Analysis on the Construction of Data Center of Large-scale Water Conservancy Project

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Abstract: This paper expounds the necessity of building data centers for large-scale water conservancy projects, which consists of data center site selection, transformation, modular cabinets, intelligent power supply, lithium battery packs and data center intelligent management platforms. It adopts new technologies and processes , new equipment, create an efficient and green data center, and provide solid computing power and data support for digital twin water conservancy projects.

Keywords: Smart Water Conservancy; Digital Twins; Data Center; Modularization

1. Introduction

Smart water conservancy construction is one of the implementation paths to promote the high-quality development of water conservancy in the new stage. In accordance with the requirements of "demand traction, application first, digital empowerment, and ability enhancement", it focuses on digitization, networking and intelligence, and focuses on digital scenarios and wisdom. Using simulation and precise decision-making as the path, comprehensively promote the construction of calculation data, algorithms, and computing power, create a digital twin watershed, and accelerate the construction of a smart water conservancy system with functions of forecasting, early warning, rehearsal, and pre-planning (hereinafter referred to as "four forecasts").

As a large-scale water conservancy project on the main stream of the Yellow River, which integrates silt reduction, flood control, flood control, water supply and irrigation, and power generation, it actively responds to the first pilot requirements of the Ministry of Water Resources' digital twin project to build a digital twin water conservancy project. The data center is an important basic information facility supporting the digital twin project, and it is the key link to integrate into the smart water conservancy system.

2. Necessity and Principles of Construction

With the rapid development of cloud computing, big data and the Internet of things, the amount of data storage shows an upward trend of geometric order of magnitude, and the requirements for data storage services are becoming increasingly urgent. The existing decentralized information islands alone can not meet the development needs of the industry. The intensive construction, large-scale operation and industrialized management mode of data center are the only way to realize the sharing of advantageous resources and solve the problems of repeated investment, resource waste and energy loss from the source. At the same time, according to the needs of information security, all kinds of data of the water conservancy project have a high degree of privacy, so it is necessary to plan and build a centralized data center[1].

(1) Normative. Comply with relevant national standards and norms, conform to industry practices, meet fire protection acceptance and use requirements, and must not change buildings and load-bearing parts.

(2) Advancement. Adopt advanced solutions and technologies, fully consider various needs in the future, and select products with long life in the market.

(3) Reliability. The computer room should have the ability to resist natural disasters such as earthquakes, fires, and water hazards.

(4) Environmentally friendly. The selected materials should be environmentally friendly, flame retardant, free of harmful gases, etc.

(5) Economy. The selection of equipment and materials must follow the principle of cost-effectiveness and the principle of easy procurement in the market, and comprehensively consider maintenance and operating costs.

(6) Scalability. Taking into account the future uncertainty and development investment benefits, consider the flexibility of power and cooling supply in the area and layout of the computer room.

3. Data Center Construction

3.1 Site Selection and Layout

3.1.1 Site Selection

According to the requirements of "Data Center Design Specification" (GB-50174), the site is selected in the water conservancy project management area. The hub area is located near the reservoir, the natural environment is clean, and there is no place where dust, oil fume, harmful gas, and corrosive, flammable, and explosive materials are produced or stored. More importantly, the hydropower station can provide multiple channels for the data center. , Reliable power supply. However, problems such as humidity and strong magnetic fields should also be fully considered during design and construction. Combining various factors, it was finally determined that the large bay of the podium of the original office building was used as the main engine room, and the adjacent room was used as the monitoring room, with a total construction area of about 500 square meters[2].

3.1.2 Retrofit

Renovating a data center with an old building must consider the problem of structural loads. According to the requirements of relevant standards, if the function of the building is changed, a load test needs to be carried out, and the structure should be reinforced according to the new requirements. According to actual needs, the data center commissioned a special organization to carry out structural inspection, and designed a reinforcement plan according to the test results, and the professional organization reviewed the plan and then carried out reinforcement treatment.

3.2 Intelligent Modular Cabinet

Modular cabinets have the following features[3]:

(1) Modularization. The cold aisle closure adopts a modular design, and the two corresponding cabinets on both sides of the cold aisle are one module; each module can be installed and removed independently, which is convenient for users to add, reduce or move some cabinets in the aisle.

(2) Security. Each roof can be linked with fire protection. When the fire signal in the machine room is confirmed, the top plate opens automatically, and the fire extinguishing gas can enter the channel to extinguish the fire.

(3) Convenience. No threshold design, convenient for transport vehicles such as trolleys to enter and exit without hindrance

(4) Aesthetics. The channel sealing window material is transparent glass, and the appearance is cold-rolled steel plate of the same material as the cabinet, with high mechanical strength, good permeability, overall beautiful appearance, consistent with the style of the cabinet, and more harmonious with the environment of the equipment room.

(5) Customized on demand. The enclosure scheme can be flexibly adjusted according to the height of the on-site cabinet and the space at the top of the equipment room.

(6) Reliability. All components of the channel closure are installed and fixed on the load-bearing frame of the cabinet; the fixing points are mainly distributed on the top surface, front and side of the load-bearing frame of the cabinet; the installation is simple, the overall coordination is beautiful, and the existing decoration of the equipment room will not be damaged, and no hot welding is required on the installation site .

3.3 Intelligent Power Supply

3.3.1 Ups

The new modular UPS integrates digital technology and power electronic technology, full digital control and high-speed communication technology based on high-performance DSP, provides excellent scalability and availability, high module efficiency, supports hot swap, and meets the requirements of efficient operation of data centers. need. At the same time, the modular UPS saves 50% of the floor space and efficiently uses space; the system efficiency is as high as 97%, and the low-load efficiency is high; it can monitor the whole link, and change from passive to AI predictive maintenance; wide input voltage range, strong adaptability to the power grid .

3.3.2 Lithium Battery Energy Storage

Lithium battery energy storage system, safe and reliable, long service life, small footprint, simple operation and maintenance. It also has active current sharing control, supports the mixed use of new and old batteries, and significantly

reduces investment costs. The three-layer BMS system, combined with the UPS and network management system, realizes intelligent battery management and greatly reduces management expenses.

3.4 Intelligent Temperature Control

The air-conditioning system mainly includes fans and air-conditioning terminal units. The frequency conversion method is adopted to realize 10%-100% stepless adjustment, which saves the operation cost of air-conditioning. At the same time, the frequency conversion technology has the following characteristics: power saving, voltage regulation function, reducing the impact on the power system, and reducing noise. The data center adopts inter-column air conditioners and sets up cold aisles to reduce cooling loss, and the return air temperature can reach 30°C-32°C. The airflow organization is shown in the following figure:

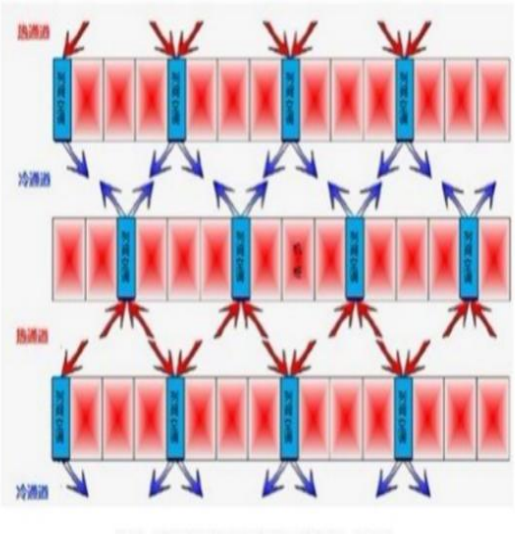

Figure 1. Airflow diagram

3.5 Intelligent Management

The intelligent management platform has the functions of asset management, warehouse management, capacity management, operation and maintenance management, etc., and can realize real-time monitoring and alarm on the status of UPS, air conditioner, power supply system, storage battery, temperature and humidity of equipment room, water immersion, etc. Among them, water intrusion monitoring adopts There are two main ways of positioning, alarm and notification: SMS alarm and on-site alarm. The platform software integrates closed cold aisle module system, video monitoring system, access control system, fire monitoring system, etc. Through the monitoring of power distribution equipment at all levels, real-time dynamic display of the energy consumption of each equipment, including but not limited to air conditioning energy consumption, IT equipment energy consumption, lighting energy consumption, etc., can generate energy consumption ratios according to equipment types and intervals Diagram for control and management[4].

3.6 Green and Low Carbon

In the construction of traditional computer rooms, issues such as energy consumption, cooling and airflow management are not fully considered. Many data centers have high PUE and use traditional high-reliability ambient power equipment, but these devices have low efficiency, the PUE of the data center is above 2.0 or even higher, and the energy used by the data center consumes about half of the energy. On the IT load, the other half is used for network critical physical infrastructure, including power supply, cooling and lighting. In terms of construction technology, the new data center saves energy by means of building thermal insulation, electrical energy saving, power transformation and distribution energy saving, air conditioning energy saving, etc., and at the same time comprehensively considers the rational layout of equipment, thereby further reducing energy consumption[5].

4. Conclusion

The construction of this data center overcomes the problem of renovating the computer room from the old building, and uses new technologies, new processes and new equipment such as closed cold aisles and lithium batteries, which solves the contradiction between the insufficient area of the computer room and the large number of cabinets, which greatly improves The capacity and management capabilities of the data center ensure the collection, storage, and calculation of data on the production and operation of water conservancy projects, and provide solid computing power and data support for digital twin water conservancy projects. In the next step, in accordance with the principle of "three-point construction, seven-point operation and maintenance", we will consider introducing AI methods such as inspection robots, and continue to explore the

intelligent operation and maintenance of data centers.

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