

Fig. 3 flow chart of query

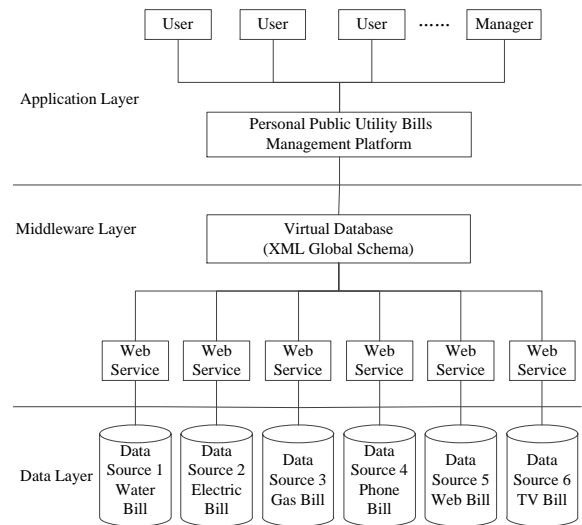


Fig. 4 Structure of personal public utility bills management platform

5) Gather the query results and send to results processing module.

6) Results processing module transform the XML format into target format.

7) Application will show the results to the user in a particular interface.

#### D. Logical Level

Based on the above process, the whole system design for three logical levels, they are data layer, middleware layer and application layer (from bottom to top), as shown in Fig.4.

1) *Data Layer*: Data layer are provide data for system and in the bottom of the system. Data sources are utility systems in different data structure, they can be a variety of structured data, such as Oracle, SQL Server, Access and other data in a relational database, also can be a semi-structured or unstructured data.

2) *Middleware Layer*: Middleware layer has two parts, the data source wrapper and a virtual database [7]. In this paper, the data source wrapper is Web Service. It can transform the heterogeneous data into a unified XML format and provide a consistent view to the application layer. Create a Web Service for each of the data source, and then use the WSDL to the registration Service centre. When used to build a new integration, integration side firstly send search requests to the registry to collect and select the appropriate data source, and then get the data from the data source through the SOAP protocol. The transformed data will present a unified view in virtual database, and the virtual database does not provide specific physical space, its main function is integrating a variety of heterogeneous data sources through the data source wrapper and providing a global data model based on XML which makes the upper applications to access the service easily.

3) *Application Layer*: Application layer is the user interface, including Web browser, application program and other various customer applications. It can select targeted

access mode and provide query interfaces to users according to the actual needs of users.

#### V. Summary

This paper combines the middleware and Web Service technology to come up with a method to integrate heterogeneous data in Personal Public Utility Bills Management Platform. This method shields difference in data structures, makes the heterogeneous data sources become transparent and realizes the dynamic integration of heterogeneous data in a web environment.

This platform provides multiple functions and helps the users to overview the different kinds of utility bills. It's very convenient for the management and operation of utility bills for both individuals and government.

This system has strong scalability and compatibility because of the unified XML format, and it's convenient to perfect the system and extend the function of platform in the future.

#### References

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