Research on the interaction mechanism of flexible demand resources

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Abstract

As the types and scenarios of customer-side flexible resources interactive operation become more and more abundant, flexible resources put forward higher requirements for the quality of information interaction. In this paper, firstly, starting from the diversified business that supports flexible resource interaction, we study and analyze the customer-side flexible resource interaction requirements and interaction content, and then design information interaction models and mechanisms oriented to multiple business characteristics and priorities. finally, we introduce relevant algorithms into the proposed model to improve the quality of information interaction. Simulation results show that the method proposed in this paper can effectively improve the interaction quality of flexible resources.

Introduction

The adjustable load in the operating area of the power grid company has great potential[1], and it is an important resource at the end of the energy ecological chain to support the linkage regulation of the source-grid-load system.However, there are some problems, such as the lack of customer-side flexible resources to participate in the normal interactive operation mode and interactive operation strategy, the lack of convenient platform access to large-scale resources, the single transaction mode of adjustable load resources and so on.

In the analysis and research of adjustable characteristics. Some scholars make a comprehensive analysis of the factors that affect the change of load characteristics, and assists the work of demand response and load modeling. We take the customer-side flexible resources to participate in the demand response (DR) as an example to divide the services based on different information interaction quality requirements to ensure that all kinds of services can obtain communication quality that matches their own service priorities. In the aspect of flexible resource interaction mechanism and improving the quality of flexible resource information interaction, Qi Bing designed an adaptive coded modulation (AMC) strategy based on demand response (DR) service level and channel signal-to-noise ratio (SNR) level. In this paper, we comprehensively consider the DR service types and DR communication devices to design the interaction mechanism.

Table 1. TYPE AND PRIORITY OF THE SERVICE

Level of service	category	services	Delay requirement	Reliability requirement	Data flow characteristics
I	Emergency control	Emergency services	<50ms	very high	randomness
II	General events	General Event Service	50~500ms	high	randomness
		Select service		general	
		registration service		general	
III	Monitoring and Reporting	Reporting services	50~1100 ms	general	randomness
	Auxiliary support	Polling services	>1100ms	low	periodic

Methods and Materials

In the OpenADR2.0b communication protocol, six service types are defined, namely, event service, selection service, registration service, reporting service and polling service. In the actual DR implementation process, events can be divided into emergency events and general events, as shown in TABLE I. We divide different services into three.

we design a flexible resource interaction scheme based on the priority of DR service, the performance of optimization algorithm and processing delay, according to the priority of DR service, the performance of optimization algorithm and the processing delay, a flexible resource interaction scheme is designed. By using Alamouti, prealamouti and other algorithms flexibly, the purpose of flexible resource interaction optimization on the customer side is achieved.

As shown in figure 1, the problem of high equipment performance of Alamouti algorithm based on precoding is solved by introducing edge stations with higher computing power. For a small number of high-performance communication terminals, the MRC algorithm can be deployed to achieve high-quality communication performance. The specific implementation plan is as follows:

•Investigate the performance, number and geographical distribution of local communication terminals that can participate in the interaction of flexible resources;

•Deploy edge stations in areas where small communication terminals with low computing power are widely distributed as relay stations responsible for communicating with these terminals;

•Alamouti algorithm based on precoding is deployed in edge stations and MRC algorithm is deployed on high-performance terminals. At the same time, we focus on the optimization of event service, so the whole system uses Alamouti coding during non-event service to avoid wasting unnecessary computing resources and power consumption.

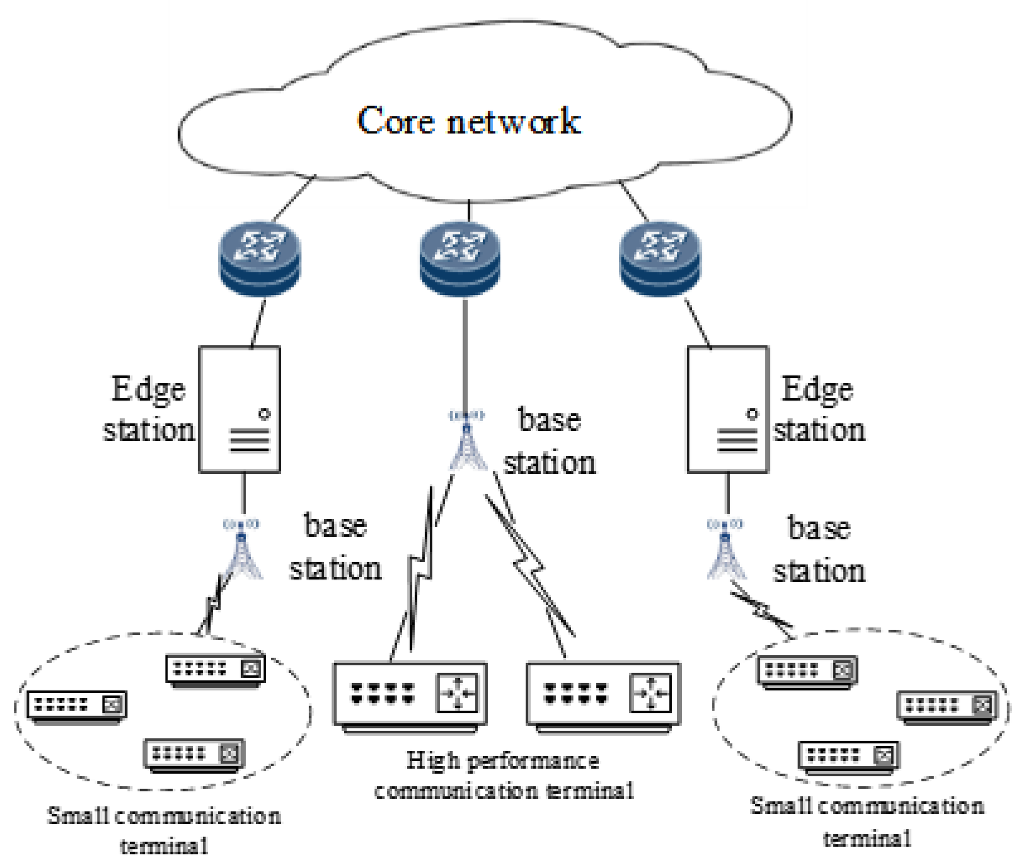

Figure 1. Interaction architecture of distributed demand response

Results

The simulation of the information exchange system proposed in this paper uses Alamouti algorithm, preAlamouti algorithm and MRC algorithm respectively, and the bit error rate(BER), in the case of different signal-to-noise ratio (SNR) is shown in Fig. 2.

It can be found that when the number of antennas is the same, the BER performance of Alamouti algorithm is close to that of MRC algorithm. PreAlamouti is an Alamouti algorithm based on precoding, and with the increase of SNR, the performance of preAlamouti is much better than that of Alamouti algorithm. Of course, the performance of receiver diversity with four antennas (MRC algorithm) is even better than that of preAlamouti.

In order to verify the effectiveness of our proposed interactive mechanism, we simulate the 24-hour BER monitoring during the summer power peak in a certain area, in which 9: 00 to 11:00 in the morning and 2: 00 to 5: 00 in the afternoon are DR implementation periods, mode 1 adopts edge station scheme, mode 2 is MRC scheme based on high-performance terminals. As shown in Fig. 3, the two schemes effectively reduce the bit error rate and improve the communication quality of the system during the implementation period of DR.

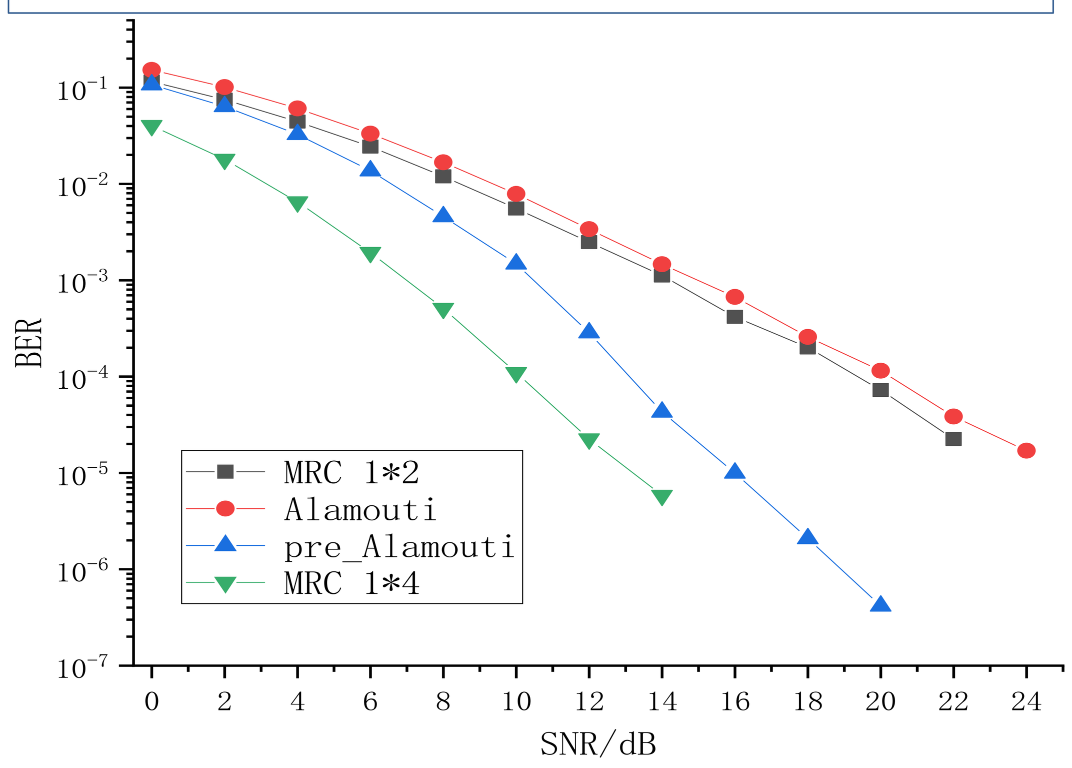

Figure 2. Bit error rate comparison of different algorithms

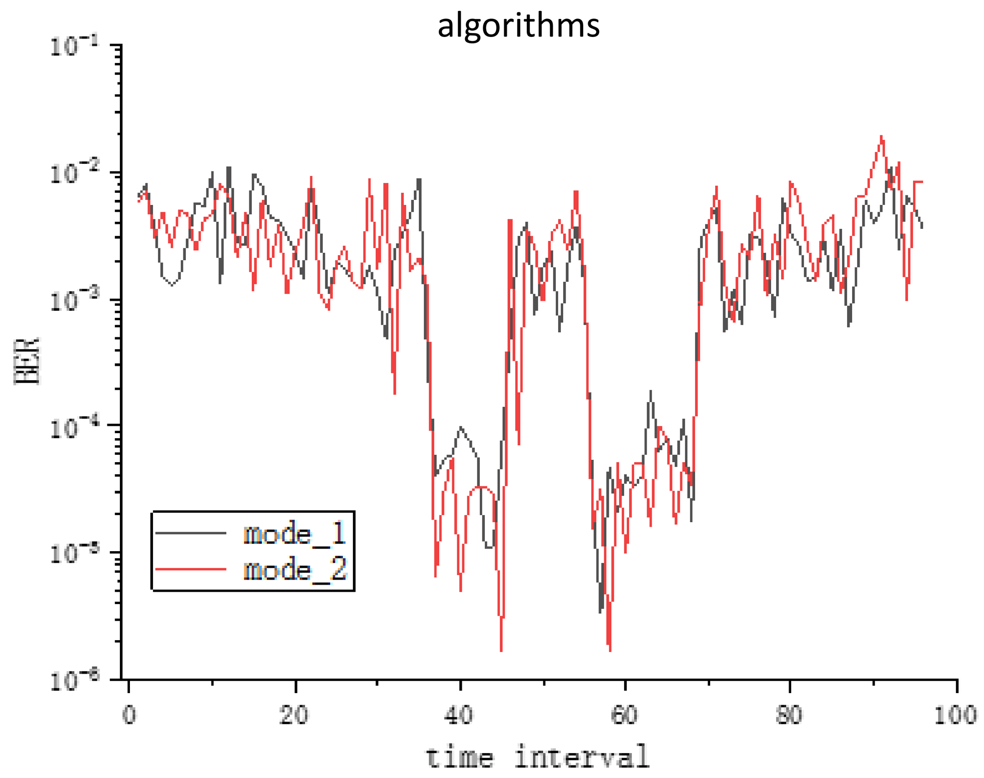

Figure 3. Bit error rate analysis throughout during demand response period

Conclusions

In this paper, the interaction mode of flexible resources in power grid is introduced, and several typical service requirements are analyzed by taking demand response as an example. An interactive mechanism is proposed, which customizes different strategies for different types and performance of user-side terminals, and focuses on optimizing the implementation period of demand response. Finally, through the simulation of an example, it is verified that the flexible resource interaction mechanism adopted in this paper can make full use of the characteristics of communication equipment resources and improve the communication quality in the implementation period of DR.

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