

Research on Real-Time Exchange Strategy Model Based on Grid Communication

Data

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Abstract—The data exchange processing technology in the grid communication data technology system can be calculated for scenarios with real-time analysis requirements. It has the characteristics of real-time calculation, low latency and high scalability, and provides a new idea for solving the problem of exchange and sharing of grid communication data. Therefore, the data real-time exchange processing technology in the paper is applied to grid communication data exchange problem, and the semantic similarity calculation is combined to realize a data exchange strategy without uniform data standard, and the architecture model of supporting platform is designed to provide reference for the exchange and sharing of grid communication data.

Keywords-Grid Communication; Real-Time Data Exchange; Data Exchange Strategy

I. INTRODUCTION

The traditional data exchange method with the intermediate metadata standard as the core is different. The non-uniform data standard needs to realize one-to-one conversion between any two metadata standards, and this conversion is impossible by manual means. Therefore, how to achieve automatic mapping of metadata becomes one of

the key issues of this method. The key to metadata mapping is to establish the correspondence between the attributes of the two types of metadata. The core of the metadata is the similarity calculation of metadata[1-2]. However, the similarity calculation process of the metadata can utilize less context information, and only includes information such as a name, an attribute type, and an attribute description. Therefore, in the similarity calculation, we must not only consider the similarity of the lexical level, but also the matching of the semantic level.

II. GRID COMMUNICATION DATA EXCHANGE STRATEGY MODEL

The star design idea in the Hub/Spoke architecture is taken as a reference, and the idea of distributed computing is combined with distributed processing technology to design a star + distributed hybrid topology. Based on the above considerations, the logical structure of the grid communication data exchange method in the paper is designed, as shown in figure 1.

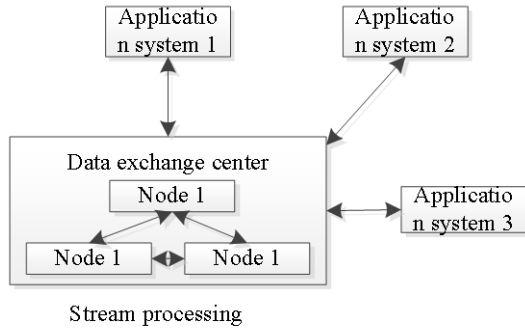


Figure 1. Logical structure of grid communication data exchange method

The overall use of a star topology consists of a data exchange center and multiple application systems, in which the data exchange center deploys a distributed streaming processing cluster, and each application system deploys a data exchange agent, and the metadata format is transmitted between the two in an XML format. The data exchange center is a unified computing center for data exchange[3]. It uses streaming processing technology to complete semantic similarity calculation and realize automatic mapping of metadata. The data exchange agent cooperates with the data exchange center to complete functions such as metadata extraction and loading and storage.

III. GRID COMMUNICATION DATA EXCHANGE CONNECTIVITY ANALYSIS

A. Data exchange topology model

The network routing design in the grid communication environment requires the construction of the link structure model of the network, and the multi-protocol marking technology is used for the fitness analysis and connectivity testing of intelligent data exchange nodes. The topology model is constructed as shown in Figure 2.

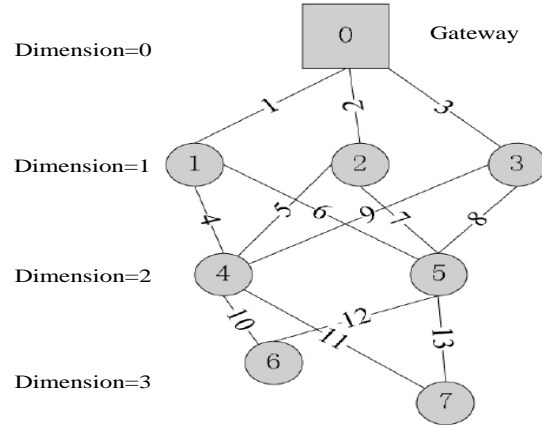


Figure 2. Network link topology

According to the multi-protocol marked grid initial network topology shown in Figure 2, the networking analysis of grid network link is carried out. Assuming that the edge vector of the grid core network is $L_i\{i=1, 2, \dots, C_i\}$, the directed graph $G=(V,E)$ is used to represent the random link distribution model of the grid, where V is the edge set of the grid, E is a multi-protocol marker point. The location update equation for the multi-protocol intelligent data exchange node is as follows.

$$v_{id}^{k+1} = \omega \cdot v_{id}^k + c_1 \cdot rand \cdot (p_{id} - x_{id}^k) + c_2 \cdot rand \cdot (p_{gd} - x_{id}^k) \quad (1)$$

In equation (1), k is the number of optimization iterations, c_1 and c_2 are learning factors, $rand()$ is the random channel distribution function, and ω is the inertia weight of the network topology. the balance of the entire network is considered, the value of ω is set to:

$$\omega = \omega_{max} - t \frac{\omega_{max} - \omega_{min}}{T_{max}} \quad (2)$$

In equation (2), ω_{max} and ω_{min} respectively represent the control coefficients of the multi-protocol label, T_{max} is the maximum control time scale, and t is the number of hops received by the grid. The network coverage radius calculation equation is gotten, as follows[4-5].

$$SLi' = \begin{cases} Li, & \text{if } i = 1 \\ New'_i, & \text{otherwise} \end{cases} \quad (3)$$

In equation (3), $New'_i = (e_{i,1}, e_{i,2}, \dots, e_{i,D})$ represents the robustness coefficient of each sensor node by periodically transmitting data, and the control protocol of the network is connected wirelessly, and the communication load of the computing node is

$$B_{N \times 1} = S_{N \times L} \cdot T_{L \times 1} \quad (4)$$

According to the topology model constructed above, the connectivity test and network protocol design of the multi-protocol intelligent data exchange node are performed to improve the balance of network output and data exchange.

B. Connectivity testing of multi-protocol intelligent data exchange nodes

Multi-protocol intelligent data exchange node connectivity testing is the key to ensuring the intelligence and accuracy of data exchange. In order to prevent data from reaching the same node at the same time, the node and its nearby nodes consume too much energy and fail. Multi-threshold level storage for all nodes of the same storage level is made before testing.

According to the hardware storage capacity in the power grid and the specific amount of network data, the storage node capacity is divided into several threshold levels. For any layer storage node, the network data is saved according to the node code value sequence, and after the storage capacity of the node reaches the i -th threshold, it is transitioned to the $i+1$ -th threshold. The detailed process is as follows:

Input: storage node capacity Q , split threshold level k , storage node storage level nl .

Output: The result is as follows.

1) The following formula is calculated:

$$R_i = i \cdot \frac{Q}{K} \quad (5)$$

2) If the data amount $Q_j \geq R_i$ of a node in the nl layer, the result is transmitted to the computing node;

3) The calculation node adjusts the result. If the data volume of all nodes in the nl layer is higher than R_i , the result is reset; otherwise, step (2) is performed again.

Data is distributed to different storage nodes by multiple threshold level storage to prevent node failure and provide data support for connectivity testing of multi-protocol intelligent data exchange nodes.

After the data is accurately stored, the source code level is debugged. In the debugging process, the vector set of the network topology is $(x, x(k))$, the correlation coefficients of the network are i and j , the load of each multi-protocol intelligent data exchange link is marked, and the network path is indicated by active detection. The expression is:

$$D_{node}(i) = \frac{N'_{node}(i)}{N_{node}}, 1 \leq i \leq N_{node} \quad (6)$$

The transmission frequency matrix of the network node $FN \times 1$ is marked. In the grid communication environment, the node C does not know the delivery message, and the exchange time of the three broadcast packets received by the node B and the node C is described as follows.

$$T(K) = T_0 \exp\left(-ck^{\frac{1}{N_i}}\right) \quad (7)$$

The message complexity of each packet along the path is recorded. The node of the multi-protocol label is NP , and the energy cost of the data exchange core in the life cycle of the grid communication environment can be gotten.

$$N = (a_2 N_p) \quad (8)$$

In equation (8), the coefficient $\alpha_2 \geq 1$ infers the coverage of the node B to the node A link until the loop termination condition is satisfied, and the iteration is completed to realize

the intelligent data exchange protocol optimization design and the multi-protocol intelligent data exchange node of the data exchange network[6-7].

IV. SIMULATION EXPERIMENTS AND ANALYSIS

In order to test the application performance of the method in the data intelligent exchange, the simulation experiment is carried out. The experiment was designed by Matlab, and the network protocol was designed in a network with 60 nodes. In the OMNet++ grid communication environment, the intelligent data exchange protocol design uses Simulink for simulation analysis. The bandwidth of the network transmission is set to $T_s = N_f T_f$, where $N_f = 2.34$, $T_f = 1200$ ns, $T_c = 12$ ns, and the sampling threshold of data exchange is set to $0.2 \leq K \leq 0.35$. According to the above simulation environment and parameter setting, the data intelligent exchange design is carried out, and the output data waveform is obtained as shown in figure 3.

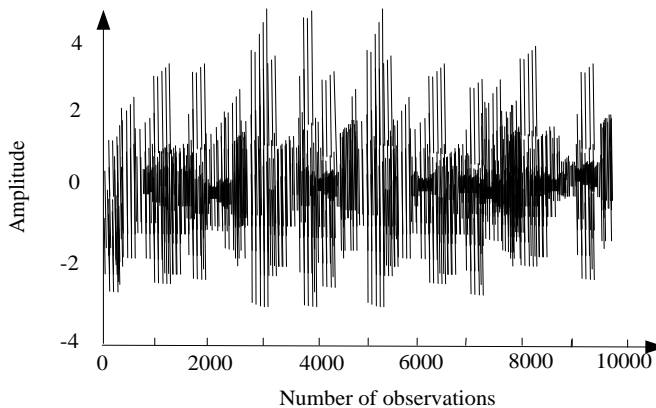


Figure 3. Data intelligent exchange output waveform

The fidelity of the data exchange is tested with the exchanged data of Figure 3 as a sample. The method of the paper has better intelligence for data exchange, can improve the accuracy of network transmission, reduce network output delay and distortion, and has low bit error rate.

V. CONCLUSIONS

A grid data intelligent exchange technology based on multi-protocol marking in the paper is proposed. The link structure model of the grid communication network is constructed, the connectivity test of the multi-protocol intelligent data exchange node is carried out. The route detection method is adopted to design the time division multiple access protocol of the multi-protocol intelligent data exchange node, and combined with the intelligent data exchange and protocol marking method. The optimal solution search of the data exchange intelligent control function of the grid communication network realizes the real-time exchange function of the grid communication data. Compared with the traditional method, this method has no cost of metadata standard management and maintenance, can meet the requirements of on-demand service and real-time exchange, and solves the problem of single-point failure and performance bottleneck of star structure.

REFERENCES

- [1] Yang Shan. Nuclear power plants gradually withdraw from the stage, and natural gas power generation capacity is known [J]. Natural Gas Exploration and Development. 2017(04).
- [2] Zhang Wenqing. Research on the Architecture and Related Technology of Internet of Things [J]. Electronic Technology and Software Engineering. 2017(24).
- [3] Sun Jianhu. Research on LoRa Technology and NB-IoT Technology Development and Engineering Construction[J]. Information Communication. 2017(12).
- [4] Huo Zhenlong. Application Analysis of LoRa Technology in Mine Wireless Communication[J]. Industrial Automation. 2017(10).
- [5] Zhang Lingli. Research and Test of OSAL Operation Mechanism of ZigBee Protocol Stack[J]. Internet of Things Technology. 2017(08).
- [6] Yang Tao, Ren Hongbo. Research on Operation Optimization of Distributed Cogeneration System with Energy Storage Device[J]. Energy Conservation. 2017(08).
- [7] Shi Jinlei, Gao Gugang. Design of Home Internet of Things Security System Based on LoRa Technology[J]. Electronic Technology & Software Engineering. 2017(10).