Designing an interoperable social assistance health insurance validation system

K A Seputra¹ and K Y E Aryanto²

¹Department of Informatics Management, Faculty of Engineering and Vocational, Universitas Pendidikan Ganesha
²Department of Computer Science, Faculty of Engineering and Vocational, Universitas Pendidikan Ganesha

Email: ¹agus.seputra@undiksha.ac.id, ²yota.ernanda@undiksha.ac.id

Abstract. Many social assistance programs must be managed by local governments, including health insurance contribution assistance (PBI). The government must be able to distribute social assistance recipients equally and accurately. The government must ensure that only one family member is registered in one of the social assistance schemes, such as PKH (Program Keluarga Harapan), PBI (Program Bantuan Iuran), or BLT (Bantuan Langsung Tunai). Therefore, interoperability of data between systems is important to check and validate the membership of potential participants in one assistance scheme. Valid data is the key in data exchange, especially PBI data that has not been processed optimally. However, there are still inconsistent and incomplete data on the annual PBI participants. The first thing that can be done is to validate PBI data. Through the PBI data validation system, validation can be carried out more thoroughly by utilizing the supported data from the API of the civil registration and the Bridging BPJS. With the validation system, PBI data management becomes more accurate and has fast access to facilitate reporting compared to the previous system that still used Excel. The PBI validation system also supplies valid PBI data to related systems that have registered with the API services. By using JWT in RESTfull API, system interoperability could be done securely.

1. Introduction

The Government of the Republic of Indonesia through the Ministry of Social Affairs is committed to improving the quality and recipients of Health Insurance Contribution Assistance (PBI). This program is a form of health protection needed by the less fortunate. The government wants the recipients of this assistance to be truly entitled and following their qualifications [1]. PBI participants are people with very low, or even no, income who have been verified and validated in detail by the government of the province and district before being determined as integrated data by the Minister of Social Affairs. The social assistance is given under coordination with the Ministry of Finance and/or heads of the regions, as well as related agencies. The Ministry of Social Affairs annually updates the data in collaboration with the Regional Government.

Bangli Regency Social Service is a government agency that plays a role in PBI administration services. These services include requests for data improvement, recommendations for deactivating PBI membership, registration of replacement participants, and PBI administrative reporting. PBI data management as a data source at the Ministry of Social Affairs must be able to run well to provide targeted services. The implementation of PBI administrative services at the Bangli District Social Service has...
been running well but has not been optimal in managing PBI data. Some PBI administrative activities are still carried out manually, so that problems are often found, including reporting that does not meet expectations, data input errors, to PBI data storage problems. Incomplete participant data and duplicate data is one of the consequences of data collection that is not optimal, resulting in a long administrative service process. This also resulted in the unavailability of fast, precise, and efficient information accessibility for related systems to support an integrated government system.

To explore various potentials and problems that exist in the current digital era, it is not enough to use manual data processing which causes processing delays. Therefore it is important to present data in digital form that can be trusted more quickly and efficiently. The use of electronic data also has a strategic role in improving quality and facilitating the delivery of public services to accelerate efforts to achieve development goals, namely a just and prosperous society [2]. The development of the PBI Data Validation Information System can be one step to create valid electronic data. This system is also one of the supporting systems in realizing the Government Information System (SIP) of Bangli Regency which is connected to various parties with API services, both government and private elements. As is well known, Bangli Regency is very serious in supporting central government programs to develop good, transparent, and efficient e-government by applying information and communication technology in government administration [3]. So that E-Government services come with high accessibility, reduce information distribution channels, authority, development responsibilities, and interoperability of data between systems that occur quickly and accurately. The realization of data integration between systems is also an effort to support the Electronic Based Government System (SPBE) program launched by the Central Government.

2. Method

Decision-making that involves many sectors must be balanced with the ability of an information system that is fast, reliable, and secure in providing data from various sectors. Even though it is currently known that there are still many SIPs being developed which are sectoral, separate, and heterogeneous. Previous research related to the integration of PBI with Jamkesda found several obstacles including membership management, technical verification, and validation of the poor. So it takes the role of the District Social Service to verify and validate the Regional PBI membership data [4]. Regarding data management, verification, and validation, technology is needed to improve the regional PBI membership data as a whole [5]. Interoperability between SIPs is an important step that must be implemented immediately [6]. Interoperability is a term that refers to the ability of two or more systems to communicate concerning technical requirements and semantic concepts to exchange data, interpret, and use data across different systems [7]. The interoperability design is intended to validate and exchange PBI data based on the relationship between the database schema and web services provided by the Dinas Kependudukan dan Catatan Sipil (CAPIL) API and BPJS Pcare Bridging System. RESTful HTTP and SOAP / WSDL are two widely used web service architectures, but RESTful has much better performance and scalability compared to SOAP / WSDL web services [8]. This research was conducted in two stages, namely the development of the PBI data validation system followed by the provision of Application Programming Interface (API) services related to PBI data. Users of the data validation system were social service employees who are responsible for administering PBI. The API services developed using the Restfull API framework were intended to validate and provide valid PBI data for related systems requiring data access. The data access mechanism used token authentication so that data exchange can be carried out safely. PBI data validation systems and API were developed using the Codeigniter framework and MySQL as the database. The research scheme is shown in Figure 1.
The developed API service has the main function of validating PBI data and providing valid PBI data for systems that require PBI data access.

- The PBI system through the API client utilized population data from CAPIL API and BPJS membership data from the BPJS Pcare Bridging System as supporting data for validating prospective PBI participants [9][10].
- Data that have been declared valid with a validation mechanism, were the main data distributed to the related system through the API server.
- The API server can be used by the Education Office System to validate prospective recipients of School Assistance.
- The API server service also allows other social assistance management systems to use PBI data to ensure that potential beneficiaries were not registered as PBI participants.
- API services can be utilized for the development of PBI registration mobile applications.

This research used the Software Development Life Cycle (SDLC) model which consists of seven stages, namely requirements, specifications, design, code, test, debug, and maintenance. The requirements were observed based on the characteristics of the data connectivity that are required by each representation of institutions that were involved. These requirements determined the specification of the planned system which became the base of the design of the system, including the hardware and network infrastructure, software, database, and interoperability schemes. After the coding was conducted, the application should be debugged for any possible abnormalities or errors. The up-and-running system should be maintained and maintenance to provide up-to-date requirements follows the developments of recent technologies.

3. Results and Discussion

3.1. Requirements
In the requirement analysis, problem identification was carried out against the object to be studied. Problem identification was carried out using observation methods and interviews were conducted at the Bangli District Social Service. Here are some of the problem identification results found.

- PBI participant data collection was not optimal. Many PBI participant data entries were incomplete, resulting in invalid PBI data.
- PBI data consists of PBI funded by APBN and PBI with APBD funding sources.
- Therefore, the first thing to do was to validate the PBI APBN data related to incomplete data and duplicate data.
- Valid PBI APBN data were used to validate applications for PBI APBD. This is an important thing to ensure that only one household head was recorded as a recipient of one of the PBI funding schemes.
In addition to ensuring the validity of PBI APBN data, validation also aimed to ensure that potential participants have not been registered in the BPJS system as PBI participants.

As an implementation of SPBE, the interoperability of PBI data between Regional Government Information Systems (SIPD) was required.

One of the purposes of interoperability was to validate the data of poor students, where PBI data is a reference.

There were so many social assistance schemes that local governments must manage, especially to ensure that one family only gets one assistance scheme. In this regard, other systems, especially those related to social assistance management, can use PBI data to ensure that potential beneficiaries are not registered as PBI participants.

The PBI system can be developed into a mobile application to serve registration for PBI participants.

3.2. Program Specifications
It was a stage where customer requirements have been defined into system requirements. From these activities, a detailed specification of the software product, including its function, identification of information to be processed, the function and performance required, system behaviour, hardware requirements, and supporting software in its development were processed. Based on the description of problem identification at the requirements analysis stage, some of the functional requirements that the system can provide were as follows.

- The system was developed based on a website that can accommodate PBI data digitally so that it is easy to access and reporting.
- The system provided two types of PBI data, namely PBI APBN and PBI APBD.
- In the system, there were features for checking and validating PBI participant data.
- The system can recognize duplication of PBI recipient data in both the APBN and APBD.
- The system can provide data interoperability services to SIPD securely via API services.

3.3. Design
At this stage, the results of the requirements analysis and system specifications were formed in a model. The model must be able to identify and analyze how data was constructed, how functions were implemented as software architecture, how detailed procedures were implemented, how interfaces were characterized.
3.3.1. System Architecture. The system was developed using the Codeigniter framework with RESTfull API as a third party library to handle API services. The API service was designed to be able to exchange data securely using a JSON Web Token (JWT). JWT is an API authentication mechanism that uses a token in the form of a string consisting of a header, payload, and signature [11]. JWT tokenization is fast because the tokens created with the HMAC encode are known to be fast and lightweight, and also the tokens are not stored on the server [12]. The token was obtained after the user successfully login using the username, password, and SecretKey inserted in the HTTP request header every time you exchange data on the API. Figure 3 can explain API Architecture.

![Figure 3. API Architecture.](image)

3.3.2. Activity Diagram. Activity diagrams can describe the workflow activities of a process in a system. This diagram was also used to group the display rules of a system. Some of the important activities, including participant validation and data interoperability mechanisms, were described in the activity diagram. The validation process was the most important thing that must be done clearly and thoroughly. For this reason, the validation mechanism used external resources in the form of Population Data from API CAPIL, and BPJS Participation Data obtained through the BPJS Pcare Bridging System as supporting data for users, in this case, the validation operator. Validation was carried out by comparing PBI participant data related to national identity number (NIK), family head number (NO KK), name, place of birth, district, and type of participant with supporting data from API CAPIL and API BPJS. If the data has been declared correct, and following with the API data, the user can be said as valid. However, if the data do not match, the user can make corrections and re-validate them. Figure 4 explains how the data validation workflow for PBI participants.

![Figure 4. PBI Participant Validation Activity Diagram.](image)
PBI data exchange that has been declared valid using JWT was only to the registered system. The system required PBI data to register to gain access consisting of a user name and password. Users who have been activated by the administrator can generate a secret key to request a token. Tokens were obtained at the request of the user using a username, password and Secret Key. The token was inserted into the HTTP Request header for each data exchange. By using a token, data exchange was secure according to the level of access given. JWT authentication can be seen in Figure 5.

3.3.3. Entity Relationship Diagram. Entity Relationship Diagram (ERD) explains data flow based on related objects in a system. Figure 6 is the Physical Data Model (PDM) of the PBI system which can explain ERD more specifically, including details of data storage in the database which are represented in the form of rows and data types.
PBI participant data in excel that have been imported by the operator were stored in the participant table, while the financing scheme was stored in the APBD and APBN tables. In this data, some participant data were found to be incomplete and registered in the two financing schemes so that the Social Service needed to validate the data. The validation mechanism described in Figure 4 was the process of validating and correcting participant data related to personal data, addresses, and financing schemes using support data obtained from API Capil and Bridging BPJS. Users can validate the data that were declared appropriate so that the validation status of the participants became valid. Then API users who have been registered in the user table and already have an active secret key in the application table can use valid participant data according to the mechanism described in Figure 5.

3.4. Implementation
The PBI information system was developed based on the website using the Codeigniter framework, responsive design was developed using the bootstrap framework, the database used the MySQL DBMS, and the API used the RESTful API.

3.4.1. JSON Format. JavaScript Object Notation (JSON) is the format for data exchange in the REST API because it is lightweight, easy to read and write, and is translated by a computer so that it is easy to implement [13][8]. JSON is very well used in data exchange in a client-server topology [14]. There are two JSON models that can be used, namely the object model and the Array. Objects were used for single data exchange, while arrays are used for multiple data in the form of lists or sequences of data [8]. In data exchange, there must be an object that can define the reporting data briefly. These objects were data, errors, and meta, this data object is called the top-level [15]. Top-level data were used to represent the main document containing the main data, errors to provide information to the user regarding the error description, and the meta-object contains some additional information related to response data.

```json
{
  "status": true,
  "code": 00,
  "data": {}
}
```

3.4.2. Token. Tokens on JWT expired 24 hours after being created. Tokens can be created several times and the new token will not cancel the old token, as long as the old token does not expire. Tokens can be obtained through the login process using the POST method on the URL {base_url}/services/rest/token. Several parameters needed to obtain a token can be seen in table 1.

| Field       | Data Type | Description     |
|-------------|-----------|-----------------|
| SecretKey   | string    | Consumer key    |
| Email       | string    | Consumer Email  |
| Password    | string    | Consumer Password |

Table 1. Parameter Get Token.
3.4.3. Participant Details. Participant API to get PBI participant details was based on NIK parameters. To use this API, a token must be inserted in the header of the HTTP Request which was sent by using the POST method in the URL {base_url}/services/API/participant. The required parameters can be seen in table 2.

Table 2. Parameter Get Participant Details.

| Field   | Data Type | Value | Description |
|---------|-----------|-------|-------------|
| Authorization | string | Token | Header |
| NIK    | string   | NIK   | Body       |

3.5. Prototype

The web-based PBI system has several functions according to the system design based on an analysis of user requirements.

- The system can manage PBI data consisting of PBI APBN and PBI APBD.
- The system can provide reports in the form of recapitulation and graphics.
- The system can identify participants registered in the two PBI financing schemes.
- The system can validate participant data.
- The system can provide data interoperability services for valid PBI participants data via API securely.

3.5.1. Data Validation page. Validation activities greatly affected the quality of data to be shared and for that, the operators were assisted by the display of population support data from API CAPIL, as well as BPJS membership data from the BPJS Pcare Bridging System. With the presence of this supporting data, users can validate more thoroughly. Figure 7 shows a validation page where users can validate or correct data.

![Figure 7. Participant Validation Page.](image)

3.5.2. API Documentation page. The documentation for using the API, from registration to data exchange mechanisms, was presented on the documentation page as shown in Figure 8. The documentation page contained a code snippet in the PHP programming language and an example of a
This was intended to provide complete usage documentation to make it easier for users to implement API services.

Figure 8. API Documentation page.

3.5.3. API Registration Form. The user filled in the registration form provided on the documentation page can be seen in Figure 9. Users can use the API after an account has been validated by an administrator.

Figure 9. API Registration Form.

3.5.4. Generate Secret Key Form. To be able to get a token, the user needed a Secret Key that was inserted in the body when making a token request. In figure 10, Secret Key allowed users to have several API services for one account.

Figure 10. List of Secret Keys.
3.6. Prototype Testing

Some tests to ensure that the PBI system, particularly the API services, were carried out according to design. Some of the functions needed to be tested were the data validation module, user authentication, token use, and data requests. The testing was carried out using the black-box testing method with several test samples. API module testing was carried out using Postman software based on several case examples. In table 3, several test scenarios were discussed.

| Input                         | Indicator                                                                                                                                       | Output                                                                                                           | Result |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------|
| User’s login                  | The system provides access based on a username and password                                                                                  | The home page appears                                                                                           | Success |
| User displays participant     | Participant data can appear                                                                                                                     | The participant detail page appears with the financing scheme                                                  | Success |
| details                       | The system can validate participant data                                                                                                        | The system stores the results of the PBI data validation                                                        | Success |
| User validates participant    | The system can recognize duplicate data                                                                                                         | The system can display duplicate PBI participant data                                                            | Success |
| The user performs a doubling  | The system can store API service data                                                                                                           | The system gives a Secret Key                                                                                   | Success |
| data search                   | The system can perform authentication according to the username, password and secret key                                                       | Users get access tokens according to their username, password, and secret key                                    | Success |
| User can register API         | The system can respond to data according to user access rights                                                                               | Users get data on request                                                                                       | Success |
| User request token            |                                                                                                                                                |                                                                                                                 |        |
| User request participant      |                                                                                                                                                |                                                                                                                 |        |

4. Conclusion

Based on the tests carried out at the implementation stage, the results showed that the PBI data collection system prototype was already running well for storing PBI participant data, recognizing data duplication, and being able to validate PBI participant data, as well as easy and fast reporting. The features contained in the system followed the data validation needs of PBI participants and have been based on relevant supporting data. PBI data that has been declared valid then were shared with several related systems that have been registered through the API service. Testing the API service using Postman software revealed that the API service was running well. The process of validation, data retrieval, and reporting were faster and more accurate than the previous system that still used Excel.

References

[1] Kabiro Humas Kemensos RI 2019 PEMERINTAH TINGKATKAN KUALITAS DATA PBI JK, PENERIMA BANTUAN LEbih TEPAT SASARAN RILIS Kementeri. Sos. RI
[2] Sudianing K and Seputra K A 2019 PERAN SISTEM INFORMASI PEMERINTAHAN DAERAH DALAM MENUNJANG PENINGKATAN KUALITAS PERENCANAAN PEMBANGUNAN DAERAH Locus 11 112–33
[3] Aryanto K Y E, Abyong I W, Seputra K A, Pradnyana G A and Paramartha A A G Y 2020 Design of the Integrated Health Information System in the District of Bangli 394 240–5
[4] Rukmini R, Ristrini R and Tumaji T 2017 Integrasi Jamkesda dalam JKN bagi PBI di Kota Blitar dan Kota Malang Bul. Penelit. Sist. Kesehat. 20
[5] Ahmad D 2016 Faktor-Faktor Penghambat Pendataan Penerima Bantuan Iuran (PBI) BPJS Kesehatan Dikelurahan Heledululaa Utarakeciamatan Kota Timur Kota Gorontalo Manaj. Sumber Daya Mns. III 119–28
[6] Istiyanto J E and Sutanta E 2012 Model Interoperabilitas Antar Aplikasi e-Gov J.
[7] MENTERI KOMUNIKASI DAN INFORMATIKA and INDONESIA R 2013 PERATURAN MENTERI KOMUNIKASI DAN INFORMATIKA REPUBLIK INDONESIA NOMOR 7 TAHUN 2013 TENTANG PEDOMAN PENERAPAN INTEROPERABILITAS DOKUMEN PERKANTORAN BAGI PENYELENGGARA SISTEM ELEKTRONIK UNTUK PELAYANAN PUBLIK vol 53

[8] Rathod D 2017 Performance Evaluation of Restful Web Services and Soap / Wsdl Web Services Int. J. Adv. Res. Comput. Sci. 8 415–20

[9] BPJS Kesehatan Webservice PCare

[10] Dinas Kesehatan Kabupaten Batang 2018 Overview Bridging System BPJS Pcare Versi 3.0 Dev

[11] Gunawan R and Rahmatulloh A 2019 JSON Web Token (JWT) untuk Authentication pada Interoperabilitas Arsitektur berbasis RESTful Web Service J. Edukasi dan Penelit. Inform. 5 74

[12] Rahmatulloh A, Gunawan R and Nursuwars F M S 2019 Performance comparison of signed algorithms on JSON Web Token IOP Conf. Ser. Mater. Sci. Eng. 550

[13] Belkhir A, Abdellatif M, Tighilt R, Moha N, Guenheneuc Y G and Beaudry E 2019 An observational study on the state of REST API uses in android mobile applications Proc. - 2019 IEEE/ACM 6th Int. Conf. Mob. Sofw. Eng. Syst. MOBILESoft 2019 66–75

[14] Agocs A 2018 A web service based on RESTful API and JSON Schema/JSON Meta Schema to construct knowledge graphs 2018 Int. Conf. Comput. Inf. Telecommun. Syst. 1–5

[15] Anon Latest Specification (v1.0) www.jsonapi.org