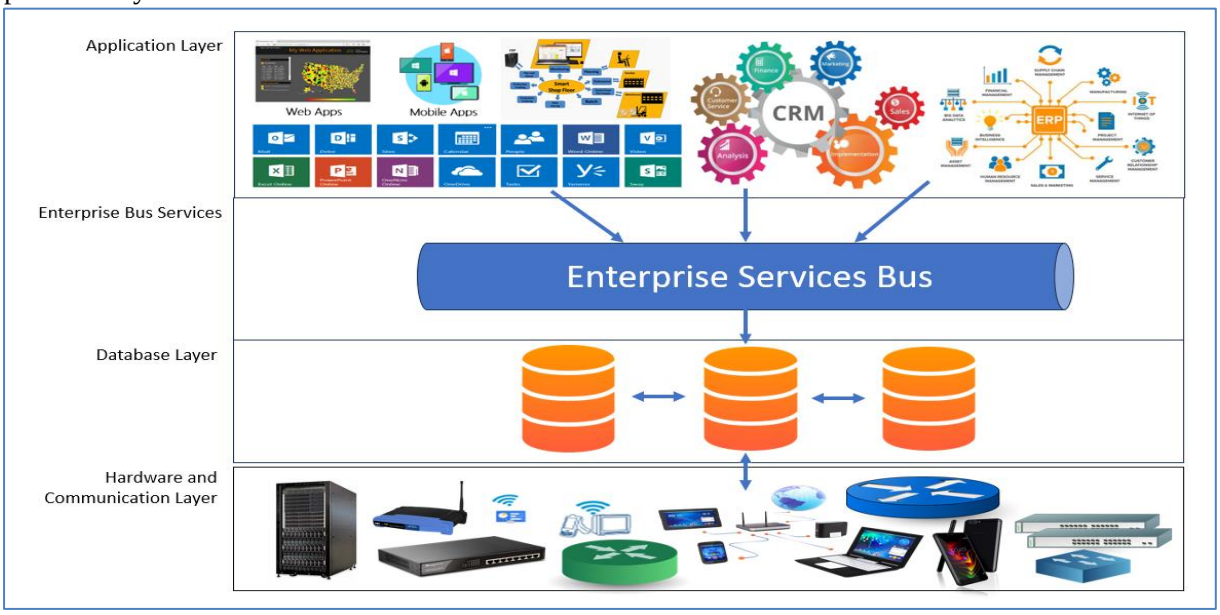

Fig. 2. Enterprise Architecture + Enterprise Service Bus
Source: Modified from Google Image

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Fig.2, Enterprise Architecture + Enterprise Service Bus, Enterprise Architecture (Kotusev et al., 2023) is a strategic method for designing, administering, and integrating all facets of an organization's information technology. The primary objective is establishing a solid structure that enables organizations to accomplish their business objectives more efficiently and effectively. Technology, data, business, and application architecture are some components of Enterprise Architecture (Hindarto et al., 2021) (EA). The Enterprise Service Bus (Bhadoria et al., 2018) is an essential component of Enterprise Architecture. ESB is a software infrastructure used within an organization to integrate disparate systems and applications. It connects applications operating in various environments, including web applications, service-oriented architecture (SOA), and legacy systems.

ESB provides various fundamental services required in system integration, including message exchange capabilities, data transformation, monitoring, and business process management. This allows organizations to achieve greater interoperability between disparate systems, reduce redundancy, improve operational efficiency, and increase their receptivity to business changes. The ESB serves as a message exchange center where applications can send and receive messages in agreed-upon formats. ESB is also capable of adapting the message format to the requirements of the recipient system. ESB also offers effective message management, monitoring, automatic retransmission, and error management. ESB is one of the critical components of Enterprise Architecture that facilitates a comprehensive data and application integration strategy. By utilizing ESB, businesses can maximize their investments in existing systems and technologies while reducing more adaptable business growth and change. In other words, ESB assists organizations in realizing their Enterprise Architecture vision by connecting and integrating all extant information technology components into a unified framework to accomplish their business objectives.

Enterprise Architecture and Enterprise Service Bus are complementary components for managing the complexity of an organization's modern information technology infrastructure. EA contributes to the organization's development of a long-term strategic perspective. This includes designing a technology architecture that ensures the IT infrastructure supports business objectives, improves efficiency, and enables rapid change adaptation. EA encompasses a variety of domains, including data architecture, application architecture, business architecture, and technology architecture. EA provides a framework that specifies how various systems and applications should interact within the context of integration. This is where ESB enters the picture. The ESB is the essential infrastructure for implementing the EA-defined integration strategy. By providing various integration services, such as message exchange, data transformation, and business process management, ESB enables disparate applications throughout an organization to communicate and operate in unison. ESB minimizes isolated "island systems" frequently occurring in large-scale, complex IT environments.

One of the primary benefits of combining EA and ESB is the ability to attain flexibility and improve business change response. EA provides a strategic perspective on an organization's direction, whereas ESB offers the infrastructure and tools required to implement these changes. When organizations face obstacles such as business growth, the addition of new applications, or the integration of external business partners, the combination of EA and ESB enables implementing these changes in a structured and efficient fashion. EA and ESB are crucial components of effective and sustainable information technology management. EA assists organizations in developing a distinct long-term vision of how information technology can support business objectives. At the same time, ESB provides the tools required to integrate disparate applications and systems into a coherent whole. By combining the two, organizations can achieve greater efficiency, adaptability, and responsiveness to change, which are crucial for business success in the constantly evolving digital age.

DISCUSSIONS

How can an enterprise architecture be designed to facilitate incorporating big data analysis technology in transforming online financial services? (First research topic)

The company's architecture has been designed to contemplate integrating extensive data analysis technologies as an integral part of the transformation of online financial services. The primary components of the architecture in this plan are:

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a. a distributed database system,
b. a scalable cloud computing infrastructure, and
c. sophisticated data analysis tools that support large-scale data processing.

This extensive data analytics technology integration allows companies to capture, store, and analyze customer and market data in real-time.

In this architecture, a distributed database system has been implemented to manage large data volumes efficiently. The system enables horizontally scalable data storage, allowing businesses to store data as customers and transactions grow. It also facilitates rapid access to both historical and real-time data. Second, cloud computing infrastructure improves data processing infrastructure and scalability. By utilizing cloud infrastructure, businesses can allocate computing resources based on their requirements, whether for providing data, training artificial intelligence models, or executing data analysis. This permits companies to optimize performance and reduce operational expenses. This architecture has also been equipped with sophisticated data analysis tools. This includes a data analysis platform that recognizes patterns, trends, and crucial insights in customer and market data. This tool allows businesses to conduct predictive analysis to comprehend consumer behavior, identify new business opportunities, and develop more effective marketing strategies.

In addition, this architecture includes a robust security layer to safeguard customer data and ensure compliance with applicable privacy regulations. This architecture incorporates real-time security monitoring, data encryption, and robust security protocols. To enhance the consumer experience, the system architecture also includes an intuitive and responsive user interface. This enables consumers to conveniently access their financial data, conduct transactions, and manage their accounts from multiple devices. Overall, the company's architecture is designed to facilitate the incorporation of big data analytics technology as a critical driver in the transformation of online financial services. With this strategy, companies can provide more personalized, accurate, and efficient service to their consumers while adhering to the financial industry's stringent security and regulatory requirements.

How can online financial services implement a modular enterprise architecture design that prioritizes operational efficiency, competitiveness, and customer satisfaction? (Second research topic)
The online financial services industry is one of the most impacted by digital transformation. Online financial services companies must design a modular enterprise architecture to remain relevant and competitive in this ever-changing environment. In this approach, the enterprise architecture is segmented into modules capable of operating independently but are still interconnected via clearly defined interfaces. This modular design aims to increase operational efficiency, competitiveness, and customer satisfaction.

First and foremost, a thorough comprehension of business and consumer requirements is essential. Companies must comprehensively understand the financial services they provide, their target market, and customer preferences and expectations. This will aid in the design of the most pertinent and efficient modules. Each module in the architecture should have responsibilities such as account management, transaction processing, risk analysis, and customer management. Implementing lucid interface standards and documentation is necessary to ensure seamless interoperability between modules. The adaptability of technologies such as containerization and cloud computing enable businesses to rapidly adapt and update their modules, which is essential for remaining competitive. In addition, each module must comply with applicable financial services industry regulations and laws. Data security and auditability must be integral to the design of the module. The architecture should also include performance measurement and data analysis to monitor operational efficiency and identify improvement areas. A key aspect of modular design should also focus on the consumer experience. Every module should incorporate a user-friendly interface, responsive customer service, and individualized service. Lastly, it is advisable to iterate and update this modular design continuously. Architecture must adapt to the constantly changing business and technological environment.

By implementing a modular enterprise architecture design that considers all the factors mentioned above, online financial services can improve operational efficiency, increase development flexibility, and improve customer experiences and personalization. This is what is required to maintain relevance in this swiftly transforming industry.

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CONCLUSION

In the fast-paced digital age, online financial services must change. This study examines enterprise architectural design for this transformation. Online financial assistance must have a robust business architecture to stay competitive in a changing industry. Business goals, strategy, and technological and customer needs must guide company architecture. This research emphasizes integrating the Enterprise Service Bus into enterprise design. Multiple services from different application domains can interact smoothly with Enterprise Service Bus, ensuring safe and effective client service. Enterprise Service Bus lets ambient observations connect with the system, providing context parameters for enhanced decision-making. Enterprise architecture change is a means to more significant business goals, not an end goal. Enterprise architecture must support business strategy and market and technological changes. Online financial services organizations can stay competitive, give value to customers, and adapt to a fast-changing business environment with exemplary architecture.

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