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Design of Data Interchange Regulation for Regional ICT Office

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Abstract— The rapid development of e-government systems raises issues of the importance of data integration and interoperability. Recently, most government offices provide data interchange services through web services or using database direct-link (db-link), and the process usually runs without referring to certain regulations, standards, or procedures. It can cause some problems such as lack of a standard for data interchange services, lack of procedure for building, deploying, and monitoring the services, duplicate services, problems in tracing and maintaining the services, and much more. The research aims to provide the practical method for designing the regulation for supporting data interchange and propose a draft of the regulation package that consists of policy, procedure, and technical guide. The research is located in a regional ICT government office and the process for designing the regulation is building through a design thinking approach. Outputs of this research are the conceptual map of the issues that should be covered by the regulation, the structure of the policy, the draft of standard and procedure for supporting data interchange mechanism, and the sample of the technical guide. The draft of the regulation is then tested against the actual problem to see how the regulation, procedure, and guide can resolve it. The result shows that it can fill the needs of regulation in the organization and can address some needs on data interchange mechanisms.

Keywords— Interchange; interoperability; web services; e-government.

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I. INTRODUCTION

The need for collaborating and interchanging data and information between government agencies has increased significantly in Indonesia for the last five years. It was triggered by some factors such as increasing e-government usage, public digital literacy, awareness of regional government offices, and regulation from the central government for facilitating and integrating the data. Responding to these needs, some of the regional offices have prepared and built some tools and mechanisms for the data interchange.

In most cases, the data interchange services are delivered through web services or database direct-link (db-link). The services are published both for public consumption or restricted access based on the agreement between two regional government offices. These services, usually, provided and managed by the regional ICT office, or Dinas Komunikasi dan Informatika (Diskominfo). This office has responsibility for building and publishing the services based on requests from others and manages the middleware for the services.

The process of the build, publish and consuming the services was running based on daily practice and without following certain guidelines, regulations, or standards and procedures. It produces some problems such as duplicate services, unknown data interchange services, non-standard format on data interchange, and problems in maintenance and monitoring them.

Data interchange can be considered as a part of components for supporting the Digital Transformation program that has targeted to be realized in 3 years [1], and plays significant roles in implementing of Indonesia E-government System or SPBE [2].

Previous researches on the data interchange problem in government cover some issues such as lack of standard and policy, and lack of government support can arise a significant impact on slow electronic data interchange (EDI) implementation in China [3]. The use of API as a technology for supporting data interchange is mentioned in Gartner's report on a study of the Digital Government Benchmark Study [4]. The conclusion of this study mentioned that API can help in supporting the complex integration of large systems and support open government initiatives.

Data interchange also becomes an important part of the IT strategic action plan that is based on three principles: transparent and collaborative accountability, enabled exchange, and authorized exchange [5]. API as a supporting tool [6] for enabling open government data. Vacarri et.al [7] proposed 4 pillars on adopting API for government: policy support, platform, and ecosystem, people, and processes. In their research, API usage aims to facilitate data interchange.

The need for an open data policy for supporting data interchange is also discussed in previous research such as the need for open data policies for increasing the frequency and quality of data sharing [8]. Chatfield and Reddick [9] found the state government that adopted open government data policies as policy innovation. Kassen [10] recommends the policy for helping the campaign of popularizing open data technologies and reusing them among independent developers.

The research aims to resolve the problem mentioned above by providing a draft of the policy, standard and procedure, and technical guide for a regional ICT office, where the research is located.

The article will discuss the relevant material needs for completing the research, the method we use, the structure and sample of a draft of the regulation, the problems expected to address, and the conclusion.

II. MATERIAL AND METHOD

In this section, we present the method for research and the relevant reference for defining the regulation.

A. Method

The research was carried out by following the policymaking process that consists of 5 steps [11]: agenda setting, policy formulation, decision making, implementation, and evaluation. Figure 1 shows the conceptual diagram of the policymaking process.

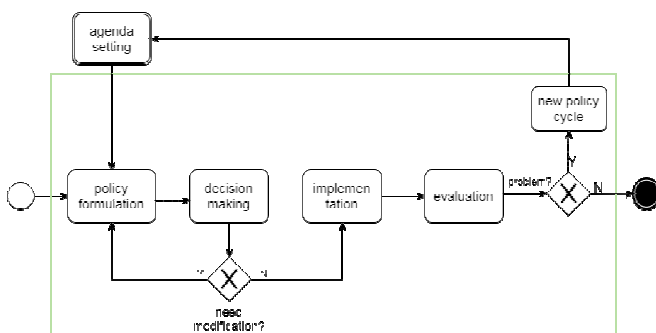


Fig. 1 Conceptual Diagram of Policy Making Process [11]

The design of the data exchange policy follows the design thinking process in policymaking [12], which consists of five phases: environmental scanning, participant observation, open-to-learning conversation, mapping, and sense-making. Figure 2 shows the phases of the design-thinking process.

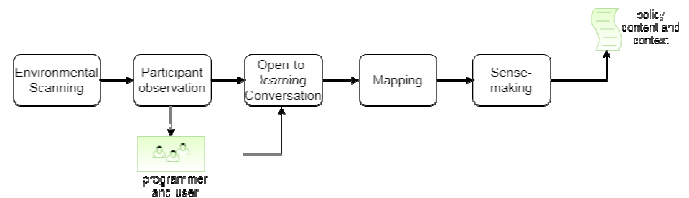


Fig. 2 Phases on Design Thinking Process for Policymaking [12]

B. Data Interchange

Data interchange refers to exchanging or transferring data between two systems or applications, in automatically, predefined format, and real-time or near real-time, via secure file transfer, bulk upload, or once-off [5]. The methods of data transfer that covers in this research are web services and database links. We don't cover the usage of API yet, because at the time the research is conducted, the initiative for managing the interchange in API is still in insight discussion but not ready implemented yet.

Web services is an additional piece of software that provides a web API [7], exposes via HTTP, and can communicate using SOAP, REST, or XML-RPC.

Database links refer to direct access to database objects such as tables or views, based on specific requirements and restrictions. Some benefits of using web services are [13]: loosely coupled, can support RPC and document exchange and having a synch/a-synch function, solve interoperability issues, and easy to reuse.

C. Web Service Management

The Web services can describe using standard and formal XML notion called service description. The service description consists of the message format, operations, documentation, port, binding, and services [14]. The roles that exist in web services architecture are service provider, service requestor, and services registry.

The web services architecture consists of three entities [15]: service provider, service requester, and registry. Managing web services means setting the activities, rules, and roles on each component above. The management process can be summarized as follow:

1. Development
2. Registering
3. Publishing
4. Manage request and access
5. Maintain the performance
6. Troubleshooting
7. Monitoring

D. Concept of API Management

Recent research on managing data sharing and interchange mainly focus on API management, because it can be considered as the gateway for accessing the services behind, regardless it was a web service or other type of service.

We can consider all types of web services as an API, but not vice-versa [16], so for managing web services, we can adopt some practical approach in API. Based on this reason, we consider adopting some concepts from API management. Gartner modelling API ecosystem in the public sector, that provided by the government, as described in figure 3. As we

can see from figure 3, API can be produced by government agencies and facilitate data interchange between agencies (private), government agencies or businesses (open secured), or public (open public) [4].

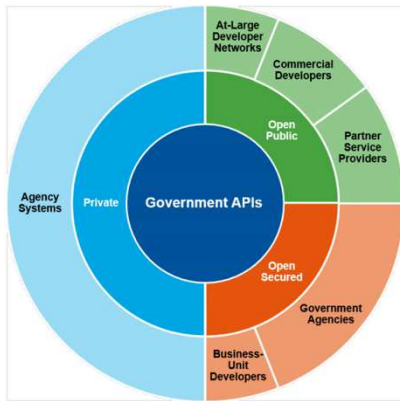


Fig. 3 API Ecosystem for Government Services [4]

Each category needs different treatment and policy on creating and using them. The policies, enforced by tools and the supporting system, will deliver the data interchanges through API accountable and reliable.

Medjaoui et.al.[17] introduced 10 pillars for API, that can be adopted for managing web services, as follow: strategy, design, documentation, development, testing, deployment, security, monitoring, discovery, and change management.

Gartner describes the challenges and considerations for publishing API on government, which are [4]: security, regulation, further regulatory consideration, and specification or standard.

E. Web Service Policy

For supporting the management process, web services need policies that can be divide into three categories [18]: versioning, QoS (Quality of Services) and security.

When service is published and used by the customer or service requestor, each modification on the services will impact the user. Some services usually need to modify for some reasons such as adding new functionalities, improving performance, or add new security features. In this process, the operation of the service can be added, removed, or revised based on user requirements.

Service versioning is a policy to ensure that the user knows the modification and has the mechanism to update the service when its changes.

QoS policy covers functional or non-functional properties that are established as the SLA of the services. It can cover the performance requirement, service availability, response time, thresholds, change management, and notification.

Security policy is an important part of data interchange. It covers security tokens, digital signatures and encryption.

F. Roles in Data Governance

DAMA-DMBOK, as a comprehensive guide, best practice, and framework for managing data in enterprises, defines data governance as: “the exercise of authority and control over the management of data assets”. DAMA-DMBOK has covered the process of data interchange in Data Integration and Interoperability (DII) issues on data sharing between

applications and across organizations. DII architecture can be achieved through application loose coupling techniques using services, API, or message queues [19].

Some practical articles in data management divide the roles on data governance into four types: data owner, data stewards, data producer [20], and data consumer or into three types [20]: data stewards, data owner and data custodian Data Governance Framework from Australian Government [21] also defined the data custodian as the staff that has responsibility for collecting and using data under specific policies and guidelines The role of data custodian also covered in President Regulation on “Satu Data” [22] as “walidata”, which defined as the unit who collect, check, manage and distribute data, from data producer, and providing access for data customer or users.

III. RESULT AND DISCUSSION

In this section, we explain the result on implementing a design thinking approach on designing the regulation for data interchange, writing the draft, and evaluating it.

A. Environmental Scanning

Environmental scanning aims to explore the present behaviors of individuals and groups in a location and identify the outcomes and its behaviors. It can be conducted by analyzing certain situations, scanning the input, material, influences, and technologies. The goal of this process is to find new opportunity areas, threats, and potential blind spots.

According to our research subject, we scan the situation in the existing environment and identify some relevant information that can be categorized into ten aspects as described in table 1.

TABLE I
ENVIRONMENT INFORMATION

No	Aspect	Main Finding
1	Problem	How to manage data interchange facility through web services, so they can deliver the services securely and well managed.
2	Organization	Regional ICT government office.
3	Role	As a facilitator for data interchange
4	Rule	Provide data interchange services, host web services, manage and control the web services
5	Existing condition	Lots of web services need to create, publish and manage. Lack of standard and procedure, lack of guide on operation and management
6	External factor	The need for data interchange is mandatory for supporting seamless services between government agencies.
7	Technology-Management	Through COTS software, but the feature is limited to use because lack of knowledge on customizes the monitoring tools.
8	Technology-Interchange method	Web services: RESTful Database direct link (db-link)
9	Registration	Manually through the portal
10	Standard	Not available

B. Participation Observation

Participant observation aims to capture the real stakeholder of the problem, identify the rule and role, and find the task need to do, the way they complete the task, and problems in the existing environment.

During the research, we observe the participants that consist of four stakeholders:

1. Data requestor: the unit that asked for the services. It can be between regional offices, external government agencies such as ministry or institution, commercial stakeholders such as banks or insurance, or public.
2. Data provider: the unit that provides the data which are another regional government office.
3. Data custodian: the unit that has a responsibility to provide the data interchange architecture, technology, and process, manage and monitor the process.
4. The service developer: the unit that has a responsibility to build and implement the data interchange technology.

The role of data requestor and data provider is matched with data customer (users) and data producer, refers to President Regulation on “Satu Data” [21] as a legal reference for defining regulation.

The task need to be done can describe as follow:

1. Handling the interchange request, including analysis, defining the interchange requirement, mapping into existing services, or deciding to make new services.
2. Facilitate the coordination between two agencies to gain understanding and cooperation between them.
3. Creating, registering, and managing the data interchange services.
4. Maintain the service availability and troubleshooting.
5. There is an additional function that needs to perform by the office, which is, as a data collector.
6. The regional ICT government office needs to collect certain significant data in regional areas to put in data-center to facilitate easy data sharing and report generation.

C. Open-to-learning Conversation

The open-to-learning conversation is the process for collecting the idea and emerging new options from all participants based on their experience, expertise, and knowledge. This process aims to search for the most suitable solution based on environmental behavior and consider the organization's capability to perform the new regulation, if it will be implemented, later.

We conduct this activity by performing regular meetings for each stakeholder and discussing the opportunity for each problem. To manage the process effectively, we divide the problem into some areas as shown in table II.

Some result we got from this stage can be summarized as follow:

1. General principle of data interchange that should be fulfilled by the regulation, which consists:
 - a. Supporting on data integration and Indonesia One Data program

- b. Data interchange should be integrated into e-government system and using data interoperability mechanism
 - c. Data interchange should be based on an agreement between data owner and data requestor, facilitated by a data custodian
 - d. The stakeholders should support the availability and continuity of the data interchange process.
2. There are two mechanisms of data interchange: through web services and database direct link (db-link), but the web services will be chosen as the preferred method in the future.

There is a need for collecting data from another regional government office, and the regulation should cover the process, including identifying the data domain priority that should be collected.

TABLE II
MAPPING OF PROBLEM AREA

No	Area	Data request or	Data provider	Data custodian	Service Developer
1	Request handling	x	x	x	
2	Documentation			x	
3	Web service specification		x	x	x
4	Security		x	x	x
5	Web service development		x	x	x
6	Monitoring and problem handling	x	x	x	x

D. Mapping

The mapping process is organizing the idea into a conceptual framework to explore the link between them and design the backbone for the policy content. We use some diagrams to collect and categorize the idea. The diagrams can be useful for analysing the context, prioritizing the subject, or removing the non-relevant or not important subject.

We categorized the idea into some groups such as stakeholders, process, type of interchange, scope, data resources, etc. Each group then mapped into the specific issues to resolve. For example, for stakeholders, we need to define the role and responsibility for data interchange, as described in Table III.

To organize the concept and idea, we made some diagram as follow:

1. Class diagram (figure 4) show the meta-model of the context on policy and the relationship between components.
2. Mind-map diagram (figure 5) shows the scope and issues of the data interchange policy.
3. Data interchange architecture design (figure 6) gives an illustration of the required infrastructure for support the implementation

TABLE III
RESPONSIBILITIES OF STAKEHOLDERS

Stakeholder	Responsibilities
Data provider/ data owner	Ensure data availability Ensure data security Preparing and publishing data dictionary Informing the problem on data resource, if exist Analyse/approve data request Provide sectoral statistic data Establish data access permission Collecting data on specific area
Data requestor	Requesting data interchange Using data with secure and given authority Inform the problem Utilize data as requested
Data Custodian	Ensure the availability of data interchange infrastructure Ensure the data interchange mechanism perform seamless Provide data interchange service through middleware Giving access for data requestor Ensure data security Follow up the data interchange problem report Monitoring the data interchange usage and performance
Service Developer	Build or modify middleware (web service or db-link) based on approved request Ensure the middleware (web service or db-link) comply with standard specification Preparing data interchange documentation (web service specification) Publish web service Register web service

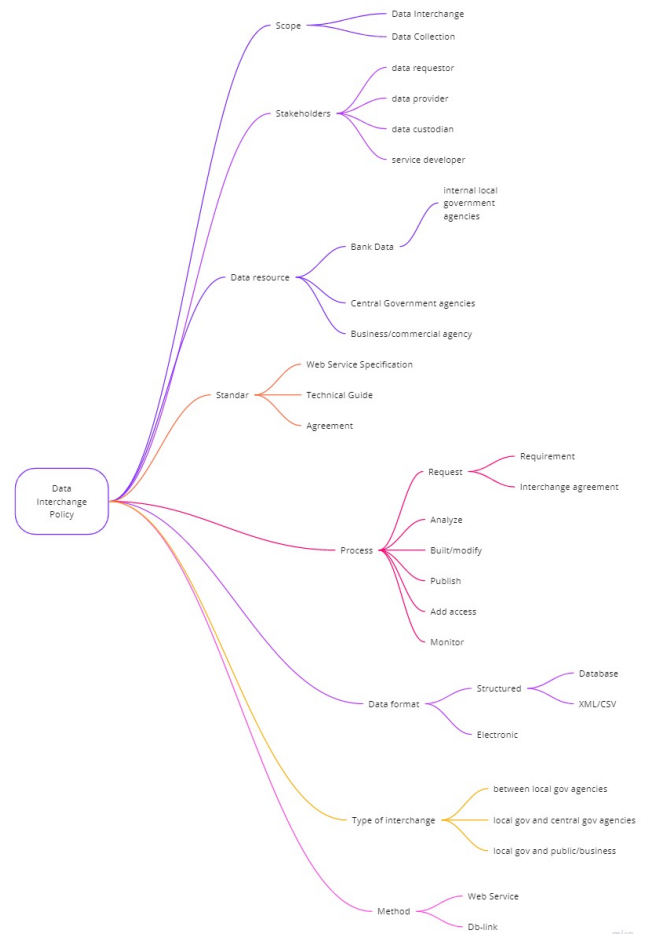


Fig. 5 Mind-map of the scope of data interchange policy

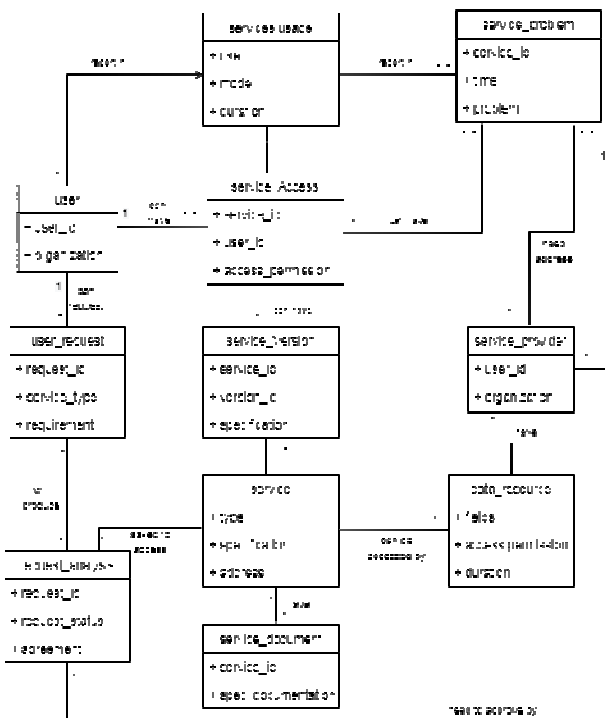


Fig. 4 Meta-model of Data Interchange Policy

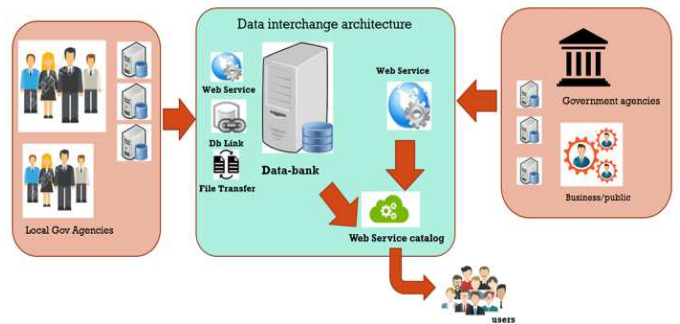


Fig. 6 Data Interchange Architecture

E. Sense-making

In the sense-making process, we adjust the content based on the condition in the organization. We add or modify some detail based on the testing result. In the first version, we build the draft of the policy based on ideal conditions or literature references. After the draft is available, while reviewing the content, we also conduct some simulations to get insight into the real condition. As the result, we then made some adjustments such as:

1. Simplify the document that includes:
 - a. Data dictionary description, metadata description
 - b. Web service specification
 - c. Test report
2. Simplify the process that includes:
 - a. Analyse the request

- b. Test the web services, more specific on security and performance test. Security test is limited into controlling access, and performance tests is limited into response time.
3. Prepare the appendix of policy such as:
 - a. Detail procedure
 - b. Technical guide

F. Policy Structure

The main goal of this research is to provide the general framework for developing the policy for data interchange. We propose the structure of policy as derived from meta-model and mind map, as follow:

1. General principle of data interchange
2. Objective, purpose, and the scope of policies
3. Object: Data resource
4. Stakeholders: data provider (data owner), data custodian, data requestor
5. Role and responsibilities
6. Type of data interchange
7. Model of data interchange
8. Mechanism for data collection and interchange
9. Content of data interchange agreement
10. Monitoring and evaluation

G. Policy Draft

As the result of this research, we attach some samples of policy contents as an illustration

1. Sample of Policy Content

Chapter III consists of the role involved in the data interchange process. Clause 7 of this chapter expresses the role that involved in the data interchange process. Clause 8 explains the detailed definition of “data requestor” as mentioned in previous clauses.

Chapter III - Data Resource and the Officer

Clausa 7

- (1) The Data Collection Officer consists of:
 - a. Data custodian; and
 - b. Regional government office, as data provider;
- (2) The Data Interchange officer consists of:
 - a. Data custodian;
 - b. Data provider/data owner; and
 - c. Data requestor (user)
- (3) Data custodian is performed by regional ICT government office.
- (4) Regional ICT government office can use the data bank as resource for data interchange and analysis on decision support policies.

Clausa 8

Data requestor as mentioned in clausa 7 poin (2) number c, can be categorize by 3 groups:

- a. Regional government office in the same area
- b. Government office or government institution in central government
- c. Public (business, citizen and non-government organization)

2. Appendix

The appendix consists of standard procedures and technical guides as detailed explanations for implementing the policy.

The policy consists of 4 procedures: procedure for data collection and three data interchange procedures for covering the data interchange process among regional government office, between regional government office and central government or external entities (companies, non-government organization), and for public services (citizen). Figures 7 and 8 show the procedure for data collection and data interchange among regional government offices.

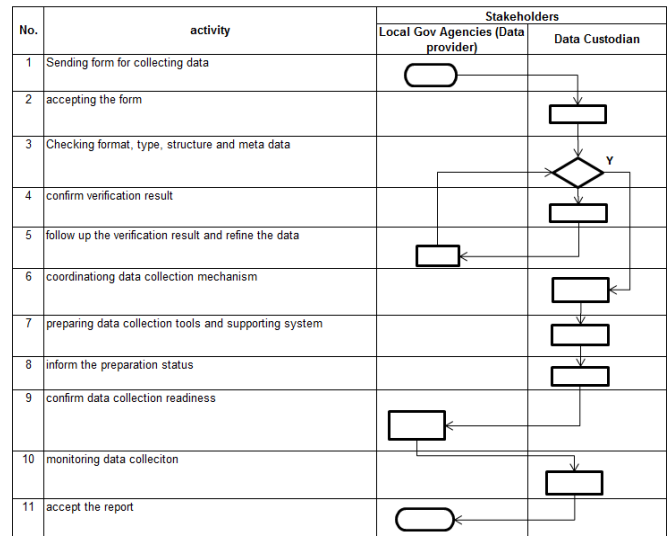


Fig. 7 Procedure for Data Collection

The technical guide consists of the form, reporting template, and template for data interchange specification, and the guide for filling the form and preparing the document. Figure 9 shows the sample of the testing report template as attached in the technical guide. The testing report is a result of activity no.6 in the procedure for data interchange among regional government offices as shown in figure 8.

H. Policy Evaluation

We conducted some simulations for testing and evaluating the proposed policy. The simulation consists of a role-playing game and mapping existing problems and documents into procedure and template. Table IV show sample of issue that arises on simulation of policy implementation.

Figure 10 shows the sample result of the mapping document. The result show that the existing document is matched with some fields on the template but the position of information needs reorganized. In figure 10, “Web Services for PTSP” is the name of web services for facilitating the data interchange between a regional government office (PTSP) and another application. The web service created by a data custodian and the creator of the web service also has the responsibility for preparing the web services’ technical specifications.

The evaluation result shows that the policy is feasible to implement and the organization has sufficient capability on running the policy and procedure. The people, processes, and technologies are sufficient for supporting policy implementation. The lack of some document contents is

understandable because the previous documents are made not refer to standard technical guides or procedures.

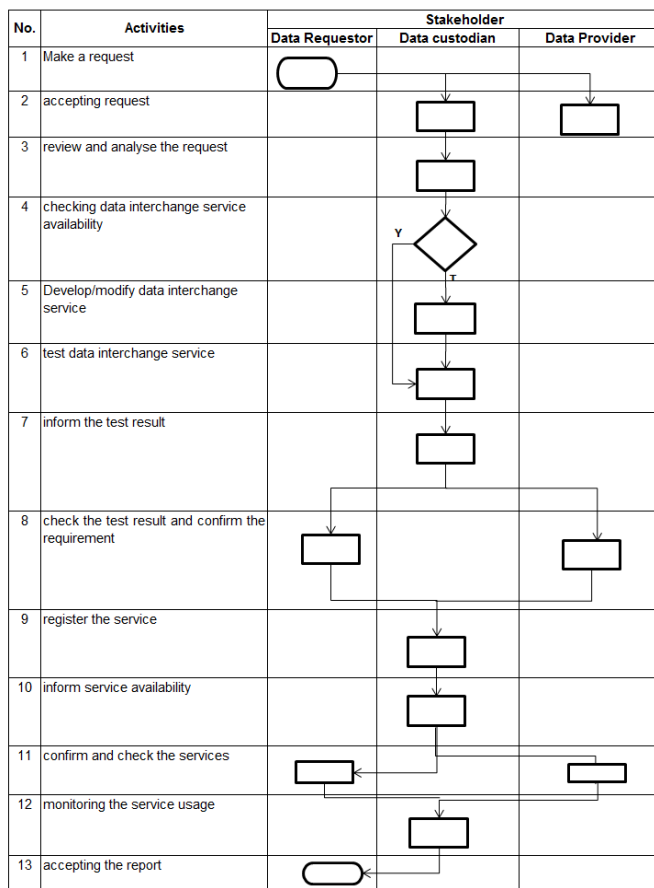


Fig. 8 Procedure for Data Interchange among Regional Government Office

Technical Guide for Data Interchange

I.3.b. Testing Report

The testing report should be written following this template

Cover

Document Information

Document Title	Testing Report		
Nama Data			
Document File Name	Testine WS XXX.xlsx		
Document Referred	[number of document of data interchange request]		
Revision Number			
Created By			
Created Date			
Phase			
Status			
Testing Date (Start - Finish):	14/10/2016	Until	14/10/2016

Test Environment

(describe the environment/configuration for test : server name, directory name, computer name, etc)

Summary

WS_Name	Test_Type	Total Test Case	Pass	Failed	Pending
WS_XXX		73	73	0	0
WS_YYY					
Grand Total		73	73	0	0
Percentage		100%	100%	0%	0%

Fig. 9 Template for data interchange testing report as attached on Technical Guide for Data Interchange

TABLE IV
RESOLVED ISSUE FROM POLICY IMPLEMENTATION SIMULATION

No	Problem	Causes	Resolved by
1	Data interchange request is not easy to track and documented	No form for handling the request	Procedure and form for data interchange request
2	Non-standard web-services format	No standard guide	Standard and technical specification of web services
3	No clear information about existing web services specification	Lack of web service documentation	The regulation that ordering all the web services should be registered and having technical document
4	User accessing web service with low performance or error in data delivery	Lack of standard procedure of testing web services	Testing procedure and standard document for reporting

Data Interchange Subject		Web Services for PTSP			
Document's Creator		Data Custodian			
Section	Technical Guide for Data Interchange	Availability			not available
		Available and comply	position	content	
Form for Data Custodian	No	Subject			
	II.5.1	Verification Data interchange analysis			x
		Date		x	
		User		x	
		Data domain		x	
		Data provider		x	
		Data interchange specification analysis		x	
		risk if not available		x	
		priority			x
		follow up			x
		target date			x
		User			x
		Group			
		II.5.2. Technical Specification		x	
		Cover, approval sheet			x
		revision note		x	
		Web service type description		x	
		scope		x	
		definition and term			x
		WS profile			x
	user		x		
	function		x		
	data security policy		x		
	QoS		x		
	services interface			x	
	message			x	
	data element			x	
	service implementation				
	appendix				
	Referensi				

Fig. 10 Procedure for Data Interchange between Regional Government Office

IV. CONCLUSIONS

Data interchange is a mandatory requirement to support the rapid development of the e-government system. Lack of policies, standards, and procedures can be an obstacle to the data interchange process because it usually involves cross-

functional and cross-organizational processes. The objective of this research is to provide a framework and a draft data exchange policy that can be implemented at the regional ICT government office. The draft policy is prepared to refer to the data management principles of DAMA-DMBOK, the President Regulation "Satu Data", and adopts the concepts and best practices of API management. We use the design-thinking approach in designing the policy and making some adjustments based on the capabilities and conditions of the organization in implementing the policy. The evaluation results show that the proposed standards and technical guidelines made based on the policy, are appropriate to support the data interchange process in the organization where the research is located.

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