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Energy Adaptation of Energy Internet Based on Cloud Computing

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Abstract: With the rapid development of the world economy, energy crisis and environmental crisis have become the focus of the world. Energy Internet can achieve a better combination of traditional energy and renewable energy, improve energy efficiency, and become an important direction to solve this problem. Through the corresponding interpretation of cloud computing, energy Internet and energy adaptation, this paper integrates the algorithm of cloud computing into the energy adaptation of energy Internet, and proposes an improved algorithm lsdemfo. Through the simulation test and analysis of this algorithm, it is concluded that this algorithm has many advantages, such as low cost, strong load capacity, fast computing speed, and has a good development prospect.

1. Introduction

Energy is an important supporting resource for people's life and social development at present. The era of fossil energy with coal, oil and other non renewable resources as the core is coming to an end. Driven by the energy reform, mankind will face the "hybrid energy era" with renewable resources as the main energy[1]. The proposal of EI breaks the matching conditions of supply and demand between different traditional energy industries, and promotes the interconnection, interworking and complementary relationship between primary and secondary energy sources such as coal, oil, natural gas, photovoltaic, electricity, etc[2].

EI is a new energy, which advanced regulation technologies to effectively regulate the relationship between a variety of power generation, storage equipment and power load, and promote the efficient utilization of renewable energy[3]. For a long time, electric energy accounts for a large proportion of China's energy composition. Based on electric energy and by means of information technology, EI has promoted great changes in the mode of electric energy production and consumption[4]. Energy Internet is the product of the deep integration of Internet technology into

energy, and has received extensive attention in academia and industry. As the target product of the development of smart grid, EI includes power grid and power communication network[5]. The energy scheduling forming an interdependent and mutually restrictive correlation network. Therefore, exploring the energy service adaptation relationship and the ability to optimize service adaptation in the energy Internet is conducive to promoting the better development of the energy Internet. After EI, a new technology, was put forward, it set off a global research climax in a very short period of time and achieved certain results. In the decade of the 21st century, China began to step into the "third industrial revolution" and carried out the research on EI related topics at the same time. Compared with foreign countries, it started late, but it has made good progress at present. Compared with the traditional energy supply system, the relevant technologies of the above "energy Internet" can effectively promote the optimal scheduling of renewable energy and improve the utilization rate of renewable energy at the same time[6-7].

Therefore, on the basis of the above research, this paper introduces cloud computing algorithm into the energy adaptation process of the energy Internet, and proposes an energy Internet service adaptation mechanism taking into account the prediction, which can achieve the purpose of reducing the impact caused by the variability of the energy Internet such as renewable energy changes and load time-varying, so that the service adaptation can more effectively reflect the operation of the energy Internet.

2. Theoretical Research on Energy Internet Energy Adaptation Based on Cloud Computing

2.1. Energy Internet

The current energy development is not flexible enough to regulate the supplys, and the energy storage technology for distributed power generation such as wind energy and solar energy is immature. China's huge population leads to great pressure on energy demand[8-9].

These backbone energy and distributed energy are coordinated with each other, and sufficient energy services are provided with the demand side of industry, commerce and housing[10]. The focus of energy under EI environment is different from that under smart grid. Smart grid mainly refers to centralized power, which initially involves some new energy, while EI focuses on different types of distributed energy, especially renewable and environment-friendly, such as solar energy, wind energy, nuclear energy, ocean energy, etc. One of the main problems in EI is the optimal and adaptive scheduling of distributed power generation capacity, which mainly involves the operation cost, maintenance cost, interaction cost and income between energy LAN and external power grid, and the treatment cost of pollution generated during power generation. When the wind and solar energy production equipment is added to the power grid, a series of unstable factors will be caused due to temperature, weather and other problems, resulting in high fluctuation of power generation in the energy LAN. Due to the large-scale access of EI to distributed energy, it has become a new research difficulty for EI to allocate the power of distributed energy under the premise of comprehensively considering the objectives of economy and environmental protection, so as to achieve the optimal service adaptation[11].

2.2. Cloud Computing

Cloud computing technology is the most advanced and fastest-growing technology in the computer field. As a new network technology, cloud computing provides a unique IT technology advantage for the computer industry[12]. Compared with traditional data centers, cloud based

services provide more system independence, requirements, reusability and reliability. Cloud computing is the latest development of computing in organizing and delivering services across the network. Practical computing, parallel computing, virtualization and service-oriented architecture are the key features of cloud computing. The term "cloud" refers to the shuttle of networks, interfaces, storage and hardware to provide good services.

Cloud computing is not a new concept. Amazon set up its subsidiary Amazon Internet service, and produced elastic computing cloud server (EC2). The beta version of the application engine was proposed by Google. Since then, many information technology (it) organizations, such as Amazon, Yahoo, Google and other platforms are using cloud computing to provide cloud services for their customers[13].

The cloud provides unique it advances and applications through third parties through the web. It can realize resource calculation, such as storage space and CPU power. As a basic utility, end users pay through the network and publish according to order. For those businessmen of small companies that have just launched start-ups, it is of great economic value to meet their demand for resources, especially when there is demand in the market, cloud services can be used for specific analysis. Therefore, cloud computing plays a key role in health care, agriculture and other fields[14].

2.3. Cloud Computing Features

Super large scale: cloud computing can provide super large-scale computing resources with strong computing power. Large scale computing can be achieved because physical server resources can be transformed into physical resource pools, which can be infinitely expanded[15].

Fast, elastic and extensible: computing services must have information resources that can expand rapidly and meet their needs. Therefore, whenever users have use needs, they will expand the services provided; When the demand ends, they will scale down as the service stops.

Resource pooling: it sources (such as storage, networks, servers, software, and services) are merged, as if there was a resource pool available to serve multiple programs and many tenants in an uncommitted manner. Many clients provide services for the same physical source[16].

High reliability: cloud computing is protected by fault-tolerant mechanism. Cheap nodes can become their computing nodes. In the public cloud mode, the utilization rate is significantly improved. Node errors can be detected automatically, and resources can be load balanced to avoid server downtime caused by overload. When a node fails, it can automatically switch to a normal node to ensure the security and reliability of cloud computing services.

Cloud computing has the characteristics of data fault tolerance, and advanced computer node measures can ensure the reliability of this service; Cloud computing is used in a wide range of fields and is very flexible. With the support of the Internet platform, it provides flexible cloud computing services for enterprises, and promotes a cloud platform to meet the needs of different industries. When cloud computing was first proposed by IBM, elastic computing cloud was proposed, so cloud computing has scalable characteristics. Therefore, cloud computing service mode can be dynamically scalable, so as to meet the data statistics needs of users in different industries; Different enterprises have different requirements for cloud computing services. Cloud platform is a very large intangible platform. Enterprises can choose the appropriate "cloud" service type according to their needs, and can use very economical cloud computing services. Special fault-tolerant technology enables data nodes to form a "cloud". Cloud computing services have very good compatibility, scalability and versatility, which can significantly reduce the cost of enterprise data management.

2.4. Related Formula

The initial formula of lsdemfo formula is as follows:

$$C_{jh} = \sum_{0}^{VM_C} \ (C = \text{vm Count}) \tag{1}$$

The average load is calculated as:

$$Z_{avg} = \frac{\sum_{n}^{n-1} z}{C_{jh}} \tag{2}$$

Among them, the virtual machine that meets the upper limit of the threshold is used for migration σ N, the formula is as follows:

$$\sigma_n = Z_{avg} > Zn_{Max}(C_{jh} > n > 1) \tag{3}$$

Combined with the above formula, it is simplified into a formula as follows:

$$\sigma_n = \frac{\sum_{n}^{n-1} z}{\sum_{0}^{vm} \text{Count}} > Zn_{Max} \tag{4}$$

The algorithm controls the dynamic migration of virtual machines by setting the upper and lower thresholds to achieve the goals of load balancing and energy saving. This mechanism has a fine granularity of resource scheduling, can provide transparent resource scheduling for applications in virtual machines, and provide better application prospects for ensuring the fluency and reliability of energy Internet systems.

3. Energy Adaptation Design of Energy Internet Based on Cloud Computing

The energy adaptation scheduling scheme of the energy Internet in this paper is based on the actual output power of each distributed energy, so the data set containing the output power of each distributed energy in the energy Internet should be selected in the experiment. For the energy adaptation scheduling problem in the energy Internet, there is no public research data set at present. This paper combines the existing research comprehensive model to generate a random data set, and takes the output power candidate set of the energy Internet distributed generation as the solution space. According to the non renewable characteristics of bat, FC and MT in the model, the output power range is determined to be randomly generated between [-30,30], [3,30] and [6,30] respectively. The literature gives the output power of renewable energy PV and WT in one day. In the experiment, the duration of each period Δ t is 1 hour, the control time domain t is 24 hours, and the total simulation time is 1 day. The capacity limits of bat, FC and MT are shown in Table 1, and the operation cost, maintenance cost and power generation efficiency of each distributed energy are shown in Table 2.

Table 1. Power generation limitation of distributed energy

DG	Min(KW)	Max(KW)	Up(KW)	Down(KW)
MT	6	30	140	30
FC	3	30	120	160
BAT	-30	30	20	60

Table 2. Operation cost, maintenance cost and power generation efficiency coefficient

DG	PV	WT	BAT	FC	MT
Operating expenses	0	0	0	0.2	0.4
Maintenance cost	0.08	0.11	0.02	0.04	0.12
Power generation efficiency	1	1	1	0.3	0.3

Bat, FC and MT will have an output power for each Δ t duration. Therefore, in order to facilitate the verification of the solution performance of the algorithm, a 200*72 scale data set is randomly generated as the solution space in the simulation process, and each data in the data set is set as a random number in the range.

4. Analysis of Energy Internet Energy Adaptation Data Based on Cloud Computing

4.1. Analysis of Fitness Value Change Characteristics

In order to verify the effectiveness and convergence of the fused lsdemfo algorithm, this paper compares the experimental simulation results of lsdemfo with the other three algorithms: lsmfo, MFO, De, PSO. In this part, the population size is set to 100, and the given initialization dimension is 51, that is, bat, FC, MT initialize an output power at Δ t in each time period of a day. The variation of the total running cost of the five algorithms with the number of iterations is analyzed. The corresponding relationship between the fitness value of each algorithm and the number of iterations of the algorithm is shown in Figure 1.

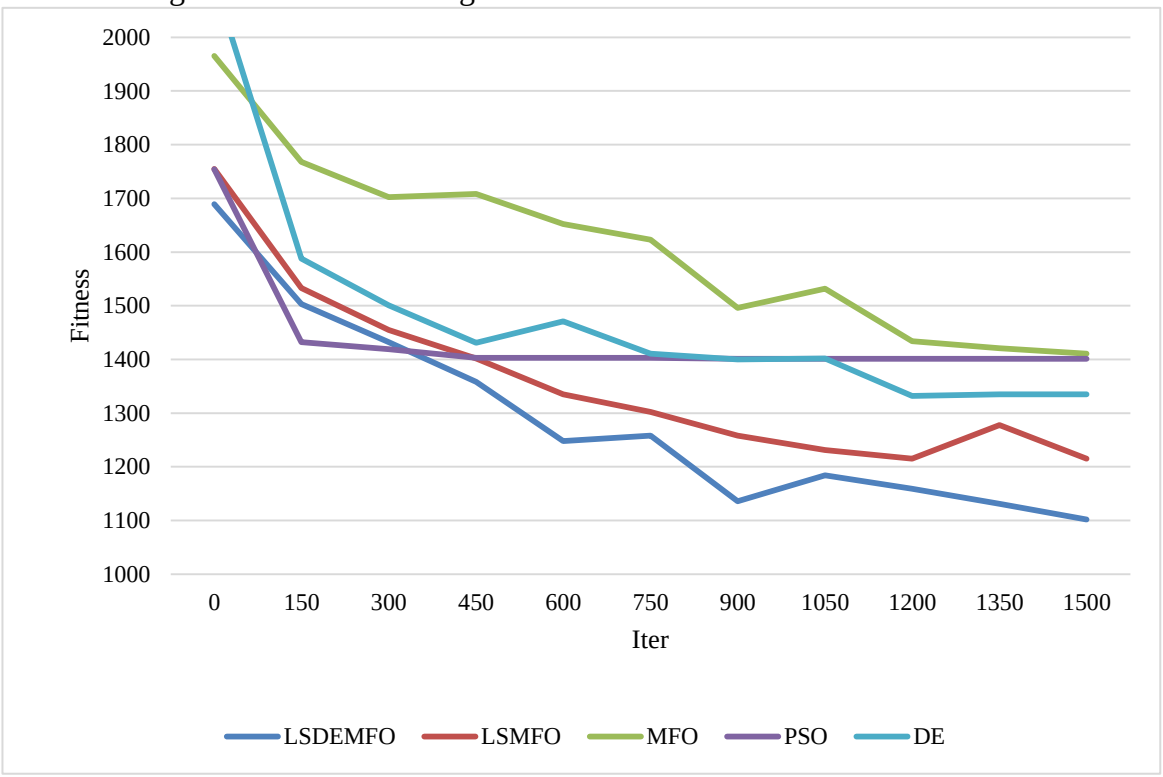

Figure 1. Convergence characteristic graph of algorithm

Figure 1 shows the convergence characteristics of five intelligent optimization algorithms for

optimal scheduling of energy Internet energy environment adaptation. From the final convergence results of MFO, PSO and De, it can be seen that MFO has better optimization effect on energy Internet energy environment adaptation than the other two algorithms.

Table 3. Variation characteristics of algorithm fitness value

	LSDEMFO	LSMFO	MFO	PSO	DE
0	1689	1755	1965	1754	2103
150	1503	1533	1768	1432	1588
300	1432	1455	1702	1419	1501
450	1358	1402	1708	1403	1431
600	1248	1335	1652	1403	1471
750	1258	1302	1623	1403	1411
900	1136	1258	1496	1401	1400
1050	1184	1231	1532	1401	1402
1200	1159	1215	1434	1401	1332
1350	1131	1278	1421	1401	1335
1500	1102	1215	1411	1401	1335

It can be seen from table 3 that the fitness values of De and PSO are not ideal, either in the process of iteration or in the energy environment adaptation model of the energy Internet. The optimization effect of lsdemfo in the energy environment adaptation model of the energy Internet has also been correspondingly improved compared with lsmfo.

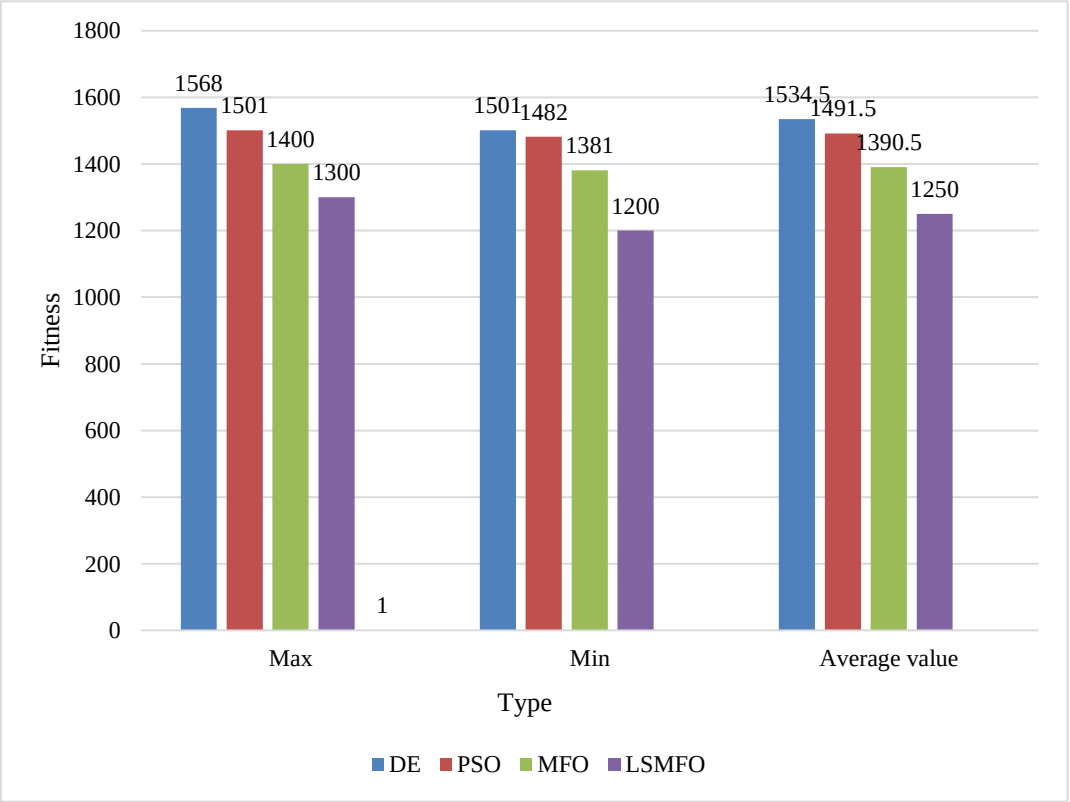

Figure 2. Descriptive analysis of the algorithm running 20 times

Figure 2 compares the maximum, minimum and average fitness values of energy Internet energy environment adaptation optimization scheduling convergence from lsdemfo, lsmfo, MFO, PSO and de in a day. It can be seen from the figure that lsdemfo is smaller than the other three algorithms in terms of maximum value, minimum value and average value, which shows that the total operation cost of this algorithm in the energy environment adaptation of the energy Internet is the lowest, and the optimization effect of the final energy environment adaptation scheme of the energy Internet is the best.

5. Conclusion

Compared with the current smart grid and Microgrid, the energy Internet has great advantages. According to the characteristics and connotation of energy Internet, studying various key technologies in the Internet has important theoretical significance and practical value for the development of energy Internet. This paper mainly builds the model for the energy adaptation scheduling scheme in the energy Internet, integrates the cloud computing algorithm into the energy adaptation, and selects the energy adaptation algorithm lsmfo which is most suitable for the energy Internet. This algorithm has the characteristics of low cost, strong load capacity, fast computing speed and so on.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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