Research on Integrated Technology Based on A Wind Turbine

Hu Tao[1], Yuehong Pan[1], Shengjun Yuan[1], Chuan Yang [1], Zhijiang Xie[2]

[1]*Chongqing CEPREI Industrial Technology Research Institution, Shapingba, Chongqing, 401332, China*
[2]*State Key Laboratory of Mechanical Transmissions, Chongqing University, No. 174 Shazheng Street, Shapingba District, Chongqing City, 400044, China*

Abstract

With the influence of economic globalization, the manufacturing mode of network operation has become a highly efficient means to improve the production efficiency of enterprises, and the internal collaboration between enterprises has become more and more important. Multi-mode operation and integrated optimization technology have become the main problem facing the development of manufacturing information technology, and is a development trend of manufacturing information construction. This paper establishes a multi-mode operation system and integration technology research based on wind turbine, which provides a certain technical basis and operation guarantee for the multi-mode organization and operation of wind turbine [1].

Keywords

integrated wind turbine platforms

1. Introduction

In recent years, the wind power industry, as a clean energy and renewable energy, has been developing rapidly under the vigorous support of national and local industrial policies. Wind turbine products are a complex electromechanical system, which is assembled from wind turbines, transmission and control mechanisms and towers, each of which is assembled from different kinds of mechanical and electronic parts [2]. At the same time, wind turbine products require regular repair and maintenance in the service process, and professional equipment and professional technicians are needed to complete the repair and maintenance of wind turbine products. Therefore, the design, manufacturing and O&M service process of wind turbine products require close cooperation and collaboration throughout the industry chain, including upstream raw material suppliers and parts suppliers, midstream host plants and assembly bases, and downstream wind turbine users.

The networked collaborative designs and manufacturing of wind turbines involves the whole product life cycle process, covering design, manufacturing and operation and maintenance, and involves different information systems within and between enterprises, and different suppliers of information systems, and there are phenomena such as system heterogeneity and semantic divergence, which cause difficulties in exchanging information between information systems in each link. Therefore, it is necessary to study multi-mode operation and integration optimization technology for solving the problem of data exchange between various information systems in the design, manufacturing operation and maintenance links, so that various different manufacturing enterprises can realize comprehensive sharing and work collaboration in manufacturing resources, computing resources, information resources, knowledge resources, expert resources, and equipment resources on a global scale.

AIoTC2022@International Conference on Artificial Intelligence, Internet of Things and Cloud Computing Technology
EMAIL: *Corresponding author's e-mail: 373288728@qq.com (Hu Tao)

2. Integrated Technology

2.1 Integrated Technology

Information integration between heterogeneous systems through information integration bus is one of the effective means to solve the integration of various information within and between enterprises and realize the interconnection between different information. Through the information integration bus to carry out information integration, the integration between various information systems is no longer the original direct exchange of data integration, so that the whole integration processes structure is simplified, and at the same time will effectively reduce the coupling degree of integration between various information systems, so that the whole integration mode of intelligent manufacturing becomes flexible, and the scalability and adaptability of integration performance is enhanced[3].

2.1.1 Establishing a system semantic mapping-parsing model

The standard conversion protocol of information defines the formatting scheme of standard information, which is mainly used to realize the uniform conversion of information between different application systems and different data formats, so as to achieve the purpose of consistent understanding of information between enterprises. It is actually a translator that converts the information output from the upper application system interface into a standard format for transmission, and then restores it according to the requirements of the destination application system.

In the standard conversion protocol of information, two models are mainly studied: the common information label model and the mapping model of information. The generic information label model is used for the unified expression of various exchanged information in networked collaborative design and manufacturing, and solves the problem of conversion between different data formats; the mapping model of information, on the other hand, carries out the corresponding conversion between information in standard formats and local application systems according to the generic information label model, and is used to solve the problem of conversion of information between different application systems. Through the cooperation of the above two models, the conversion and integration of information between different data formats and different application systems are realized. The process is shown in Fig1.

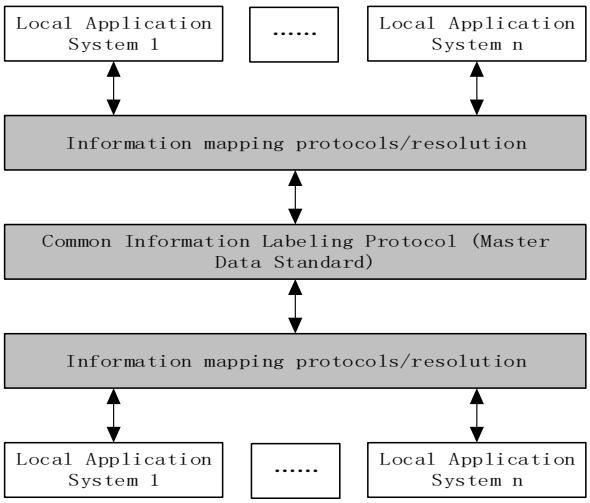

Figure 1. Systematic Semantic Mapping - Parsing Model

2.2 External operation mode of the integrated bus of a wind turbine

According to the heterogeneous system integration operation model proposed above, the external operation model for constructing an integrated bus of a wind turbine is shown in the following **Figure 2.**

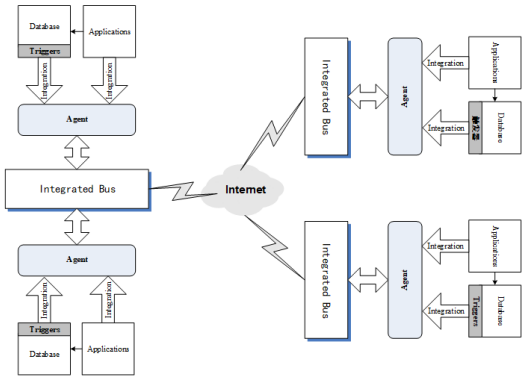

Figure 2. External operation mode of the integrated bus

The integration of enterprise information technology heterogeneous systems can be divided into information integration, functional integration, process integration and comprehensive integration, but fundamentally, it mainly includes information integration and functional integration. For information integration, the main idea is to synchronize the database changes of heterogeneous systems through the integration bus, so as to realize information integration based on database level; for functional integration, the main idea is to carry out unified interface conversion through the integration bus to realize the decoupling of interface changes of heterogeneous systems, and to carry out interface mapping and interface data conversion of heterogeneity. In order to realize the connection between information system and integration bus, an Agent (intelligent agent) is established as an intermediate layer between them. To facilitate the deployment of integration bus, the unified interface conversion module in integration bus, which is more coupled with information system, is put into Agent.

2.3 Integrated integration of wind turbinedesign, manufacturing, operation andmaintenance based on integrated bus

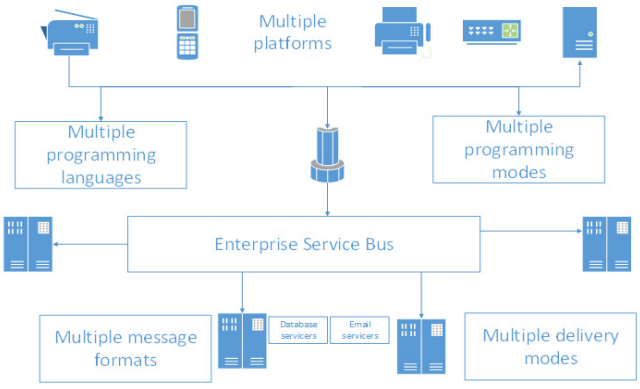

Figure 3. All-in-one integration model

The design, manufacturing and O&M of a wind power company involve different systems, PLM system, ERP system and own developed O&M and big data analysis system respectively. The above systems use different platforms, different programming methods, different data expressions, etc. In order to reduce the integration coupling of the above systems, the integration bus is used for the initial integration between each system.For more details, see Figure 3.

The integration of enterprise information technology heterogeneous systems can be divided into information integration, functional integration, process integration and comprehensive integration, but fundamentally, it mainly includes information integration and functional integration. For information integration, the main idea is to synchronize the database changes of heterogeneous systems through the integration bus, so as to realize information integration based on database level; for functional integration, the main idea is to carry out unified interface conversion through the integration bus to realize the decoupling of interface changes of heterogeneous systems, and to carry out interface mapping and interface data conversion of heterogeneity. In order to realize the connection between information system and integration bus, an Agent (intelligent agent) is established as an intermediate layer between them. To facilitate the deployment of integration bus, the unified interface conversion module in integration bus, which is more coupled with information system, is put into Agent.

2.4 Integrated integration of wind turbine design, manufacturing, operation and maintenance based on integrated bus

The design, manufacturing and O&M of a wind power company involve different systems, PLM system, ERP system and their own developed O&M and big data analysis system respectively. The above systems use different platforms, different programming methods, different data expressions, etc. In order to reduce the integration coupling of the above systems, the integration bus is used for the initial integration between each system.

ESB is a pre-assembled SOA implementation that contains the basic functional components necessary to achieve the SOA hierarchical goals. ESB is the product of the combination of traditional middleware technology and XML, Web services and other technologies to achieve accurate, efficient and secure delivery of different messages and information for enterprise applications. Reusing existing services and modules to meet changing business requirements.**[4]**

The SOA-based integrated environment for wind turbine design, manufacturing, operation and maintenance is shown in **Figure 4**. The integration environment is divided into three parties based on the SOA infrastructure: service demander, service provider and service intermediary. The three parties correspond to the three roles in the classical SOA architecture, and at the same time, the basic architecture of the platform matches each other and follows the SOA standard protocol. The manufacturing middle party is composed of three layers: the representation layer uses JSP technology to realize demand interaction with other actors; the service integration layer is the core integration layer, which uses the enterprise service bus ESB to realize multi-protocol connection, conversion and management functions. The platform selects synapse ESB tool as a service intermediary to complete the joint execution, proxy, caching, load balancing and other services that may be generated in the dynamic alliance of cloud manufacturing.**[5]** The data layer will use SQL Serve/OraCle and other database software to provide storage services for virtual services, execution processes and other data and support the execution of platform-related functions.

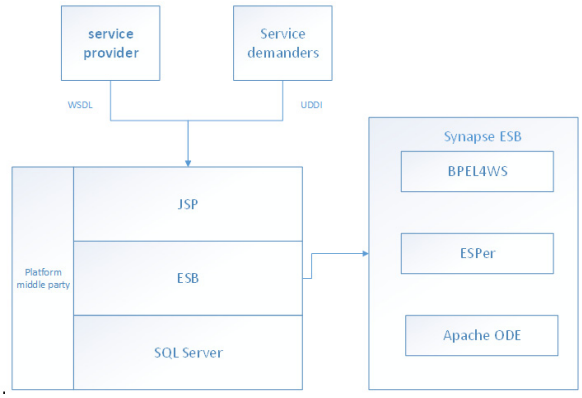

Figure 4. SOA-based integrated environment

2.5 Figure 5 to Figure 8for integrated bus deployment method

```
            <serviceTarget>svc1</serviceTarget>
            <serviceAddress>/svcDir/mySvc_1_0_1_proxy?soamethod=create</serviceAddress>
            <filePath>/app1/dir1/myfile1.txt</filePath>
            <callbackUri>http://test.sc.com/app1/svc1</callbackUri>
        </soapHeader>
    </soapenv:Header>
    <soapenv:Body>
        <ns:query>
        <ns:param>
            <xsd:TX_TRACE_ID>C6</xsd:TX_TRACE_ID>
            <xsd:CNT_FLAG>1</xsd:CNT_FLAG>

            <xsd:REC_PAGE_DIR>1</xsd:REC_PAGE_DIR>
            <xsd:REC_PAGE_NUM>10</xsd:REC_PAGE_NUM>
            <xsd:REQ_SYS>CRME</xsd:REQ_SYS>
            <xsd:TX_INSID>1111</xsd:TX_INSID>
            <xsd:TX_OPERID>2222</xsd:TX_OPERID>
            <xsd:QRY_EXP>
                <![CDATA[
            {
                "QRYID":"SGADA",
                "CONDI":{
                "":  {"CODE":{"GE":"21"}}
                },
                "RESP":["CODE","DATETIME","FARMID","DEVICE","VAL","ALIAS"]
            }
         ]]>
            </xsd:QRY_EXP>
        </ns:param>
    </ns:query>
    </soapenv:Body>
</soapenv:Envelope>
```

Figure 5. Development of the basic functions of the bus service

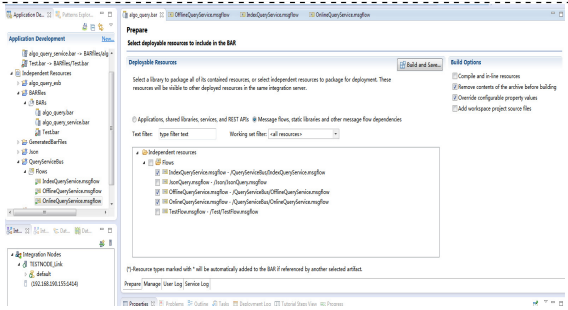

Figure 6. Integration of services to IIB

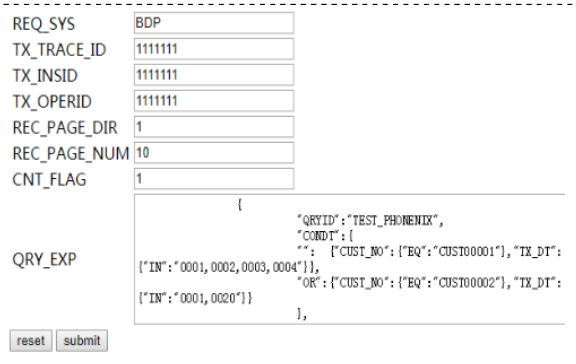

Figure7. Calling the bus service

Figure 8. Return Results

3. Conclusion

In order to meet the heterogeneous resource information sharing needs of a wind power enterprise networked manufacturing, this paper establishes a service platform model based on multi-mode operation, proposes an optimization integration method for networked manufacturing, and applies it in the design and implementation of the prototype system of a wind power enterprise networked collaborative manufacturing service platform. In the future, the main consideration is to expand the scope of use in the wind power industry and further improve the integration and optimization methods of resource information ontology to meet the requirements of efficient and high-level cooperation in the industry. We will establish a pilot demonstration for the networked collaborative product development, lead the industry's technological development and paradigm shift, and promote the overall transformation and upgrading of the wind power industry.

4. References

[1] Zhang Xingguo., Liu Shuhua., Huang Lliang., et al. The current status and development trend of wind power generation[C]// 7th International Conference on Advanced Materials and Computer Science, Dalian, 2018.

[2] Loredo S.A.M., WittwerA.R, CastroH.G, et al. Characteristics of Zonda wind in South American Andes[J]. Wind and Structures, 2017, 24(6): 657-677.

[3] DeaIl J,Ghemawat S.MapReduce:Simplified data processing on large cluSters【C】//Process of me 6th Symposium on 0perating SyStem Design and Implementation，2004：137-1 50．

[4] SHI ZhongZm，Dong MiIlgKaj，JiangYuncheng，et a1.A logical foundation for me semantic Web[J]Science in China，Ser．F：Information Science，2005，48(2)：161-178．

[5] ZHOU Ning, WANG Bin, LIU De -fang,Research on Ontology Integration of Industry Service Platform Oriented to Networked Manufacturing[J]Enterprise Management and Informatization,1672 -1616(2009) 21 -0011 -05.