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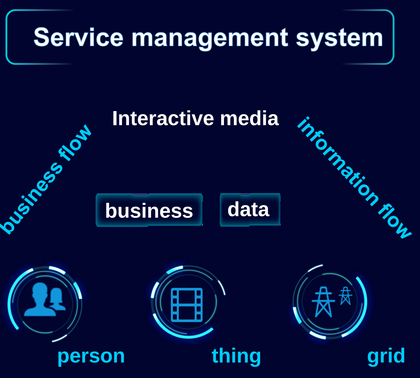
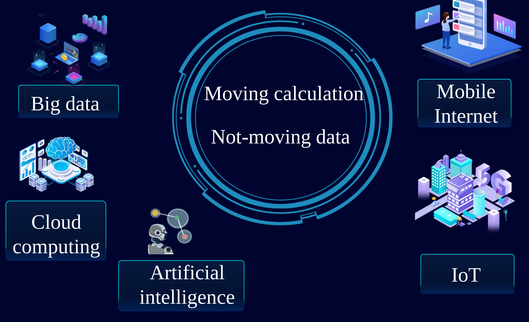
Paper CS201

Design and Application of the Intelligent Operation, Control and Maintenance of Distribution Networks Based on Wide-area Distributed Sinking Computing Technology

The distribution network is characterized by wide coverage and highly scattered data distribution. To improve the business process and data calculation capability for distribution network management, a foundational computing technology, the wide-area distributed sinking calculation technology , is proposed based on the application of big data, artificial intelligence, block chain and other technologies. It is applicable to the OCMS (operation, control and maintenance) of distribution networks. The technology adopts the concept of moving computation to data to realize fast processing of business applications. The algorithm and business logic are designed at the primary node level, and the algorithm compilation and data crawling and mining are performed at the sub-node level to realize the fast business response. This paper introduces the technical implementation methods and technologies of each link, and performs a comparative analysis for typical business scenarios between the sinking calculation scheme and the original framework calculation. It is verified that applying the sinking calculation scheme can significantly enhance the rapid processing ability and computational efficiency.

In China, the Power Supply Service and Command platform makes full use of the professional information of the dispatching, operation, maintenance and marketing systems, and integrates the functions of the marketing system, PMS system, real-time production control, electricity acquisition, scheduling automation, distribution automation, OMS and other system. However, due to the huge scale of DN nodes, the application of power flow calculation and state estimation in distribution automation system is often accompanied by a large number of matrix operation and loop iteration. Due to the restriction of data magnitude, the analysis and decision are directly affected, and the calculation speed is difficult to meet the requirements.





In order to realize the requirement of "Moving calculation, Not moving data", a four-level analytical computing system is designed, which is the algorithm layer, the analysis layer, the fusion layer and the calculation layer. In the algorithm layer, a progressive and syncretic sinking algorithm model is designed containing operators and examples.

(1) Distributed scheduling of algorithm load

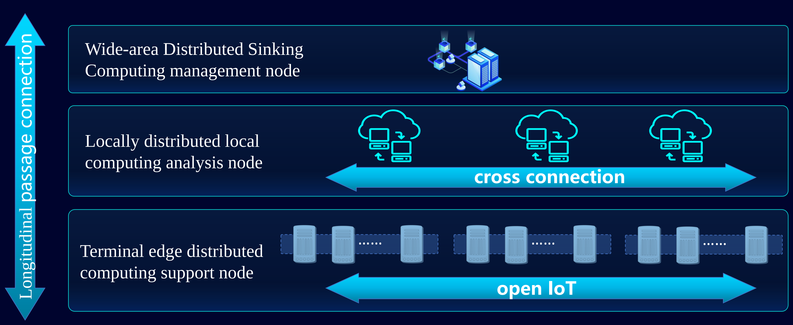
The uneven distribution of data results in different tuples number per key, data skew occurs, and the amount of data received by Reducer is unbalanced. If the amount of data is too large, the node operation speed will slow down, which will seriously restrict the completion speed of the whole task.

(2) AI analysis preloading

In the process of users' response, the analysis results requires deep mining to ensure the effective analysis results. Inputting the AI analysis logic formula, the memory dynamic allocation mechanism is established to carry out the data calculation in blocks, progressive mining, repetitive matching, and storage of the calculation logic process in the cache improving the response speed of the calculation process.

(3) Containerization and rapid sinking

The Docker Engine loaded by the sinking computing nodes can be used as a daemon on the two-level nodes, providing services such as rapid delivery of business applications based on the specific requirements of the total node design, dynamic management, allocation and real-time deployment of the sinking application service resources.



Based on the research of big data analysis technology, this paper makes a comprehensive analysis of the current distributed data architecture of the distribution network. The W-A DSCT was proposed to realize the visual construction of the algorithm, the active encapsulation of sinking and multiple iterations of calculation methods. Benefits are as follows:

Operation analysis calculates efficiency	Mass data computing scale	Economic efficiency
Increase by more than 30%	Increase by more than 50%	more than 100,000,000dollars