

# Design of Data Package Software System for Aerospace Product Quality and Reliability

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**Abstract:** The quality and reliability data package management of space products is one of the important contents of the fine quality management of the space model, and is also a major basic work throughout the model development process. In order to meet the needs of enterprises, this paper proposes a design of quality and reliability data packet software system, introducing quality intelligence and open architecture. As an exploration of the intelligent direction of quality and reliability data package management platform, the system has launched a new quality management model to meet the quality data management and analysis requirements of the enterprise, and provided intelligent data support for the enterprise.

## 1 Introduction

At present, facing the new trend of the accelerated development of space technology in the world, space science and technology industry of China is in the period of the fastest development and fierce competition. The situation and task have put forward new and higher demands on our work, and the quality management can be urgently needed to achieve new leapfrog development. In the face of mass product quality data, it has become an urgent need of product quality management model to improve the reliability of product quality data and to improve the ability of analyzing and utilizing quality data [1]. The quality and reliability data package of space products refers to the requirements for the quality and reliability of the product during the development, production, inspection and delivery of the space products, as well as the record of the implementation process and results. It is an objective evidence for the quality and reliability of the product implementation, and is also an

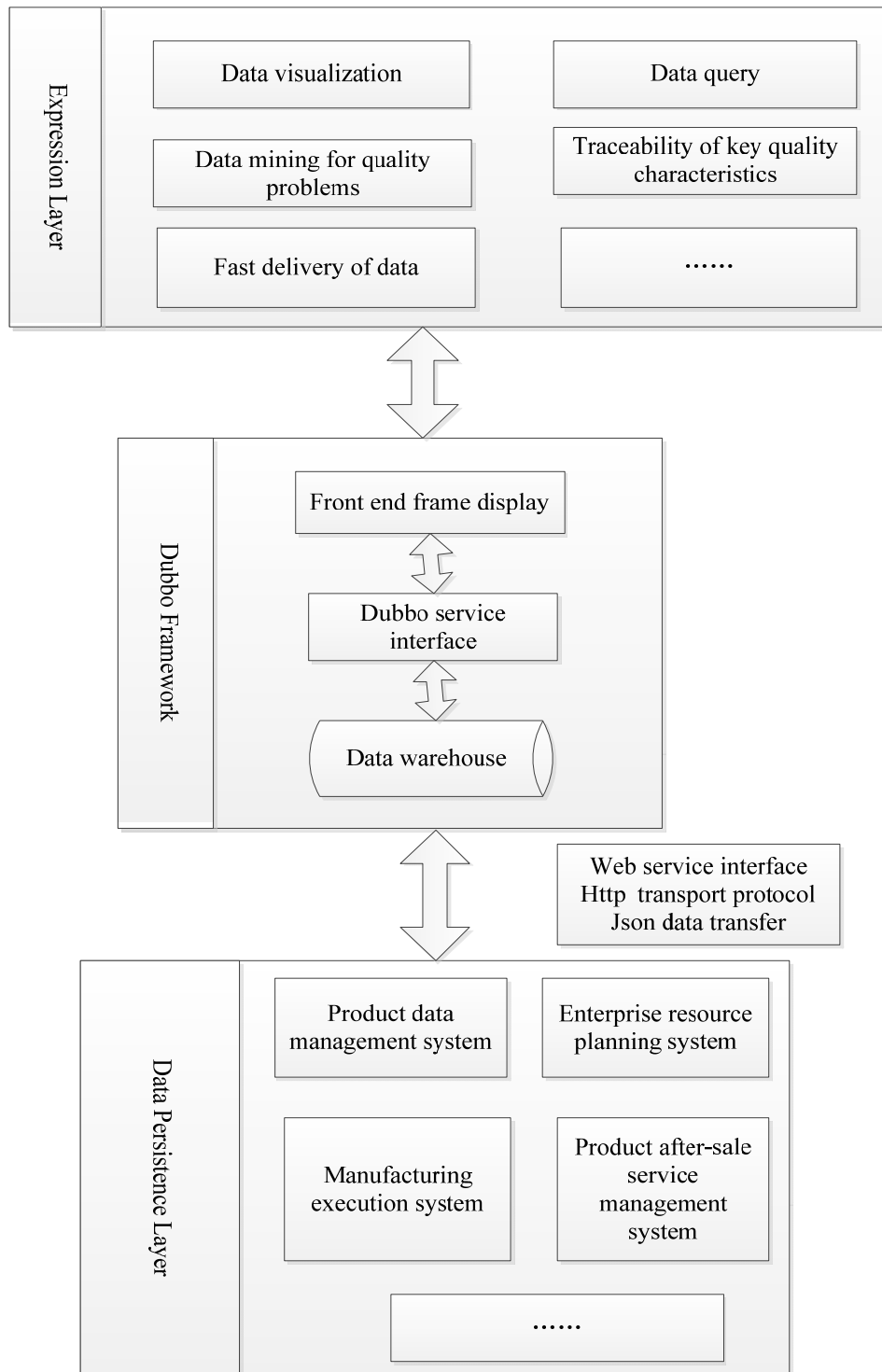
important basis for the implementation of process control and quality improvement[2- 3].

A software system for quality and reliability data package is designed in this paper. Its main function is to manage the whole life cycle quality data of the product, carry out the traceability analysis of the key quality characteristics, the historical data mining of the quality problems, the rapid delivery of quality data and so on. At the same time, the distributed service framework Dubbo adopted by the system can fully meet the service processing requests of enterprises and greatly enhance the level of enterprise informatization.

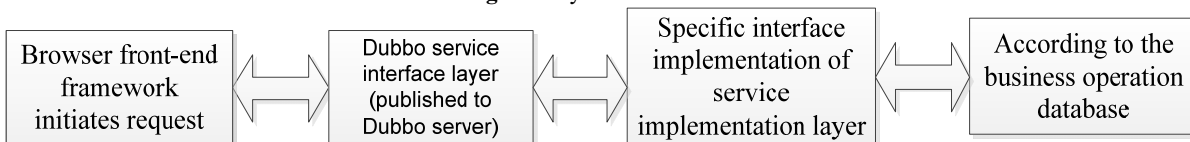
## 2 System architecture

In the face of the demand for the development direction of enterprise quality intelligence, the core of the model concept proposed in the industrial 4 concept is "intelligent + networking"[4], which integrates the information

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**Figure 1** System overall Architecture



**Figure 2** System Development Architecture

software developed at various stages of the product, including the realization of Product Data Management System (PDM), Enterprise Resource Management System (ERP) and Manufacturing Execution System (MES), Product after-sales Service Management System and so on [5]. These systems play a synergistic role in

"industry 4", and become a powerful tool for enterprises to carry out intelligent production and quality management. We have designed a set of integrated quality and reliability data packet interconnection platform, which will collect and analyze the quality data at various stages of the product, and provide valuable

decision analysis data to the enterprise management layer. The overall design architecture of the system is shown in Figure 1. The core architecture of the system adopts the Dubbo distributed service framework of Alibaba. Its main advantages are that it can support large data service processing requests of large enterprises and meet the high performance and transparent RPC implementation service. It is the core framework of the Alibaba SOA service management scheme[6-7]. The design of the system development architecture is shown in Figure 2. The core business logic of the system is implemented in the service implementation layer and is released to the Dubbo server through the Dubbo service interface. The front-end framework can easily invoke the related interface services. The detailed invocation process is the unified cluster management of service provider delivery service to the service registry zookeeper. Service consumers continue to initiate requests to obtain service information, invoke registered available services, and thus realize system stratification. The registry does not forward requests, which is less stressed and loosely coupled to facilitate the development and maintenance [8].

### 3. System function

The core of the quality data package system is collecting, managing and analyzing data. The specific function modules of the system are shown in Figure 3. The system mainly includes the base library of data package management system, data summary analysis, data identification coding management, and data standard management.

#### 3.1 Base library of data management system

The basic library of the data management system is the foundation of the quality and reliability data package management platform. The main function is to develop the basic template library and the basic framework required for the operation of data summary analysis, and to realize the standardized definition of the resource formats including records, lists, files, video and audio of

the data package. The body includes: (1) data packet meta database (basic dictionary library); (2) packet template library; (3) data packet storage framework.

#### 3.2 Data summary analysis

Data summary analysis mainly realizes the intensive collection and analysis of the records, lists, file video and audio resources involved in the quality of the product in the process of development, and constructs and encapsulates the product quality data according to the dimensions of product, model, development stage and responsibility unit to form efficient management, analysis and application mechanism. Specifically, it includes:

(1) data encapsulation and release sub modules - for data collection, encapsulation and release, quality data related to product objects and development processes, for product delivery, technical filing or quality review.

(2) the data traceability module provides a variety of algorithms and functions based on the key quality characteristics of electronic identification and process empirical data tracing and related retrieval, and provides support for the activities of quality review, problem searching, quality improvement and so on.

(3) data mining sub module, with the implementation and development of data packet management platform, massive quality data will be formed in the process of model development. This sub module will provide abundant data mining functions and provide support for model quality management, improvement and decision making.

#### 3.3 Data identification coding management

The data resource coding system based on electronic identification technology is set up in order to develop the quality and reliability data package management requirements. The integrated operation of the data summary analysis module is realized, and the quality data

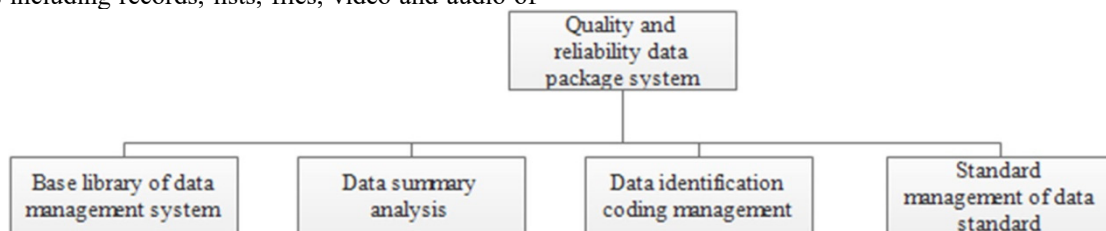


Figure 3 System Function Composition

resource object of the model product is unified, unique and electronic fast marking.

#### 3.4 Data standard management

The module realizes the electronic management of the quality and reliability data package related technology and management specification of the model product, and forms the integrated operation capability with the data

summary analysis module, which includes the quality data classification specification, the quality data hierarchy division specification, the quality data definition specification, the quality data mapping relation and the quality data mapping relation Integrated interface specification; quality data delivery specification.

## 4 System design and implementation

The quality and reliability data package management system finally realizes the collection, management and analysis of the quality data at various stages of the product, and provides valuable decision analysis data to the enterprise management layer. The system uses Web Service service interface, HTTP protocol transmission, Json data transfer to obtain quality data from the information software of each phase of the product, and obtain the related quality information from the supplier management center. The front end of the system uses Html5 to develop the browser end interface and invoke the service that is published in the background. The front end of the system adopts Html5 to develop the browser interface and invoke the services published in the background. At the same time, the EasyUI front-end framework is adopted, which saves the time and scale of web development and enhances the configurability of the system [9].

The system integrates WEKA software for data mining analysis. WEKA (Waikato Environment for Knowledge Analysis) is an open source data mining platform researched by Waikato University. It integrates a large number of machine learning algorithms that can undertake data mining tasks, including preprocessing data. Association rules mining, classification, clustering, etc. , and provide a wealth of visualization capabilities [10].

## 5 Summary

In this paper, from the requirement of quality and reliability data package system, the data of the whole life cycle of the product are fully collected and utilized, the traceability analysis of key quality characteristics, the data mining of quality problems and the rapid delivery of quality data make the quality management of the enterprise more efficient and intelligent. At the same time, the framework of the system is more advanced, and it has good flexibility and flexibility in order to improve the functions of the system, increase the service of the system and increasing the amount of data. It meets the needs of the development of the system platform at present.

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