DESIGNING A MICROSERVICES BASED ENTERPRISE ARCHITECTURE USING TOGAF 10: A CASE STUDY APPROACH

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Abstract— *PT Umbara Karya Sejati, operating in the home living and industrial product sectors, faced significant digital transformation challenges, marked by inefficiencies due to system integration issues and vendor dependencies that incurred cost penalties of 10-15% each month. Addressing these challenges, this research developed an Enterprise Architecture using TOGAF 10's Microservices Architecture (MSA) from the Preliminary Phase to Phase F: Migration Planning. This approach aimed to enhance system integration and operational efficiency, thereby improving modularity and scalability while reducing reliance on external vendors. A pivotal component of this architecture, an API gateway, provided robust monitoring capabilities for integration processes, enabling quick identification and prioritization of critical issues, which will assist the internal IT team's workflow. Furthermore, the research planned the establishment of a DevOps team, incorporating Agile methodologies, and scheduled IT governance and data security training to prepare for future policy development and strengthen internal controls. This strategic design equips the organization to navigate the volatility, uncertainty, complexity, and ambiguity (VUCA) of market demands with agile and effective responses, projecting a 10% increase in both operational and cost efficiency for PT Umbara Karya Sejati.*

Keywords: *design, enterprise architecture (EA), microservices, TOGAF 10.*

Intisari— *PT Umbara Karya Sejati, yang beroperasi di sektor produk rumah tangga dan industri, menghadapi tantangan transformasi digital yang signifikan, ditandai dengan ketidakefisienan akibat masalah integrasi sistem dan ketergantungan pada vendor yang menyebabkan kerugian biaya sebesar 10-15% setiap bulan. Menanggapi tantangan ini, penelitian ini mengembangkan Arsitektur Enterprise menggunakan Arsitektur Microservices TOGAF 10 (MSA) dari Fase Awal hingga Fase F: Perencanaan Migrasi. Pendekatan ini bertujuan untuk meningkatkan integrasi sistem dan efisiensi operasional, dengan demikian meningkatkan modularitas dan skalabilitas sekaligus mengurangi ketergantungan pada vendor eksternal. Komponen kritis dari arsitektur ini, sebuah gateway API, menyediakan kemampuan pemantauan yang kuat untuk proses integrasi, memungkinkan identifikasi dan prioritas masalah kritis dengan cepat, yang akan membantu proses kerja tim IT internal. Lebih lanjut, penelitian ini merencanakan pembentukan tim DevOps, menggabungkan metodologi Agile, dan menjadwalkan pelatihan tata kelola IT dan keamanan data untuk mempersiapkan pengembangan kebijakan di masa depan dan memperkuat kontrol internal. Perancangan strategis ini memperlengkapi organisasi untuk menavigasi volatilitas, ketidakpastian, kompleksitas, dan ambiguitas (VUCA) permintaan pasar dengan respons yang gesit dan efektif, memproyeksikan peningkatan efisiensi operasional dan penghematan biaya sebesar 10% untuk PT Umbara Karya Sejati.*

Kata Kunci: *perancangan, arsitektur enterprise, microservices, TOGAF 10.*

INTRODUCTION

The urgency of digital transformation in the e-commerce sector is driven by evolving market demands and technological advancements, creating substantial operational and integration challenges. PT Umbara Karya Sejati, with operations in the home living and industrial sectors, faces significant inefficiencies and financial burdens due to system

integration issues and vendor dependencies, resulting in monthly cost penalties of 10-15%. These challenges require an innovative enterprise architecture to streamline operations and reduce costs.

While existing literature extensively covers the benefits of enterprise architecture frameworks like TOGAF and the advantages of microservices in improving system flexibility and scalability, there is a noticeable gap in research focused on their combined application within the dynamic environment of e-commerce. Studies such as Irufaan et al. (2021) and Puspita et al. (2023) explore the effectiveness of microservices in specific contexts but do not address their integration under the TOGAF framework to tackle the unique challenges faced by e-commerce entities like PT Umbara Karya Sejati. This research seeks to bridge this gap by demonstrating how TOGAF's structured approach can be harmoniously integrated with microservices to enhance system integration and operational efficiency in a complex e-commerce setting (Puspita et al., 2023).

This research introduces a novel application of TOGAF 10's Microservices Architecture (MSA) to develop an enterprise architecture from the Preliminary Phase to Phase F: Migration Planning, specifically tailored to the e-commerce industry's volatile and complex environment(The Open Group, 2022). Unlike prior applications that predominantly focus on static enterprise settings, this study leverages TOGAF 10 MSA to create a flexible, scalable, and robust architecture capable of addressing real-time integration and scalability challenges posed by PT Umbara Karya Sejati's distributed and diverse IT infrastructure (Srivastava, 2021).

The proposed approach is supported by the findings of similar research endeavors that have successfully employed TOGAF and microservices in different contexts. For instance, the research by Irufaan et al. (2021) demonstrated the cost-efficiency and resource optimization benefits of microservices for SMEs, providing a foundation for their application in larger, more complex systems like those at PT Umbara Karya Sejati, Similarly, (Puspita et al., 2023) employed TOGAF to design a microservices architecture for government procurement, highlighting its efficacy in improving data processing and system responsiveness.

This research combines TOGAF's enterprise architecture with microservices to improve operational efficiency and system integration at PT Umbara Karya Sejati, aiming to reduce operational costs and vendor dependency by 10%. This approach meets the company's needs and sets a standard for adaptive enterprise architecture in e-commerce, supporting digital transformation goals.

MATERIALS AND METHODS

This study utilizes an exploratory research design to develop an Enterprise Architecture using TOGAF 10's Microservices Architecture (MSA) for PT Umbara Karya Sejati. This design integrates qualitative methods to assess the impact of the MSA and its derivatives on the operational processes within the company. The TOGAF ADM is employed through phases A to F to systematically analyze and design solutions that enhance the integration of systems from pre-sales to sales (order management) (Liliana & Andry, 2024). Additionally, this approach examines the broader impacts of implementing MSA across various aspects of the organization's value chain, including Build, Acquire and Implement; Program and Project Management; Asset Management; Deliver, Service, and Support; and Adjustment, Planning, and Human Resource Management.

Information is collected directly from PT Umbara Karya Sejati's employees involved in the architecture's implementation and daily operations. Informants include supply chain managers, IT staff, and users actively engaged in the operational value chain. Documentation such as Standard Operating Procedures (SOPs), Key Performance Indicators (KPIs), and policy documents supporting the value chain are reviewed to provide a background and supplement the primary data.

Observers focus on specific domains within the value chain and extend their scope to five additional aspects crucial for a comprehensive enterprise architecture evaluation (Hasibuan et al., 2023). These areas include Build, Acquire and Implement; Program and Project Management; Asset Management; Deliver, Service, and Support; and Adjustment, Planning, and Human Resource Management. Observations are documented through detailed notes.

Structured interviews are conducted with the selected personnel mentioned above. These sessions aim to gather insights into the practical challenges and benefits perceived during the MSA implementation (Hasibuan et al., 2023). Each session focuses on understanding the workflows, challenges, and efficiencies introduced by the new system architecture.

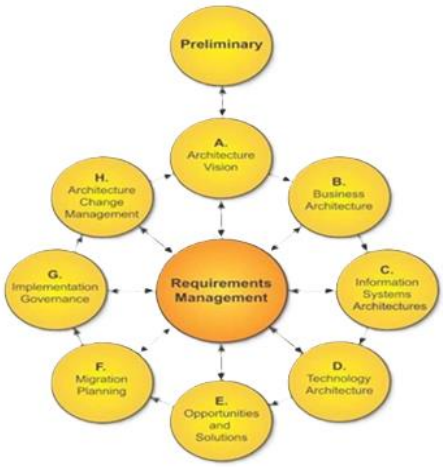
Extensive reviews of current academic and industry literature on TOGAF and microservices architectures ensure the research is grounded in robust theoretical frameworks and reflects recent advances in enterprise architecture.

All observational and interview data are systematically recorded in written form (Panjaitan et al., 2023). Detailed notes are taken during each interview and observation session, and all

documentation is securely stored and organized for easy access during the analysis phase.

The collected data are qualitatively analyzed to identify key themes and patterns that emerge from the observations and interviews (Bentalha & Alla, 2024). The analysis focuses on how the implementation of the MSA and its derivatives impacts the operational processes and overall system efficiency at PT Umbara Karya Sejati. Simple descriptive methods are employed to synthesize findings from the secondary data, providing a clear understanding of the current state and potential improvements.

The six phases used are depicted in the image below:



Source: (The Open Group, 2022)

Figure 1. Stages of the TOGAF Framework

The methods used include Phase A, B, C, D, E, and finally F, which encompass defining the architecture vision, optimizing business processes, designing information system integration, developing supporting technology, identifying solutions to bridge current gaps, and planning the migration process.

RESULTS AND DISCUSSION

1. *Preliminary Phase*

a. Identification of 5W + 1H

The enterprise architecture project at PT. Umbara Karya Sejati aims to enhance operational efficiency and data security using a microservices approach, applying the TOGAF (MSA) ADM framework with Agile methodology. The project is planned for April to September 2024 and will be implemented at the company's headquarters.

b. Rich Picture

Table 1. Rich Picture Activities of PT. Umbara Karya Sejati

Activities	Code	Duration (days)
Inventory Planning & Supplier Coordination	A1	5
Purchasing	A2	3
Warehouse Operations (Receiving Goods)	A3	4
Logistic Allocation	A4	2
E-Commerce Platform Optimization & Integration	A5	7
Live Streaming Content Planning & Scheduling	A6	5
Live Streaming Execution	A7	2
Order Processing & Logistics Coordination	A8	4
Monitoring Logistic & Delivery	A9	3

Source: (Research Results, 2024)

Dependencies Between Activities:

- A1 → A2 → A3 → A4
- A1 → A5 → A6 → A7
- A7 → A8 → A9

Table 1 presents the core activities at PT. Umbara Karya Sejati, from A1 to A9. A1 involves forecasting product needs, followed by A2, where procurement is managed accordingly. A3 deals with receiving goods, and A4 focuses on logistics allocation. A5 ensures sales channels are optimized, while A6 and A7 cover the planning and execution of live streaming. A8 facilitates order processing and logistics coordination, with A9 ensuring efficient monitoring and delivery. These activities, managed through systems like Upfos CRM/OMS, Yonyou ERP, and TTX WMS, are interconnected to streamline logistics, live streaming, and order management processes

Discussion of Results:

In the Preliminary Phase, PT Umbara Karya Sejati used TOGAF 10's Microservices Architecture (MSA) to tackle critical integration problems and reduce reliance on external vendors, which had previously led to inefficiencies. This phase established a governance framework to prepare for the transition to a scalable microservices-based system.

Comparison with Theory and Previous Research:

This approach aligns with the TOGAF® MSA guidelines, which advocate for a structured readiness assessment and governance planning at the outset of architectural transformation(TOGAF® Series Guide MSA). Similar to the findings in "Proposing a Microservices Architecture for AMEL Information System"(Puspita et al., 2023), this phase set the groundwork for modular and flexible system architecture, essential for adapting to the dynamic demands of the e-commerce market.

*2. **Requirement Management***

Table 2. Solution Concepts for Activities at PT. Umbara Karya Sejati

No	Issues	Activity Solutions
1	System integration issues between e-commerce platforms, ERP, and CRM	Development of a microservices-based middleware to monitor all integrations, data flows, and transactions.
2	Issues in coordination and communication among teams, particularly in live streaming and decision management	Integration of the Dingtalk application with the CRM/OMS system and e-commerce platform through microservices, automating information and approvals, also using an Agile approach.
3	Errors and delays in delivery due to a poorly integrated logistics system	Implementation of a seamless communication integration solution between the CRM/OMS and WMS systems, using a microservices architecture.
4	Lack of effective data security and management standards	Implementation of comprehensive data security policies, using a microservices-based architecture.
5	Overlap and challenges in network monitoring	Implementation of a centralized network monitoring system based on microservices, enabling efficient and secure network management and monitoring.
6	Dependence on external vendors and errors in IT implementation	Implementation of a robust IT governance framework to ensure that adopted technologies align with business strategies, reducing dependence on vendors.

Source: (Research Results, 2024)

In table 2 above, explains the concept of solutions based on the activity issues that exist at PT. Umbara Karya Sejati. In the table, PT. Umbara Karya Sejati has activity issues, namely in the integration and automation system, lack of coordination and communication, inefficient logistics and delivery, lack of standardization for data security, lack of network infrastructure management, and has not adopted the governance framework.

Table 3. Information System Solution Concepts

No	Issues	Activity Solutions
1	The current manual queuing system creates bottlenecks and errors, disrupting operational workflows.	Implementation of a service mesh, load balancing, with API management integration between services, and real-time logging features.
2	Lack of integration between various platforms and applications results in data duplication and errors.	Development of a microservices-based architecture that facilitates efficient integration and data management across systems.
3	The current archiving system is not integrated, making document access and management difficult.	Development of an integrated electronic document management system, ensuring secure document access, easy retrieval, and data backup.
4	Barriers in internal communication affect coordination between departments.	Integration of the Dingtalk communication system with microservices architecture.
5	Lack of visibility into operational performance and business outcomes.	Implementation of an analytics dashboard that integrates big data and machine learning in real-time.
6	Current data security measures are insufficient to protect the company's sensitive information.	Implementation of encryption technology and layered security protocols.

Source: (Research Results, 2024)

In the table 3, the researcher provides a solution concept to PT. Umbara Karya Sejati in the form of an Information System (IS) concept that can help resolve issues regarding PT. Umbara Karya Sejati's Information System activities.

Discussion of Results:

The Requirement Management phase at PT Umbara Karya Sejati identified and documented key requirements for integrating three ERP systems: Upfos, TTX, and Yonyou. This phase aimed to improve system integration, resolve communication failures between systems, and reduce dependency on external vendors to avoid additional costs and inefficiencies.

Comparison with Theory and Previous Research:

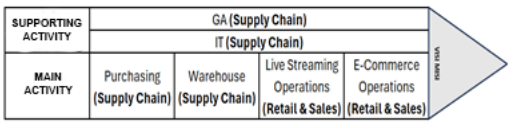
The structured approach used in this phase aligns with TOGAF's MSA principles, which emphasize the importance of clearly defining requirements to ensure that the architecture supports both current and future business goals (TOGAF® Series Guide MSA…). Similar strategies were observed in the study on the AMEL Information System, where TOGAF-ADM was used to redefine system requirements to enhance data processing and system integration(Puspita et al., 2023). This alignment with established practices underlines the efficacy of the TOGAF framework in handling integration complexities in a volatile, uncertain, complex, and ambiguous (VUCA) operational environment, similar to those discussed by (Irufaan et al., 2021).

3. ***Phase A: Architecture Vision***

The vision of PT. Umbara Karya Sejati is "To deliver innovative and sustainable home living and industrial solutions, by strengthening technology and operational integration to enhance long-term business quality and efficiency".

The mission of PT. Umbara Karya Sejati is 1) To provide high-quality Home Living and industrial products that meet market needs. 2) To implement an integrated omnichannel solution, leveraging technological advancements to enhance customer experience and operational efficiency. 3) To apply a sustainable live streaming strategy to optimize customer interaction and increase sales. 4) To ensure operational excellence through proper, transparent, and accountable governance and management, supporting stable and sustainable growth.

a. *Analisis Value Chain*

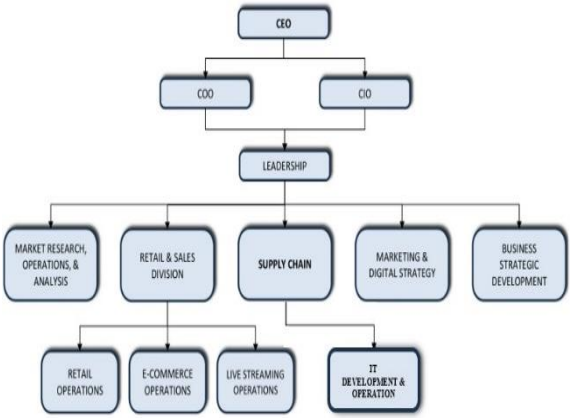


Source: (Research Results, 2024)

Figure 2. Value Chain Analysis of PT. Umbara Karya Sejati

The image above explains the supporting activities owned by PT. Umbara Karya Sejati, namely in GA (General Affair) Supply Chain and IT Division. The main activities owned are in the Purchasing Division, Warehouse Division, Live Streaming Operations Division, and E-Commerce Operations Division. On the right side of the image there is an arrow that says Value Chain which shows that all of these activities, both supporting and primary, play a role in creating value for the company.

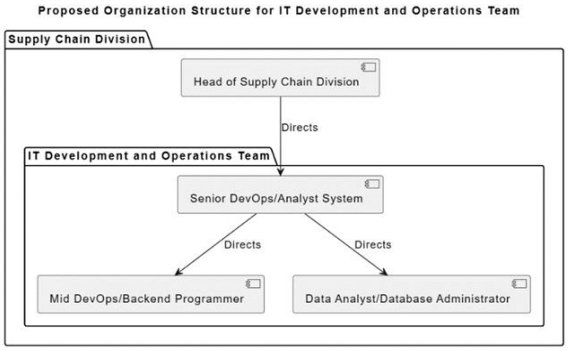
b. Proposed Organizational Structure



Source: (Research Results, 2024)

Figure 3. Proposed Organizational Structure

The image above shows that the proposed additional organizational structure of PT. Umbara Karya Sejati, namely the IT Development and Operations Division at PT. Umbara Karya Sejati is designed to improve operational efficiency and support the implementation of the latest technology. This structure is in accordance with the company's needs in implementing Agile methodology and microservices architecture, and adds a strong focus on project management to ensure the successful implementation of technology solutions effectively and efficiently.



Source: (Research Results, 2024)

Figure 4. Detailed Proposed Organizational Structure

The image above is a detailed structure of the proposed additional organizational structure. In the IT Development and Operations Division at PT. Umbara Karya Sejati is headed by a Head of Supply Chain Division who is directly responsible to the IT Development and Operations Team. The IT Development and Operations Team is led by a Senior DevOps/System Analyst whose members are Mid DevOps Backend Programmer and Data Analyst/Database Administrator.

Discussion of Results:

In Phase A, the architecture vision for PT Umbara Karya Sejati aimed to integrate ERP,

CRM/OMS, and WMS with e-commerce platforms to resolve inefficiencies and reduce costs. The focus was also on establishing a DevOps team and training program to support Agile methodologies, ensuring better collaboration and faster response to market changes. This vision helped create a roadmap for improved operational efficiency and adaptability.

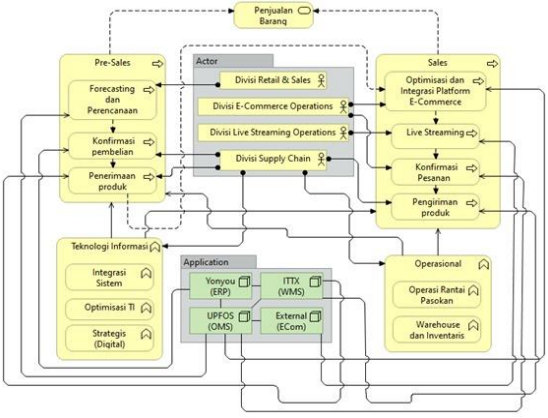
Comparison with Theory and Previous Research:

The strategic approach in Phase A aligns with the TOGAF MSA guide's recommendations for establishing a robust enterprise architecture that supports distributed applications efficiently (The Open Group, 2022). This alignment is reflected in the adoption of microservices, which enhance modularity and improve system scalability and responsiveness. Similar strategies were noted in "Microservice dynamic resource provision for small and medium-sized enterprises," which discusses the advantages of microservices in improving operational efficiency and reducing technical debt in an SME context (Irufaan et al., 2021)

Furthermore, the introduction of a structured DevOps team as part of the architectural vision is supported by the benefits described in the TOGAF MSA guide, which suggests that such integrative structures facilitate faster deployment cycles and improve system reliability and scalability. The proposed training and adoption of Agile methodologies are designed to enhance the organization's responsiveness to change, a key trait for maintaining competitiveness in dynamic environments(Andi et al., 2024).

4. ***Phase B: Business Architecture***

The business architecture at PT. Umbara Karya Sejati structures its services, processes, and functions to enhance efficiency and adaptability, supporting rapid response to market and technological shifts.

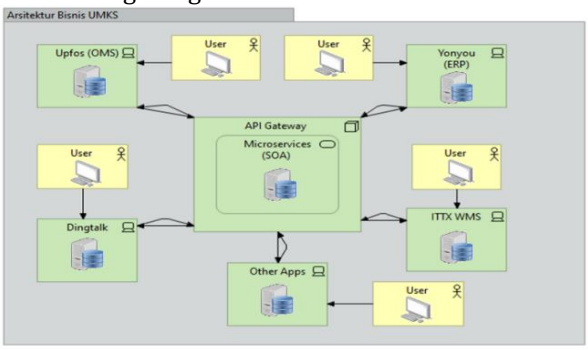


Source: (Research Results, 2024)

Figure 5. Tree Diagram of Service, Process, and Business Function Mapping

a. Business Architecture Design

The business architecture diagram shows the integration of key systems to optimize operations. The API Gateway connects Upfos (OMS), Yonyou (ERP), Dingtalk, and ITTX WMS, using a microservices architecture for flexibility. Upfos manages orders, Yonyou handles resource and finance, Dingtalk supports communication, and ITTX manages logistics.



Source: (Research Results, 2024)

Figure 6. Business Architecture Design of PT. Umbara Karya Sejati

Discussion of Results:

Phase B at PT Umbara Karya Sejati aimed to improve IT operations through a microservices architecture. Key changes included introducing a DevOps model and developing an API Gateway. These upgrades were implemented in the background to enhance IT infrastructure without affecting non-IT personnel. The main goals were to cut vendor costs, reduce system inefficiency penalties, and speed up IT response, thus boosting agility and cost-efficiency.

Comparison with Theory and Previous Research:

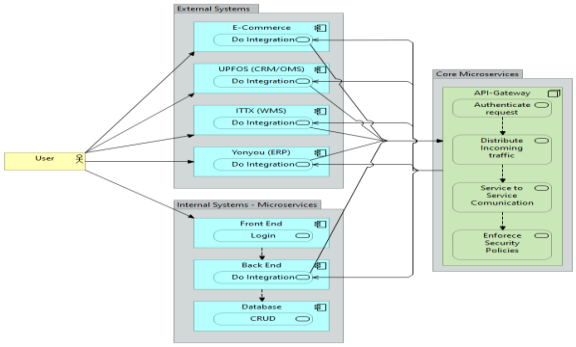
This phase's strategic focus aligns with the principles outlined in the TOGAF® MSA guide, which advocates for an architecture that supports scalability and flexibility through microservices and enhanced IT governance structures. The implementation of a DevOps framework and API Gateway is supported by findings from similar enterprise environments where internal IT enhancements led to significant operational efficiencies without disrupting core business functions (Soleman et al., 2021)

Furthermore, this approach directly addresses the volatility, uncertainty, complexity, and ambiguity (VUCA) challenges identified in PT Umbara Karya Sejati's operational environment, as suggested by the TOGAF framework. By optimizing IT operations, the company is better positioned to manage external pressures and adapt to market changes swiftly and efficiently (Rahman et al., 2021).

5. *Phase C: Information System Architecture*

a. Application Architecture

The application architecture at PT. Umbara Karya Sejati integrates key systems efficiently using an API Gateway, Load Balancer, and Service Mesh for traffic management and security. Upfos CRM/OMS, Yonyou ERP, and TTX WMS handle customer interactions, inventory, and logistics, ensuring seamless e-commerce, order management, and shipping, thus optimizing business processes and maintaining agility.

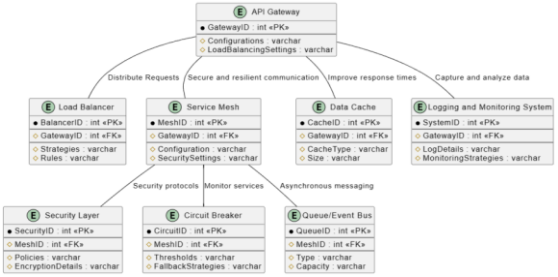


Source: (Research Results, 2024)

Figure 7. Use Case Diagram

b. Data Architecture with a Microservices Approach

The data architecture employs a microservices approach to ensure scalability and flexibility. It uses database clusters like Postgres and MySQL, synchronized for reliability. Microservices connect Yonyou, Upfos, and TTX WMS via an API Gateway, managing data communication and security through load balancing, data caches, event buses, and service mesh.



Source: (Research Results, 2024)

Figure 8. Data Dissemination Diagram of the API Gateway at PT. Umbara Karya Sejati

Discussion of Results:

Phase C at PT Umbara Karya Sejati centered on implementing an API Gateway to streamline data integration across ERP, CRM/OMS, and WMS systems, handled by internal IT team. This approach maintained existing data structures while improving data exchange efficiency and reliability. The API Gateway reduced external vendor dependencies and accelerated adaptation to changes, enhancing IT system flexibility.

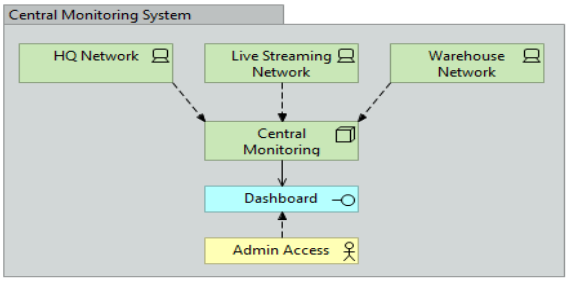
Comparison with Theory and Previous Research:

The implementation aligns with the TOGAF MSA guide's emphasis on leveraging technology to enhance system integration without the need for extensive changes to existing infrastructures (TOGAF® Series Guide MSA…). This targeted approach reflects practices similar to those in the AMEL Information System study, where integration enhancements were achieved through middleware solutions without overhauling the underlying business systems(Puspita et al., 2023). Furthermore, the focus on developing an API Gateway corresponds with Agile methodologies aimed at rapid deployment and iterative improvements, a strategy supported by research on microservices' role in facilitating agile and scalable IT architectures (Korontenko, 2024).

6. *Phase D: Technology Architecture*

a. Internal Network Configuration

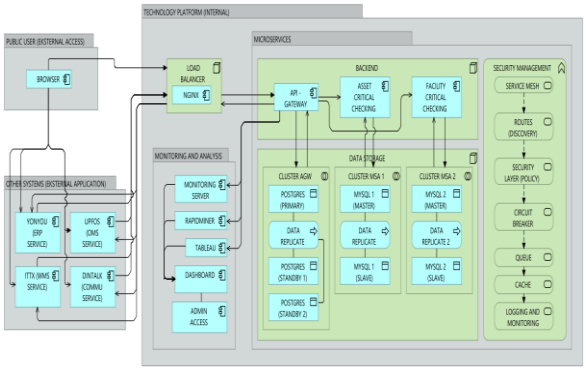
PT. Umbara Karya Sejati's internal network comprises three segments: HQ, live streaming, and warehouse. These segments are connected via a centralized monitoring system for effective oversight. The network uses Cisco and Mikrotik routers, switches, and access points, secured by VLANs and firewalls.



Source: (Research Results, 2024)

Figure 9. Multi-Area Network Monitoring Diagram of PT. Umbara Karya Sejati

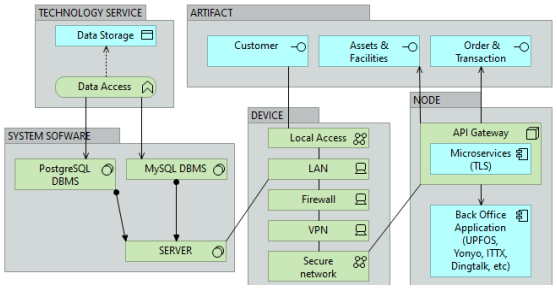
b. Platform Decomposition Diagram



Source: (Research Results, 2024)

Figure 10. Platform Decomposition Diagram of PT. Umbara Karya Sejati

c. Implementation of Microservices Architecture



Source: (Research Results, 2024)

Figure 11. Enterprise Architecture Implementation Diagram

Discussion of Results:

In Phase D, the focus was on developing a technology architecture to centralize data integration through an API Gateway. The internal IT team took over the management of the gateway and planned future pilot projects. This reduced dependency on external vendors, aiming to cut costs and improve efficiency.

Comparison with Theory and Previous Research:

This architectural strategy aligns with the TOGAF MSA guide's recommendations for enhancing system agility and reducing vendor lock-in by internalizing key technological competencies and infrastructure, such as the API Gateway (TOGAF® Series Guide MSA…). Similar strategies have been observed in other industries where internal management of critical integration points leads to improved control over system upgrades and maintenance which highlights the effectiveness of internal resource optimization in SMEs (Irufaan et al., 2021).

By focusing on internal capabilities for managing integration through the API Gateway, PT Umbara Karya Sejati effectively addresses the operational VUCA challenges, reducing external dependencies while enhancing responsiveness to system issues and upgrades(Fahlevi et al., 2023).

7. Phase E: Opportunity and Solutions

Gap Analysis plays a crucial role in identifying and addressing gaps between the current state and future needs(Padel & Sutabri, 2023).

Table 4. Gap Analysis of Enterprise Architecture for PT. Umbara Karya Sejati

Current Condition	Target	GAP
Errors in integration between e-commerce platforms, UPFOS, Yonyou, and ITTX lead to data inconsistencies.	Ensuring consistent integration between e-commerce platforms and backend systems UPFOS, Yonyou, and ITTX.	Middleware development needed to synchronize all platforms in real-time.
Ineffective coordination and approval among teams result in errors in live streaming activity schedules.	Improve coordination and approval among teams by automating notifications and approvals through a centralized dashboard.	Lack of proper integration between Dingtalk, UPFOS, Yonyou, ITTX, and the e-commerce platform.
The lack of a cohesive and effective data security policy increases the risk of data breaches.	Implementing stricter security policies and integrated security management tools across all platforms.	Lack of cohesive data management and security standards.
Overlapping and difficulties in monitoring network topology reduce network management effectivenes	Developing a centralized network monitoring system with effective management and quick response to network issues.	The IT network still has a fragmented topology and is difficult to monitor. Dependency on external vendors and errors in technology selection and implementation.
The low capacity for independent IT decision-making often occurs, affecting the alignment of IT solutions	The High capacity for independent IT decision-making often occurs, affecting the alignment of IT solutions	Adopt a comprehensive IT governance framework to ensure that technology choices align with business strategy.

Source: (Research Results, 2024)

Discussion of Results:

Phase E aimed to bridge the gap between the current and target enterprise architecture of PT Umbara Karya Sejati by addressing integration inefficiencies. Solutions included middleware for real-time data synchronization across e-commerce, UPFOS, Yonyou, and ITTX platforms, enhancing IT network monitoring, and improving IT governance to align technology with business goals. Automated notifications and centralized dashboards were also

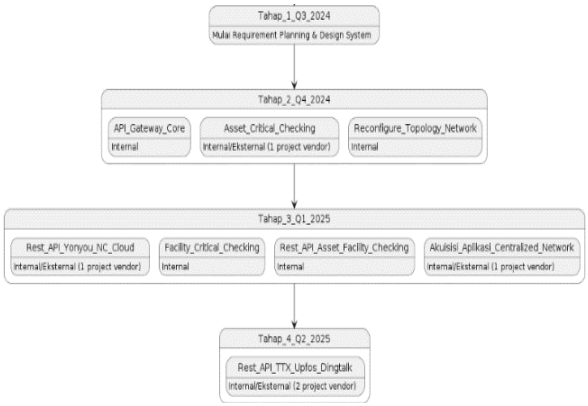
introduced to improve team coordination, particularly for live streaming activities.

Comparison with Theory and Previous Research:

The approach to solving these integration issues through middleware development aligns with TOGAF 10's MSA principles, which advocate for modular and flexible system designs that can be easily integrated. This strategy is supported by similar implementations seen in studies like "Proposing a Microservices Architecture for AMEL Information System Designed Using TOGAF-ADM" where microservices architecture effectively addressed integration challenges in government procurement systems (Puspita et al., 2023). Furthermore, the initiative to enhance data security and network management echoes the best practices in enterprise architecture for ensuring robust, secure, and efficient IT operations (Raharja, 2024).

8. Phase F: Migration Planning

a. Application Roadmap



Source : (Research Results, 2024)

Figure 12. Application Roadmap of PT. Umbara Karya Sejati

b. IT Governance Implementation Roadmap

Table 5. Information System Implementation Roadmap PT. Umbara Karya Sejati

Phase	Activity Name	Implementation Period
1	IT Policy Development	Q3 (Jul – Sept) 2024
1	DevOps and Microservices Training	Q3 (Jul – Sept) 2024
1	Agile and Project Management Training	Q3 (Jul – Sept) 2024
1	Implementation of IT Governance Framework	Q4 (Okt – Des) 2024
2	IT Security and Data Protection Training	Q1 (Jan – Mar) 2025
2	Vendor and Outsourcing Management Training	Q1 (Jan – Mar) 2025
3	Technology Usage and Understanding Training for Non-IT Staff	Q2 (Apr – Jun) 2025

Source: (Research Results, 2024)

Discussion of Results:

Phase F focused on planning to balance internal IT resources and vendor support for PT Umbara Karya Sejati. The strategy used vendor assistance to implement the API gateway and microservices architecture effectively, with only three IT staff available. The goal was to upgrade technology while managing timelines for training and integration to ensure a smooth transition.

Comparison with Theory and Previous Research:

The migration planning aligns with the TOGAF MSA guide's emphasis on phased and resource-optimized implementations, particularly in scenarios involving limited internal IT capabilities (TOGAF® Series Guide MSA…). The guide supports the strategic use of external vendors to supplement internal efforts, which is critical for managing complex technology transitions effectively.

This approach mirrors successful migration strategies observed in similar case studies where a blend of internal and external resources facilitated seamless technology integration. For example shows how SMEs managed resource constraints by integrating vendor support during the migration to microservices (Ebunoluwa Johnson et al., 2024), similar to PT Umbara Karya Sejati's strategy.

CONCLUSION

The adoption of the TOGAF 10 Microservices Architecture (MSA) at PT. Umbara Karya Sejati has significantly streamlined the integration of ERP, CRM/OMS, WMS, and e-commerce systems, ensuring smoother data flows and more efficient operations while mitigating system fragmentation via an API Gateway. This modular, microservices-based approach enhances flexibility and scalability, facilitating the development of specific services independently, thereby minimizing system-wide disruptions.

The implementation of Agile methodologies fosters improved interdepartmental collaboration and swift adaptation to business needs. Furthermore, the strategic migration planning and robust IT governance, including regular data security training, have prepared the organization for future challenges, enhancing operational and cost efficiency by approximately 10%. This framework not only supports PT. Umbara Karya Sejati in its digital transformation journey but also sets a foundation for ongoing adaptability in the face

of market volatility and complexity. Future research can focus on improving the automation of system integration and monitoring by utilizing more advanced API architecture, as well as exploring blockchain technology to enhance data security and integrity in the distributed architecture.

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