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SOA Based Integrated System for Small and Medium Enterprises Using Service Oriented Architecture

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Abstract. The purpose of this study is to create SOA Systems for small and medium enterprise (SME) which is called In-Guide. This system can accommodate SME business people and their customers doing business. It can act as gateway that can bridge entities in small and medium enterprise ecosystems to request and provided services. The first step is we collect data from depth interview and observation also to create user requirement and system design, The second step is create business model. The third step is proposed In-Guide systems layer, identifying the list of services and SOA systems architecture. The fourth stage, we evaluate the In-Guide based on SOA systems. The results of this study are user and system requirements for In-Guide systems, business model, list of back end services, strategic integration landscape, SOA architecture for In-Guide , and evaluation of In-Guide system. We evaluate the old system and the new system by analyzing the differences before and after the construction of the new system.

Keywords: SOA, small micro and medium enterprise, In-Guide, Integration Systems

1. Introduction

The number of SME business actors in Indonesia is increasing and experiencing an increasing trend. This condition provides a real opportunity for the SME ecosystem in Indonesia to create a new ecosystem that can help accelerate the increase in the economic welfare of the Indonesian people. This grows business to business, business to customer, as well as customers to customers who utilize digital transactions in this ecosystem. Business growth in SMEs in Indonesia shows a positive trend. This trend creates opportunities for business entities to collaborate and synergize. This requires efficient and effective integration of data, business processes and information. However, on the other hand, limitations on operational costs and knowledge of information technology are important things to overcome. Meanwhile, the potential for SMEs in Indonesia is potential that can be optimized to improve and grow business activities quickly and precisely One of the SME's domains is tourism and the creative industry. Small Micro and Medium Enterprises in Indonesia plays a very important role. in Economy because of IT contributions. The lack of small micro and medium enterprises in Indonesia are attractions and recreation places publications. Increasing in Indonesia's foreign tourist, increasing in small and medium enterprise growth. The benefit of align with government effort is can escalate economic growth Align with government effort can be taken with digitalized small and medium enterprise in Indonesia. As we know, the strength are Cooperate with small and medium enterprise government, support local business, complete guidance to explore Indonesia, complete information about tourist destination in Indonesia. The weakness are provide only few option of transportation booking, dependence on government's database to small medium and enterprise information. The opportunities are growth of small medium enterprise in Indonesia, increase amount of tourists, no big competition in terms of handling information about small and medium enterprise properly. The treats are new entrants of similar application, takes time to get government permit to grant access to database. The need for an integrated system for SMEs is important to solve supply chain problems. One of the problems in the tourism sector is the unavailability of complete, valid and comprehensive information. Utilization of information technology in the SME sector in Indonesia has not been maximized. Business activities are still carried out conventionally. Although some SMEs have implemented information technology, they have not fully and comprehensively implemented business processes. Business processes in the tourism sector in Indonesia require system support that can provide valid information quickly. This is because the tourism sector in Indonesia is very promising to improve the nation's economy. Foreign and domestic tourist visits can be optimized to enjoy tourist attractions, attend events, and try Indonesian culinary delights by presenting an integrated system platform. Increasing foreign and domestic tourist arrivals is a target and priority that needs attention.

2. Related Works

REST concept mechanism and implementation for Open Source REST services for environmental sensor has been discussed by (rettig et al, 2015). Service-Oriented Architecture is a technology architecture model for solutions that are oriented towards different characteristics in support and realizing service orientation and strategic objectives related to service-based applications (Erl, 2011) . Related to (Rettig et al, 2015), the advantage for integration development on resources has been explained. According to (Guinard, et al, 2011), implementation REST has been discussed from research to practice. According to (Luthria et al, 2009), organizational adoption of service oriented architecture should be considered. SOA concept related to technology and design has been proposed by (Erl, 2005). The critical success factor for SOA implementation has been discussed by (Erickson et al, 2008). Related to (MacKenzie et al, 2006), The Open Group defines SOA focused on the service orientation architectural model. SOA is a paradigm that have capabilities to manage and use services distributed in different domains (MacKenzie et al, 2006). The challenges of future microservices has been discussed and explained by (Jamshidi et al, 2018). Then, microservices feasibility of economics and budget in the implementation of microservices, has been conducted by (Singleton, 2016). The specific definitions and core principle of microservices architecture (MSA) and Its pattern has been proposed by (Christudas et al, 2019). SOA implementation in enterprise can support effective, flexible, scalable, and repeatedly useable IT infrastructure. It will be supports digital transformation in a company with the ability to be adaptive in either internal business structure or external environment (Dremel et al, 2017). According to (Anjaria et al, 2017), quantitative analysis of information leakage in service oriented architecture which is specific in web services has been discussed. Related to (Fischer et al, 2019), the urgency of integration between SOA, BPM and BRM in organization has been explained and discussed. According to (Suthendra et al, 2020), the implementation of Docker can help developers to devise a system to develop, implement, and spread services, especially to achieve the desired level of system performance in e-commerce web services. Related to (Erl, 2016), we can see the guidance for

analysis and design services and microservices. According to (Bhadoria et al, 2017), ESB is a software framework that manages services and their integration with other services on a common platform. Besides that, ESB also provides the infrastructure support needed to implement message routing, protocol translation, and message transformation. On the other hand, ESB also aggregates services from legacy application domains and provides loose coupling across services. The advantages of using ESB is one can design, develop, implement, and monitor services at runtime. This improves the concept of reusability in SOA. According to (Fersi, 2015), Middleware can provides a set of programming abstractions to facilitate the integration and communication of heterogeneous components such as Internet of Things. A study about SMES has been done by (Dong, 2022). Besides that, study SMES in ERP has been discussed by (Anusuyah, 2022).

3. Research Methodology

In this study, we proposed SOA systems which is called In-Guide systems. It is act as platform that can support integration mechanisms between system diversity. We apply the concept of service-based system development. However, before that, we try to analyze business opportunities for integrated systems in the tourism sector in Indonesia. The most difficult stage for developing this system is identifying the diverse and varied needs of users. The first stage in research method is user and system requirements analysis to capture and gathering the user needs for In-Guide Systems. In this stage, we collect data from users interview to describe the user and system needs In this stage we used depth interview to analyze and identifying the list of functionality for In-Guide Systems. The second stage we proposed the business model using business model canvas. In this stage, we compare the functionality systems that has been implemented with In-Guide systems. The third stage, we proposed SOA system architecture design for In-Guide. In this stage we create SOA layering, strategic integration landscape, analysis and identifying the list of back end services and SOA systems architecture. The fourth stage, we evaluate In-Guide systems. In this stage, we evaluate before and after implementing SOA. The research methodology can be described in figure 1 below :

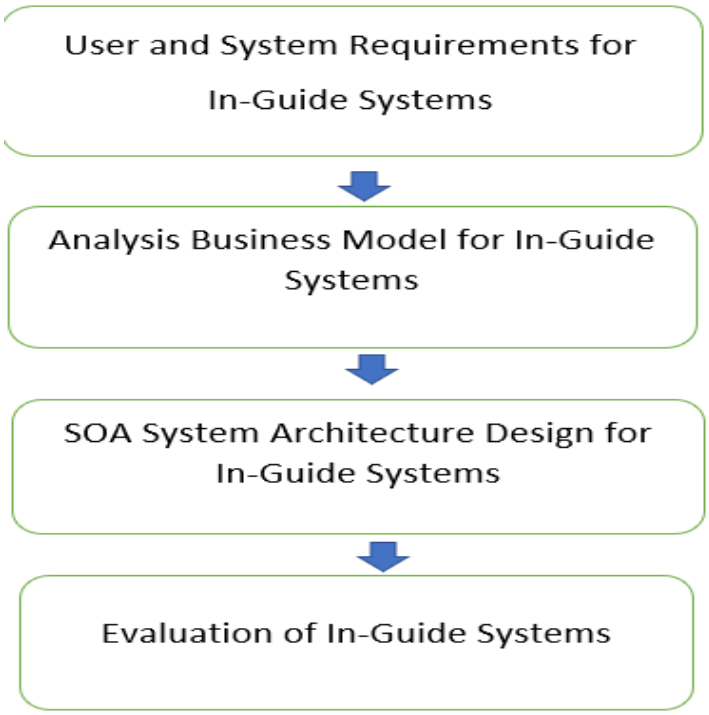

Fig 1. Research Methodology

4. Results and Discussion

4.1. User and System Requirements Analysis for In-Guide Systems

Small and Medium Enterprises in Indonesia have limitations in implementing systems to support the operationalization of their business processes. The obstacles faced by these small and medium businesses are in developing, managing and maintaining systems. This has an impact on the optimization of its business processes. Based on the interview, it was found that a number of user needs include service-based system features. The main needs that are considered important by small and medium businesses in the field of traveling

are related to events and tourist destinations. Indonesia is unique in terms of tourism and culture. This is reflected in the large number of tourist sites and cultural arts. We propose a services-based system functionality for In Guide system. We proposed several services in the such as : provide small and medium enterprise profile, provide cultural events and festival schedule, provide recreation attractions, provide natures, scenic landscape and wildfire destinations, provide culinary information, provide transportation booking service. These features are represent the user and system requirements for In Guide systems. Besides that, In-Gude systems has capabilities to integrate heterogeneous systems from diversity entities in small and medium enterprise ecosystem. It act as a middleware to coordinate and manage data and information exchange among of systems that has different platform.

4.2. Business Model for In-Guide Systems

as we know, there are system platform that has been implemented and has similar functionality with In-Guide system. However, we proposed an In-Guide system to complement the availability of functionality and services provided by other existing platforms. In this study, we are doing business model analysis using business model canvas. we try to analyze and explore the opportunities and challenges to develop the In-Guide system . The first step before making a business model, we do a comparison analysis with similar system platforms. It aims to accommodate the needs of small and medium enterprises. In Gude systems developed based on comparison of services that can be shown in figure 2 below :

	InGuide	OSMAN	Traveloka
Service:			
UMKM Information	Y	Y	N
Cultural Event Information	Y	N	N
Destination Information	Y	N	Y
Restaurant Information	Y	N	Y
Attaction Information	Y	N	Y
Booking Ticket	Y	N	Y
MAPS	Y	N	Y
Have more than 1 partnership	Y	Y	Y
MultiPayment	Y	N	Y
Channels:			
Website/Desktop	N	Y	Y
Mobile App	Y	Y	Y
Social Media	Y	Y	Y
Access:			
Location	Y	N	Y

Fig 2. Comparison of Services in Guide

According to figure 2 above, we compare services. Maps, partnership, multipayment, channels, and access. We try to mapping the availability services among of the platform with Y = Yes, and N = No. There are several list of services for comparation such as : UMKM information that means information which is related to small medium and enterprise information, cultural event information, destination information, restaurant information, attraction information, Booking ticket. Related to location, we compare the implementation of MAPS. Then we compare partnership while have more than 1 partnership. Then, we compare website. Desktop, mobile application, and social media for user channel. The last one is we compare accessibility for location. After comparative analysis that can be shown in table 1 above, we created a business model to fully describe the In-Guide system as a startup system. The business model can be explained in figure 3 below :

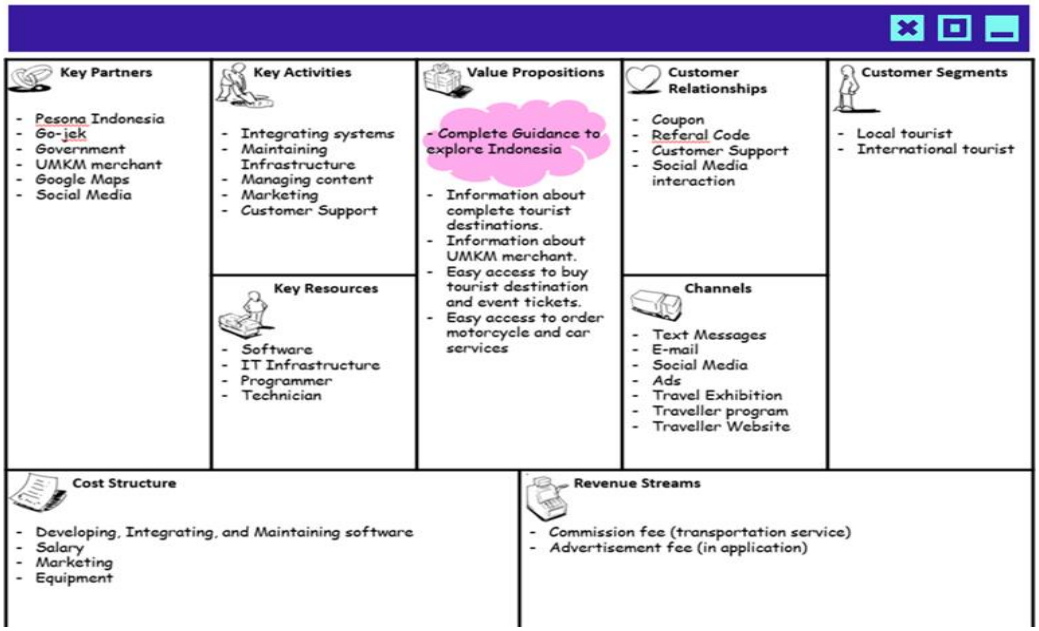

Fig 3. Business Model for In-Guide System

According to figure 3 above, business Model has been constructed using business model canvas. It is has some components that has been filling. The detail of business model for In-Guede can be shown and explained in figure 3 above. It shows the challenge and opportunities to develop In-Guide system as a startup. In this study, we see the opportunity to develop a new platform in small and medium enterprises in Indonesia. It is develop based on analysis of business model canvas in figure 3 above. Figure 3 above shown the value proposition is complete guidance to explore Indonesia. It means the systems can provide information about completeness tourist destinations, information about small and medium enterprises merchant, easy access to buy tourist destinations and event tickets, and also easy access to order motorcycle and car services. Key activities are integrating systems, maintaining, infrastructure, managing content, marketing, and customer support. According to business model, customer segments divided into local tourist and international tourist. Key partners in figure 3 above are Pesona Indonesia, Go-Jek, Small and medium enterprise merchant, government, google maps, and social media. The channels in this platform are text messages, e-mail, social media, ads, travel exhibition, travel program, and travel website. Regarding to it, the platform which is called In-Guide Systems can act as an gateway and bridging to integrate diversity applications. It is can be called enterprise services bus for tourism sector in Indonesia.

4.3. SOA Systems Architecture Design for In-Guide Systems

In this study, we used service oriented based to proposed In-Guide Systems We use service-based system development because of the ease in responding to dynamic and fast changes in business processes. On the other hand, the agility of the system to customize business process changes is absolutely essential to get a robust system. The Design of Systems Architecture consists of SOA layering, list of services, and SOA Architecture. Figure 4 below shown the SOA layering for In-Guide systems :

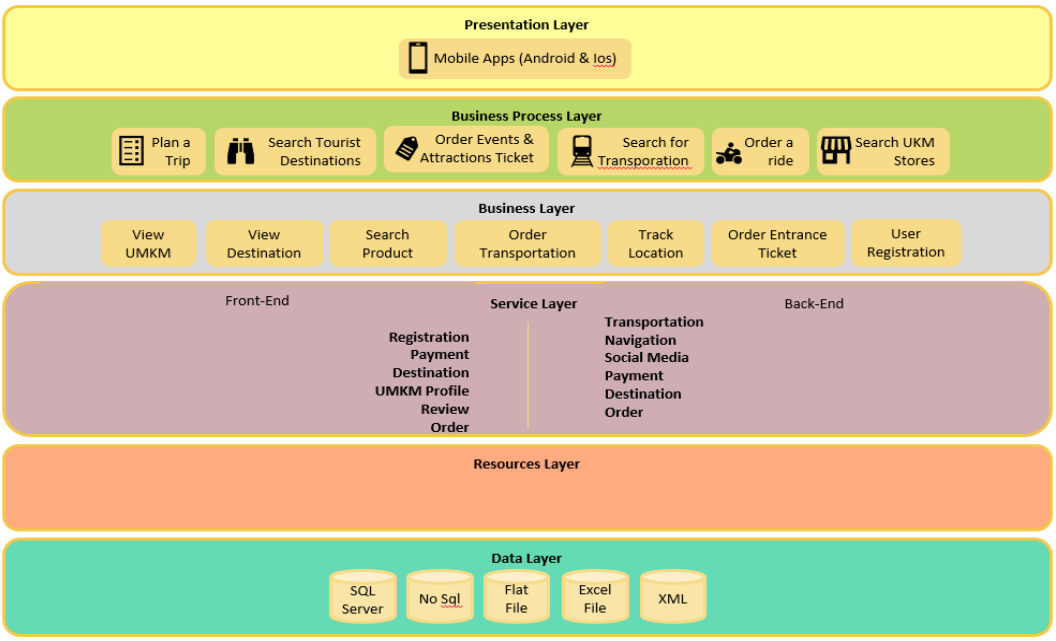

Fig 4. SOA layering for In-Guide Systems

According to figure 4 above, SOA layering for In Guide consists of presentation layer, business process layer, business layer, services layer, resources layer, and data layer. in Guide systems can be accessed from mobile application. It is handle plan a trip, search tourist destination, order event and attraction ticket, search for transportation, order a ride, and search UKM stores. UKM means in here is small and medium enterprise. Services layer divided into front end and back end services that can be taken from resources layer. The data layer included Sql Server, NoSQl, Flat file, and XML. List of services in Figure 4 above shown the front end and back end services. The group of front end services such as : registration services, payment services, destination services, UMKM profile services, review services, and order services. Besides that, the group of back end services such as : transportation, navigation, social media, payment, destination and order. According to figure 5 below, we create strategic integration landscape for implement In-Gude Systems. We can see the detail of mechanism of integration between entities in In-Guide ecosystem.

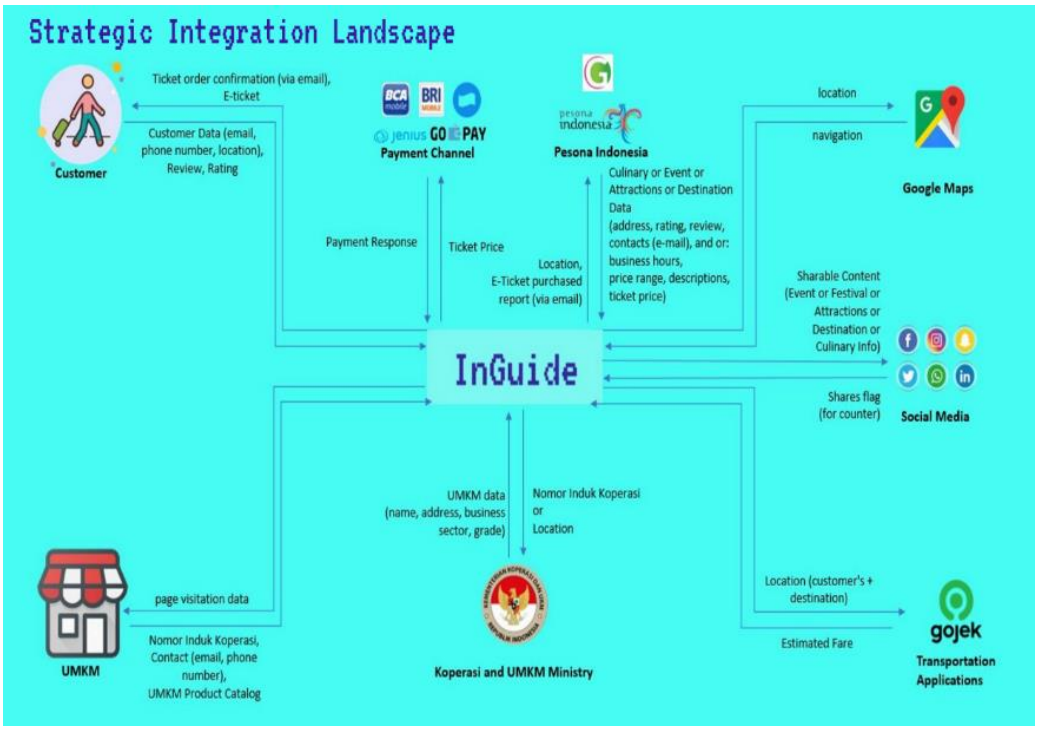

Fig 5. Strategic Integration Landscape

According to figure 5 above, we create strategic integration landscape which is shown the entities that can integrate and collaborate to exchange data and information for support business transaction. It shows the interaction between different systems using In-Guide systems. We can see flow the activities among of the systems while doing business. Figure 5 above classifying the functions and roles of entities in this SME ecosystem. Existing functions and roles include navigation, transportation, payment, social communication media, event information providers and tourist destinations, customers, and ministries representing the government.

The next stage is we identifying the list of services for front end and back end in in Guide. Figure 6 below described the list of front end services. It is divided into services group, service Id, and service name. We create clustering of group services into groups that represent the functionality of the relevant services that can be explained in figure 6 below :

Service Group	Service ID	Service Name
Registration	RC001	Customer Registration
Registration	RU001	UMKM Registration
Payment	PY002	Payment Option
Payment	PY004	e-Wallet Verification
Destination	DE004	Get Event
Destination	DE005	Get Attraction Destination
Destination	DE006	Get Culinary Destination
Destination	DE007	Get UMKM Destination
UMKM Profile	PU001	Update UMKM Profile
UMKM Profile	PU002	Upload UMKM Product Catalog
Review	RV001	Review Destination
Order	OR001	Order Event Ticket
Order	OR003	Order Attraction Ticket
Order	OR007	Display Transaction History

Fig 6. List of Front End Services for in Guide

According to figure 6 above, we classify the list of services based on service group, service id, and service name. There are 6 services group such as registration, payment, destination, UMKM profile, review, and order. for each service, we give the name of the service to describe and describe its functionality.There are 14 service name , such as customer registration, UMKM registration, Payment option, e-wallet verification, get event, get attraction destination, get culinary destination, update UMKM profile, upload UMKM prodcut catalog, review destination, order event ticket, order attraction ticket, and display transcation history. These services has capabilities to accommodate business processes in tourism and hospitality industry. It is can make it easier for customers and businesses to support operations in business to business (B2B), business to customer (B2C), government to business (G2B), and government to customer (G2C) also.

Then, we identifying the list of back end services for InGuide that can be explained in figure 7 below :

Service Group	Service ID	Service Name
Transportation	TP001	Get Estimated Fare
Transportation	TP002	Post Booking Info
Navigation	NA001	Get Navigation
Social Media	SM001	Post Sharable Content
Payment	PY001	Get Balance e-Wallet
Payment	PY003	Post Ticket Price
Payment	PY005	Get Payment Response
Destination	DE001	Get UMKM Information
Destination	DE002	Get Destination Information
Destination	DE003	Get Event Information
Order	OR002	Post Event Ticket Order
Order	OR004	Post Attraction Ticket Order
Order	OR005	Post e-Ticket
Order	OR006	Post Purchase Confirmation
Order	OR008	Post Purchased Ticket Report

Fig 7. List of Back End Services for in Guide

According to figure 7 above, it shows the list of back end services that can connected to other systems in these ecosystems. We create a group to grouping similar services. There are 6 group of services such as order, destination, payment, social media, navigation, and transportation. Service name in these services are using 2 method, such as get and post. There are 15 services name, such as get estimated fare, post booking info, get navigation, post sharable content, get balance e-wallet, post ticket price, get payment response, get UMKM information, get destination information, get event information, post event ticket order, post attraction ticket order, post e-ticket, post purchase confirmation, and post purchased ticket report. Then, we create SOA architecture to explain the interconnectedness of components and elements of IT infrastructure, applications, databases, and entities in the In-Guide ecosystem which is explained in figure 8 below :

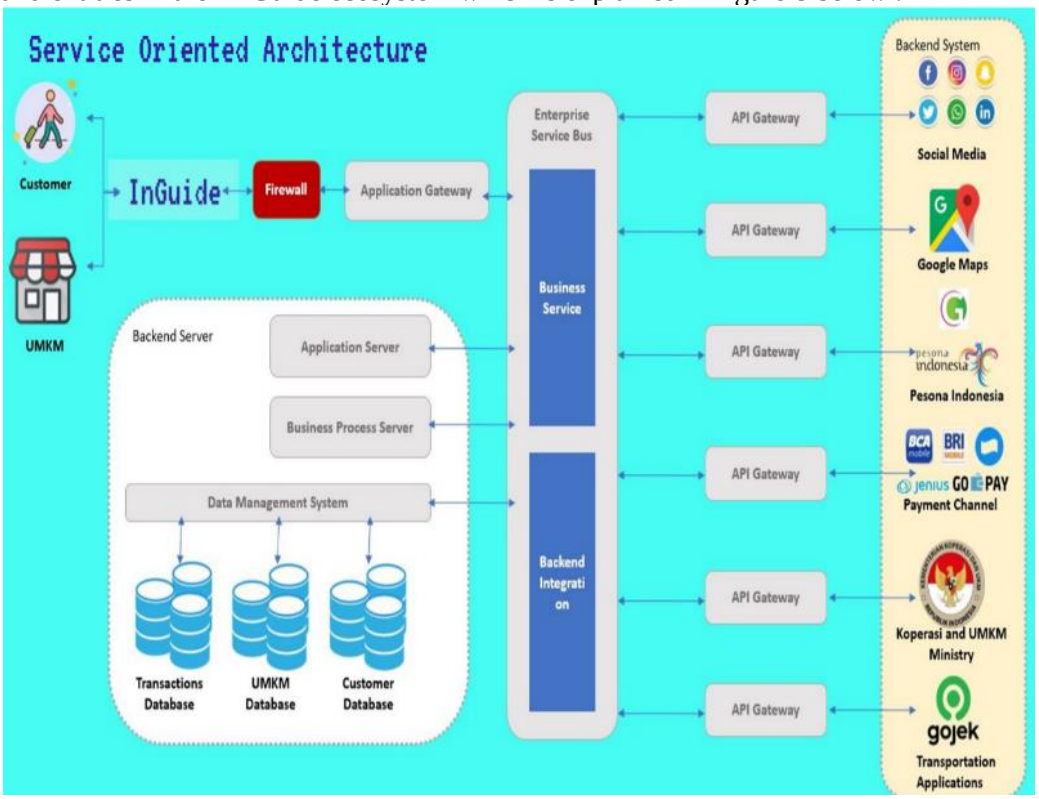

Fig 8. SOA Architecture for In-Guide

According to figure 8 above, user can divided into customer and UMKM (small and medium enterprise). Backend server consists of application server, business process server, and data management system. Data management system will covered transaction database, UMKM database, and customer database. Business service and backend integration will be connected by API Gateway to call and request services from some resources application in entities. According to figure 8 above, there are 6 API gateway that connected to backend integration and business entities. we can see the direct relationship between backend integration and business entities through the API Gateway. SOA architecture in figure 8 above describe individual customer and UMKM can access list of services using In-Guide systems. In-Guide systems has a firewall in application gateway. Then, application gateway connect to enterprise services bus. Enterprise services bus consists of business services and back end integration. Enterprise services bus connected to API gateway and back end server. Back end server divided into application server, business process server, and data management system. Figure 8 above explained the relation between application server and business process server to business services in enterprise service bus. On the other hand, data management systems connected to backend integration. Data management systems involved transaction database, UMKM database, and customer database.

4.4. Evaluation of In-Guide Systems

Evaluate the SOA systems will be explained in the figure 9 below. It shown the condition before SOA systems. We can see existing event finding until ticket purchasing business process. It shown various business processes that can be applied in diversity applications. However, it is not apply to majority of local events. Local event usually do not have their own websites, thus hard to purchase the ticket or event access the complete information . Separate system for each step decrease customer's enthusiasm, resulting low ticket sales.

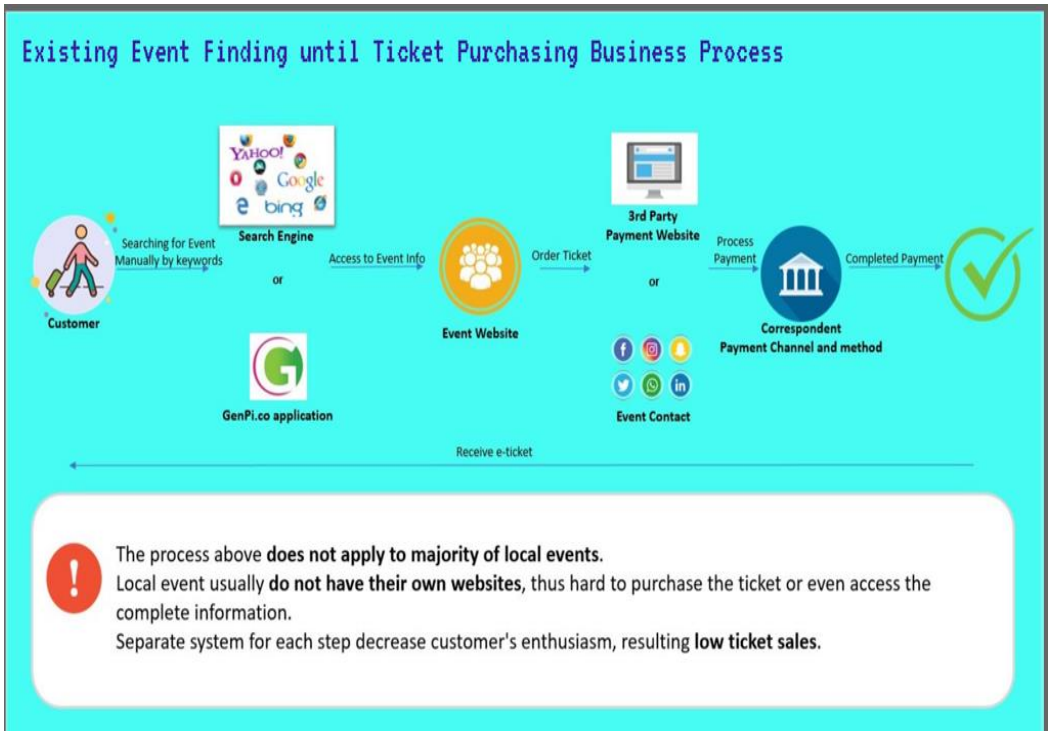

Fig 9. In-Guide System Before SOA

According to figure 9 above, it shown business process that shows customer activities looking for event tickets to getting tickets. Besides that, we can see the advantage using SOA system for inguide. We can compare the InGuide system before and after SOA with more detailed in figure 8 and figure 9 above. We can see the process does not apply to majority of local events before implementing SOA systems. Besides that, as we know local event usually do not have personal wesbite which is provide complete information. It can makes difficult for exchange information among of the systems running.

5. Conclusions

in Guide can be implemented using SOA approach. It can help actors in small and medium enterprise(SME) collaborate and integrated. It can construct the seamless integration in the ecosystem of SME. There are some resources application that can integrated in single point systems. Besides that, SOA can help backend

management system for responses changes of business entities. It happened because of the easily to custom business logic in the existing applications while SOA has been implemented. The toughest challenge in implementing this system is the openness factor of data and information in the applications to be integrated. However, the exchange of data between applications is hampered because there is no understanding and cooperation between SME business entities. On the other hand, the uniform format of data exchange protocols is important for all SME business entities to agree on. Differences in data exchange protocol formats can be bridged by using ESB. At this time, ESB or Enterprise Services Bus software consists of open source, customized, and local in-house development. This selection can be adjusted according to business and user needs. The tourism sector in Indonesia is an industrial sector that has not implemented ESB. Therefore, the development of the In-Guide System can be a solution in terms of data and information integration between SME entities in Indonesia. It can act as software as a services in tourism, event, and culinary sector in Indonesia. It provides several functionalities for support business processes in this sector. Besides that, functional requirement and non functional requirements should be considered for completion. User characteristics in this sector are things that needs more attention. This is due to differences in users who have specific characteristics that need to be accommodated with functional requirements and non functional requirements also. as we all know, user requirements are absolute to ensure the successful implementation of In-Guide systems. Karene in this system, being a user of In-Guide systems includes a number of entities that have distinctive and unique characteristics.

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References

Anusuyah.S, "Enterprise Resource Planning Critical Success Factors in Small Medium-Sized Enterprise", Journal of System and Management Sciences Vol. 12 (2022) No. 6, pp. 81-96 DOI:10.33168/JSMS.2022.0606

Anjaria.K and A. Mishra, "Quantitative analysis of information leakage in service oriented architecture based web services," Kybernetes, vol. 46, no. 3, pp. 479–500, 2017, doi: 10.1108/K-07-2016-0178. ISSN: 0368-492X

Bhadoria.R.S. , N. S. Chaudhari, and G. S. Tomar, "The Performance Metric for Enterprise Service Bus (ESB) in SOA system: Theoretical underpinnings and empirical illustrations for information processing,",. Information Systems, Volume 65, April 2017, Pages 158-171

Christudas, B., & Christudas, B. (2019). Microservices Architecture. In Practical Microservices Architectural Patterns. https://doi.org/10.1007/978-1-4842-4501-9_4. Apress

Dong.Y. L, "A Study on Smart Factory Efficiency of Small and Medium-sized Enterprises Based on Electricity and Electronics". Journal of System and Management Sciences Vol. 12 (2022) No. 2, pp. 431-442 DOI: 10.33168/JSMS.2022.0223

Dremel.C, M. M. Herterich, J. Wulf, J.-C. Waizmann, and W. Brenner, "How AUDI AG Established Big Data Analytics in Its Digital Transformation," MIS Q. Exec., vol. 16, no. 2, pp. 81–100, 2017, [Online]. Available: https://www.researchgate.net/publication/317232875_How_AUDI_AG_Established_Big_Data_Analytics_in_its_Digital_Transformation

Erickson, J., & Siau, K. (2008). Critical success factors in SOA implementation. 14th Americas Conference on Information Systems, AMCIS 2008. 14th Americas Conference on Information Systems (AMCIS 2008), 14-17 August 2008, Toronto, Ontario, Canada. **ISBN:**9781605609539. https://aisel.aisnet.org/amcis2008/107/

Erl.T, *Governing Shared Services On-Premise and in the Cloud*. Boston: Prentice Hall, 2011

Erl, T. (2005). Service-Oriented Architecture: Concepts, Technology, and Design. ISBN 0-13-185858–0

Erl.T., Service-Oriented Architecture- Analysis and Design for Services and Microservices. Pearson, ISBN: 9780133858709. Oreilly, December 2016

Fersi.G, "Middleware for internet of things: A study," , 2015 International Conference on Distributed Computing in Sensor Systems, 10-12 June 2015, **Electronic ISBN:**978-1-4799-8856-3, **DOI:** 10.1109/DCOSS.2015.43

Fischer.M, F. Imgrund, C. Janiesch, and A. Winkelmann, "Directions for future research on the integration of SOA, BPM, and BRM," Business Process Management Journal, ISSN: 1463-7154, 2 October 2019, Volume 25 Issue 7, pp. 1491–1519, 2019, doi: 10.1108/BPMJ-05-2018-0130.

Guinard.D, M. Mueller, and V. Trifa, "RESTifying Real-World Systems: A Practical Case Study in RFID," REST From Researh to Practice., pp. 359–379, 2011, doi: 10.1007/978-1-4419-8303-9_16. http://www.vs.inf.ethz.ch/publ/papers/dguinard-restif-2011.pdf

Jamshidi, P., Pahl, C., Mendonca, N. C., Lewis, J., & Tilkov, S. (2018). Microservices:The journey so far and challenges ahead. IEEE Software (Volume: 35, Issue: 3, May/June 2018). DOI: 10.1109/MS.2018.2141039 . https://ieeexplore.ieee.org/document/8354433

Luthria, H., & Rabhi, F., " *Service oriented computing in practice - An agenda for research into the factors influencing the organizational adoption of service oriented architectures* ", Journal of Theoretical and Applied Electronic Commerce Research. 2009, 4(1),pp 39-56, https://doi.org/10.4067/S0718-18762009000100005

MacKenzie, C. M., Laskey, K., McCabe, F., Brown, P. F., & Metz, R. (2006). Reference Model for Service Oriented Architecture 1.0. OASIS Standard. OASIS Open. https://www.oasis-open.org/committees/download.php/19679/soa-rm-cs.pdf

Rettig. A.J. , S. Khanna, and R. A. Beck, "Open source REST services for environmental sensor networking, Applied Geography, Volume 60, June 2015, pages 294–300, https://doi.org/10.1016/j.apgeog.2014.11.003

Singleton, A. (2016). "The Economics of Microservices. IEEE Cloud Computing". IEEE Cloud Computing ,Volume: 3, issue 5, Sept.-Oct. 2016. https://doi.org/10.1109/MCC.2016.109

Suthendra,J.A, and M. A. I. Pakereng, "Implementation of Microservices Architecture on E-Commerce Web Service", ComTech: Computer, Mathematics and Engineering Applications, 11(2), December 2020, 89-95 DOI: 10.21512/comtech.v11i2.6453. E-ISSN: 2476-907X