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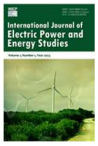

Analysis of the Application of Storage Resource Pool Technology of Inner Mongolia Power based on the Background of Big Data

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ABSTRACT

With the continuous deepening of the Inner Mongolia Power Company's level of informatization and the continuous expansion of the scale of business and application system construction, the company will also enter the era of big data, and the amount of data will show an explosive growth trend. In order to solve the problems of massive data storage and data value mining faced by the enterprise during its development process, research on the application of storage resource pool technology has been conducted. Ultimately, the unified planning, allocation, and management of storage resources have been achieved, greatly improving the utilization efficiency of storage resources.

KEYWORDS

Pooling of Storage Resources; Structured Data; Unstructured Data; Cloud Computing; Distributed Storage Systems; Disaster Recovery Center.

1. INTRODUCTION

With the progress of energy transition and the growing demand for electricity, energy storage technology has become a key solution for addressing the volatility of renewable energy and the balance of the power grid. In order to achieve efficient utilization of clean energy and ensure the stable operation of the power grid, the Inner Mongolia power system has actively explored and applied emerging storage technologies. Among them, storage resource pool technology has attracted widespread attention and application as a flexible, reliable, and efficient storage management technology. However, the storage resource pool technology still faces many challenges and issues in the Inner Mongolia power system, such as data security, storage efficiency, and cost control. Further research can explore optimization algorithms and models to improve the stability and reliability of storage resource pool technology. For the Inner Mongolia power system, storage resource pool technology will continue to play an important role and contribute to the realization of clean energy transition and the sustainable development of the power system.

2. STORAGE RESOURCE POOLING TECHNOLOGY OVERVIEW

Storage resource pool technology is a flexible, reliable, and efficient storage management technology that centralizes the management of distributed storage resources to form a unified storage pool, enabling unified scheduling and utilization of resources. The core idea of storage resource pool

technology is to centrally manage and virtualize distributed storage resources (such as hard disks and SSDs) to form a logical storage resource pool [1]. This storage resource pool has capacity elasticity, allowing for dynamic allocation of storage resources based on demand to satisfy the system's requirements in different time periods and scenarios. Storage resource pool technology has the following characteristics and advantages: (1) Capacity elasticity: The storage resource pool can dynamically adjust storage capacity according to demand, allowing for flexible handling of different storage needs. When more storage space is needed, additional storage resources can be allocated from the storage resource pool without the need to physically add hardware devices. (2) High reliability: Storage resource pool technology employs redundancy mechanisms to ensure data reliability and recoverability. Through data backup and redundant storage, even if a storage device fails, the system can still guarantee data integrity and availability. (3) High efficiency: Storage resource pool technology improves data storage and access efficiency through logical management and optimization of storage resources [2]. Techniques such as data compression, deduplication, and fast retrieval reduce storage space occupation and data access time. (4) Scalability: Storage resource pool technology enables seamless expansion of the system by dynamically adding, deleting, and replacing storage devices according to actual needs. By incorporating new storage devices into the storage resource pool, the system can quickly expand storage capacity and improve performance. The application of storage resource pool technology in the Inner Mongolia power system is of great significance. Through storage resource pool technology, data management and storage efficiency in the power system can be optimized, thereby improving operational efficiency and stability. Additionally, storage resource pool technology provides reliable support for big data processing and the construction of disaster recovery centers in the Inner Mongolia power system.

3. APPLICATION OF STORAGE RESOURCE POOLING TECHNOLOGY IN INNER MONGOLIA POWER SYSTEM

3.1. Structured Data Management and Analysis

One application of storage resource pool technology in the Inner Mongolia power system is the management and analysis of structured data. There is a large amount of structured data in the Inner Mongolia power system, such as power load data and grid transmission data. These data are of great importance for the operation and dispatch of the power system. Therefore, effective management of this structured data and accurate analysis and prediction are crucial for improving the efficiency and stability of the power system. Storage resource pool technology provides an efficient storage and processing solution for structured data in the Inner Mongolia power system through flexible resource allocation and management. Here are specific applications of storage resource pool technology in the management and analysis of structured data in the Inner Mongolia power system:

(1) Power load data management: Storage resource pool technology can centrally store power load data and ensure data reliability through data backup and redundancy mechanisms. At the same time, storage resource pool technology provides efficient data access and retrieval capabilities, allowing the power system to monitor, analyze, and predict power load in real-time, thereby optimizing power dispatch and energy savings.

(2) Grid transmission data management: Grid transmission data includes status information of various grid nodes, load data of transmission lines, etc. Through storage resource pool technology, this data can be centrally stored and effectively managed and analyzed. The power system can monitor the status of the grid and the load conditions of transmission lines in real-time, promptly identify problems and abnormalities, and improve the reliability and stability of the grid.

(3) Data analysis and prediction: Storage resource pool technology provides powerful data processing and analysis capabilities for the Inner Mongolia power system. Through storage resource pool technology, a large amount of structured data can be quickly queried and analyzed, enabling precise

prediction of power load and real-time monitoring of grid operation. Thus, the Inner Mongolia power system can make informed power dispatch and optimization decisions based on data analysis results, improving the efficiency of grid operation [3].

In summary, storage resource pool technology plays an important role in the management and analysis of structured data in the Inner Mongolia power system. Through efficient storage and data processing methods, it enhances the operational efficiency, stability, and prediction accuracy of the power system, providing strong support for the sustainable development of the Inner Mongolia power system.

3.2. Unstructured Data Storage and Retrieval

One of the applications of storage resource pool technology in the Inner Mongolia power system is the storage and retrieval of unstructured data. In the operation of the power system, there is a large amount of unstructured data, such as sensor data and monitoring device data. These unstructured data have characteristics of diversity, high dimensionality, and high velocity, playing an important role in monitoring, fault diagnosis, and decision support in the power system. Therefore, effectively storing and being able to quickly retrieve and query this unstructured data becomes a challenge in the development of the power system.

Storage resource pool technology provides a solution for the storage and retrieval of unstructured data through flexible storage resource management and data processing capabilities. An approach to an unstructured data storage method is shown in Figure 1.

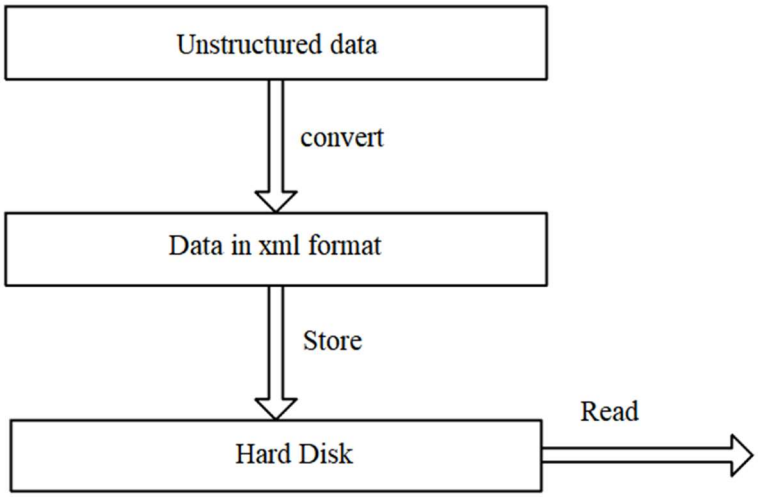

Figure 1. A method of storing unstructured data in a way

Here are specific applications of storage resource pool technology in the storage and retrieval of unstructured data in the Inner Mongolia p system:

(1) Storage and management of sensor data: Storage resource pool technology can centrally store data from various sensors, such as temperature, humidity, voltage, and other data. These sensor data are crucial for monitoring and fault diagnosis in the power system. Through storage resource pool technology, efficient storage, backup, and management of sensor data can be achieved. Furthermore, with flexible data retrieval capabilities, sensor data can be quickly queried and analyzed, providing real-time monitoring and early warning.

(2) Storage and maintenance of monitoring device data: Monitoring devices play important roles in the power system, such as transformer monitoring devices, line monitoring devices, etc. The massive data generated by these devices needs to be effectively stored and maintained. Storage resource pool technology can centrally manage these monitoring device data and ensure data reliability and availability through redundant backup and data recovery mechanisms. Additionally, storage resource

pool technology can provide efficient data retrieval and querying functionalities, facilitating device management and fault diagnosis for operations and maintenance personnel.

(3) Storage and analysis of image and video data: There is also a significant amount of image and video data in the Inner Mongolia power system, such as surveillance camera footage and drone-captured data. Efficient storage and analysis of these data are necessary for power system security monitoring and event playback. Storage resource pool technology can provide high-capacity storage space for these image and video data and enhance data access speed and analysis efficiency through optimization algorithms and models [4].

In conclusion, storage resource pool technology plays a crucial role in the storage and retrieval of unstructured data in the Inner Mongolia power system. With flexible storage resource management and efficient data processing capabilities, it enables centralized storage, data backup, and fast retrieval of unstructured data, providing a reliable foundation for monitoring, fault diagnosis, and decision support in the power system.

3.3. Disaster Recovery Center Construction and Data Recovery

A disaster recovery center is a backup facility established to mitigate the risks of data loss or system interruption due to natural disasters, human accidents, and other potential events. It serves as a replicated data center where storage resource pool technology can be utilized to achieve data redundancy and fast recovery, thereby enhancing the reliability and disaster resilience of the power system.The application of disaster recovery techniques is shown in Figure 2:

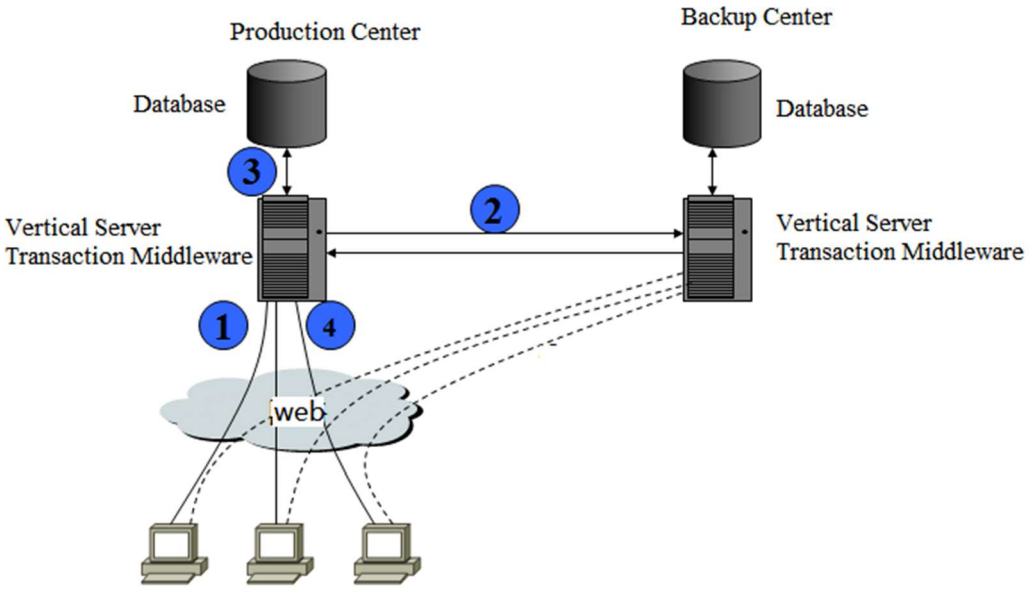

Figure 2. Applying Disaster Recovery Technology

Specific applications of storage resource pool technology in the construction of disaster recovery centers and data recovery in the Inner Mongolia power system include:

(1) Data Redundancy Backup: Storage resource pool technology can enable data redundancy backups, storing data in different storage devices or nodes. When a disaster event occurs and damages a specific storage device or node, the system can still operate smoothly by recovering from other backup data. This redundancy backup can be achieved at the physical level or through virtualization techniques at the logical level.

(2) Fast Data Recovery: Storage resource pool technology facilitates fast data recovery, ensuring rapid data restoration and system operation after a disaster event. By leveraging redundancy backup

data and employing efficient data retrieval and recovery algorithms, storage resource pool technology enables swift data recovery.

(3) Disaster Drills and Resilience Testing: Storage resource pool technology aids in conducting disaster drills and resilience testing. Simulating real disaster scenarios helps evaluate the capacity and performance of the disaster recovery center and verify the backup and recovery capabilities of the data. This ensures the effectiveness of the disaster recovery center during actual disaster events.

(4) Automatic Fault Tolerance: Storage resource pool technology can automatically monitor the status of storage devices and nodes. Upon detecting a fault, it can automatically transfer the data to backup devices or nodes, enabling automatic fault tolerance and data recovery.

Through these applications, storage resource pool technology provides critical support for the construction of disaster recovery centers and data recovery in the Inner Mongolia power system. It ensures data security and integrity, minimizes losses caused by data loss and system interruption due to disaster events, and improves the stability and reliability of the power system [5].

4. CONCLUSION

In the Inner Mongolia power system, storage resource pool technology plays a crucial role, ranging from structured data management and analysis to unstructured data storage and retrieval, and even the construction of disaster recovery centers and data recovery. It provides robust support for the operation, management, and security of the power system. Through storage resource pool technology, the power system can better manage and utilize storage resources, improving the efficiency of data storage and access. This enables precise load forecasting, real-time monitoring of the power grid operation, and timely diagnosis of equipment faults. Furthermore, storage resource pool technology also provides a reliable solution for disaster recovery and data recovery in the power system. Through data redundancy backup and fast recovery, the power system can withstand the risks posed by natural disasters and human accidents, ensuring the continuous availability of data and systems. In summary, the application of storage resource pool technology provides the Inner Mongolia power system with powerful capabilities in data management, analysis, and protection, making significant contributions to the sustainable development and safe operation of the power system.

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