A Method for Data Exchange and Management in the Military Industry Field

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Abstract. With the ongoing integration of industrialization and informatization, enterprise information infrastructure has been steadily advancing, leading to a substantial surge in data volume generated within organizations. Military enterprises, in particular, face unique challenges such as distributed data sources, data confidentiality concerns, and limited data sharing capabilities. The traditional approach of manually transferring data using physical media yields low transmission efficiency and requires significant human resources. Furthermore, the lack of comprehensive planning and standardized frameworks during the initial stages of enterprise information system development has resulted in data silos throughout the organization. Consequently, the seamless integration of data links and efficient data management has emerged as a critical priority for enterprises. This research paper presents a comprehensive methodology for data exchange and management in the military industry sector. It encompasses key aspects such as establishing data links, designing top-level architectural plans, constructing and implementing robust data models, implementing effective data warehouse management, and ultimately achieving a unified and centralized data display process. Through the implementation of this methodology, the aim is to facilitate efficient data flow, provide users with clear visualizations of data processing outcomes, enable streamlined data management, and enhance the value of data assets within the enterprise.

Keywords: Data Architecture · Data Visualization · Data Transmission · Data Processing

1 Introduction

1.1 A Subsection Sample

As the enterprise's digital transformation efforts gradually unfold, the advancement of information construction has become a key focus. In response to diverse business requirements, numerous information systems have been established, resulting in substantial data accumulation. While these information systems have brought operational

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X. Yang et al. (Eds.): ADMA 2023, LNAI 14179, pp. 674–680, 2023.
https://doi.org/10.1007/978-3-031-46674-8_47

convenience, they have also uncovered underlying challenges. Military enterprises, in particular, face the need to maintain data confidentiality, leading to data barriers among different units. As information is transmitted across systems, data redundancy becomes evident. The lack of correlation and traceability between systems hampers database access and increases the risk of crashes. Furthermore, the absence of top-level architecture and institutional processes within the enterprise contributes to fragmented data management and a lack of centralized control, resulting in duplicated data definitions and difficulties in realizing its value.

To address these issues, this research paper proposes a comprehensive method for data exchange and management in the military industry domain. This method offers robust support for enterprises in designing top-level data architectures, establishing related management systems, facilitating data interface connectivity between systems and different locations, building data warehouses, and creating data visualization platforms. By implementing this approach, enterprises can achieve enhanced data management capabilities, improved data correlation, and more effective data utilization, ultimately driving the success of digital transformation initiatives.

2 Key Technology Research

2.1 Data Architecture

Data architecture plays a crucial role within the broader context of enterprise architecture. It encompasses the business architecture and serves as the foundation for designing application architecture [1]. The diagram provided illustrates the comprehensive structure of the data architecture [2].

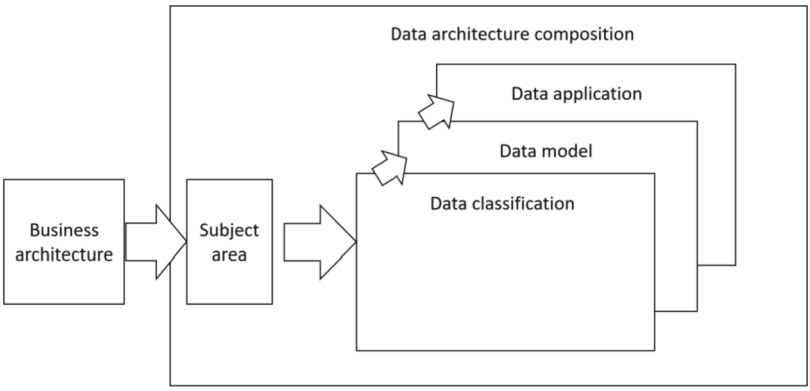

Fig. 1. Data Architecture

The diagram illustrates the data architecture's comprehensive structure, which can be divided into four main components: subject domain, data classification, data model, and data application (Fig. 1).

a) Subject Domain
   The subject domain serves as the foundational structure of the data classification system within the enterprise architecture. It establishes a fundamental alignment with the business domain and provides the basis for defining the data architecture.
b) Data Classification
   Data classification entails the systematic categorization of all essential data objects. It involves dividing the data objects into distinct groups based on their respective topic domains and conducting analysis and classification within each domain.
c) Data Model
   The data model encompasses the definition of conceptual and logical models for data. These models represent the content and relationships of data objects, providing a framework for understanding and organizing the data within the architecture.
d) Data Application
   Data application involves the strategic planning of the top-level architecture and implementation approach for data application systems. It is driven by the enterprise's vision and guides the construction and implementation of data management application systems throughout the organization.

2.2 Data Warehouse Construction

A data warehouse [3, 4] is a strategic repository that facilitates comprehensive data support for decision-making processes across all levels of an enterprise. It serves as a centralized data store specifically designed for analytical reporting and decision support, offering valuable insights to enhance business process optimization and enabling enterprises to monitor aspects such as time, cost, quality, and control. This dedicated data resource plays a crucial role in empowering organizations with business intelligence capabilities.

2.3 Data Visualization Technology

Data visualization [5, 6] refers to the process of visually representing location-based information within a vast dataset using graphics or images, leveraging data analysis and development tools to their full potential.

Finereport, a leading provider of big data BI and analysis platforms in China, specializes in the fields of business intelligence and data analysis. Offering a user-friendly interface and robust features, Finereport caters to various requirements such as diverse report display, interactive analysis, data entry, permission management, scheduling, print output, portal management, and large screen display. Its extensive range of features reduces implementation costs while meeting the daily management needs of enterprises.

2.4 Data Exchange

Data exchange [7, 8] is the procedure of establishing a transient interconnection pathway for data communication between multiple data terminal devices. It enables the seamless transfer of data between any two terminal devices. Data exchange encompasses various modes, including circuit exchange, message switching, packet exchange, and hybrid exchange.

3 Design and Implementation

3.1 Enterprise Model Management Platform

After investigating and analyzing the current basic situation of the enterprise, the proposed approach is the "1 + 2 + N" framework. This framework focuses on developing a robust data management system as the core, while simultaneously nurturing the capabilities to construct a comprehensive data architecture and data platform. The data is then empowered through the implementation of various value-added initiatives.

a) Building Data Management System

By establishing high-level data management entities such as data management committees and data management offices. Defining top-level systems and departmental standards and developing data management processes, the enterprise can effectively govern the operations of data management.

b) Data Architecture and Data Management Platform

Utilizing the new era quality management system, the business processes within the enterprise are thoroughly examined. This includes organizing business objects, mapping them to corresponding data entities, constructing conceptual and logical data models, and establishing a comprehensive, distinct, and authoritative definition of business objects in the enterprise's data landscape. This standardized foundation serves as a reference for subsequent information system development, database design, data integration, and data sharing initiatives.

3.2 Data Warehouse Construction

In order to store and use date more efficiently, the enterprises build their own data warehouse, which contains stage layer, CDM (Common Dimension Model) layer and ADS (Application Data Service) layer. The CDM layer includes DWD (Data Warehouse Detail) layer and DWS (Data Warehouse Service) layer. The model hierarchy is shown in the figure.

The different layers of the system serve distinct functions as outlined below:

1) Stage

The primary role of the stage layer is to facilitate data synchronization by directly storing data from various information systems within the enterprise into a centralized data warehouse. Additionally, it involves the archival or cleansing of historical data based on the specific requirements of data operations (Fig. 2).

2) CDM

Within the CDM layer, the data from the stage layer undergoes processing to generate detailed fact data and dimension table data. Subsequently, this processed data is further transformed to generate summarized public indicator data.

3) ADS

The application data layer (ADS) functions as a repository for personalized statistical indicator data derived from processing activities based on the stage layer and the common dimension model (CDM) layer (Fig. 3).

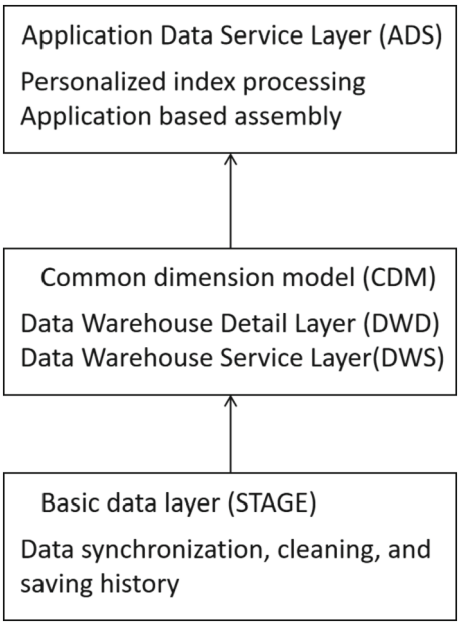

Fig. 2. Model Hierarchy

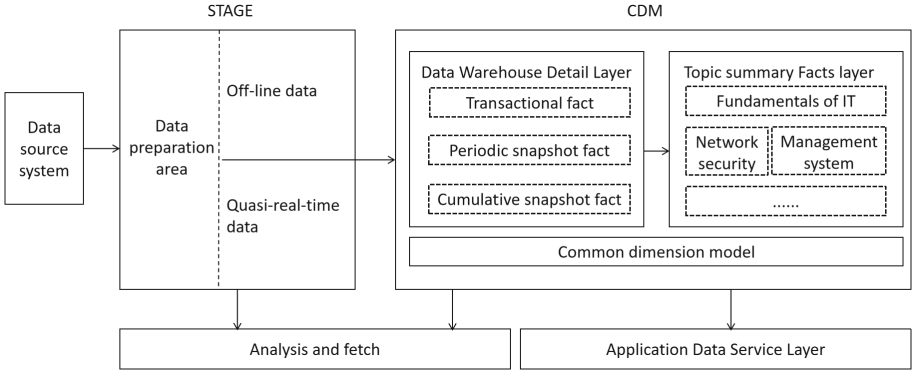

Fig. 3. Circulation relationship

When constructing a data warehouse, it adheres to the principles of data architecture design and aligns with the data management standards established within the enterprise. This approach aims to manage the growth trajectory of data volume, thereby enhancing the efficiency of data exploration and development while optimizing data storage space and reducing associated costs.

3.3 Big Data Center

In order to unlock the inherent value of data, transform it into tangible insights, and enhance the enterprise's data-driven capabilities, an enterprise big data center is established utilizing the Finereport tool. Tailored to cater to diverse user groups, the big data center offers varying types of foundational data information. Recognizing the confidentiality requirements of military enterprises and the need for access control, the big data center implements a dual-layer authorization mechanism. This approach grants authorization to data visualization pages within Finereport, while also managing user visibility through the data center management system's menu access privileges. The dual-layer control ensures robust data security measures are in place.

3.4 Remote Data Transmission

During the initial construction phase, the decentralized generation of data across multiple locations resulted in a lack of unified and standardized data. This led to a complex network of data transmission, as illustrated in the diagram. The intricate mesh of data transmission links gave rise to issues such as redundant transmissions, duplicated requirements, missing attributes, and unclear process records. To address these challenges, our enterprise will establish dedicated data centers in various regions. These centers will serve as centralized hubs, consolidating and harmonizing the data requirements. Consequently, the complex mesh of data transmission links will be transformed into a more efficient "dual star data link" configuration (Fig. 4).

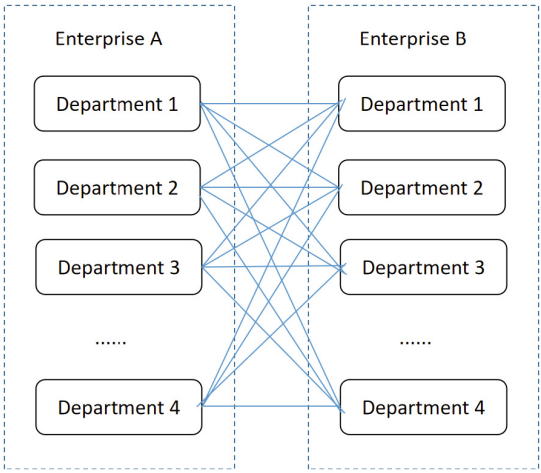

Fig. 4. Old Data Link

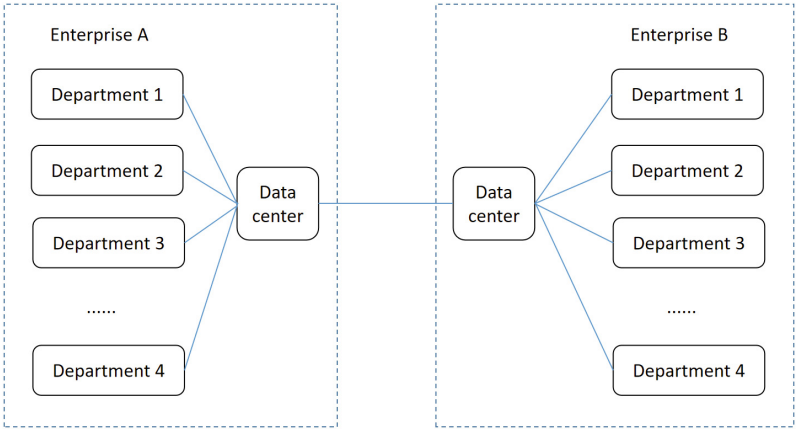

Fig. 5. New Data Link

4 Prospect

This article presents a comprehensive approach to data exchange and management in the military industry (Fig. 5). It outlines a systematic method that encompasses various components such as data management system planning, data model management platform development, data warehouse establishment, big data center construction, and remote data transmission connectivity. By implementing this approach, it enables standardized definition management, efficient storage, unified display, and seamless data exchange and sharing among individual information systems within enterprises.

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