Analysis of the Application of IT Information Platform Interconnection in Charging Infrastructure

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Abstract. With the continuous formulation and promulgation of national policy system documents, the rapid development of new energy electric vehicle production and manufacturing, and the IT informatization integration of charging infrastructure industry have become a comprehensive carrier supporting industry information, technology and services. In view of the interconnection of different levels of information and data, it is bound to give full play to its unique information value. This paper analyzes the application of informatization through informatization, interconnection, security, big data integration and other aspects, combined with the current industry development background and status quo, in order to support the informatization development of charging infrastructure industry, realize the application of high-tech information, drive the industry system forward and improve the informatization platform.

Keywords: Electric vehicles; Charging infrastructure; Informatization; Interconnection; security; Big data fusion.

1. The Policy Background of Building an Information Platform

In order to speed up the construction of electric vehicle charging infrastructure, the State Council General Office issued the "Guiding Opinions on Accelerating the Construction of Electric Vehicle Charging Infrastructure" (the general office of the state council [2015] No. 73, hereinafter referred to as: charging Guidance on facility construction). The guidance on the construction of charging facilities pointed out: "Charging infrastructure refers to various types of charging and replacing facilities that provide electrical energy for electric vehicles. It is a new type of urban infrastructure. Vigorously promoting the construction of charging infrastructure will help solve the problem of charging electric vehicles. It is an important guarantee for the development of the new energy automobile industry, and is of great significance for creating a "dual engine" for mass entrepreneurship, innovation, and increasing public products and public services, achieving stable growth, adjusting structure, and benefiting people's livelihood." The following content is proposed (excerpt):

1.1. Construction Guidelines

According to the State Council’s decision-making and deployment, adhere to the purely electric drive as the main strategic orientation for the development of new energy vehicles, place charging infrastructure construction in a more important position, strengthen overall planning, unified standards and norms, improve support policies, innovate development models, and cultivate good The market service and application environment form a rational layout, scientific and efficient charging infrastructure system.
1.2. Basic Principles
Overall planning, scientific layout. Do a good job in the overall planning of charging infrastructure construction, increase the integration of public resources, scientifically determine the construction scale and spatial layout, and simultaneously build a charging intelligent service platform to form a relatively complete charging infrastructure system.
Unified standards, universal and open. Improve the product certification and access management system for electric vehicles and charging equipment, promote the interconnection of different charging service platforms, and improve the versatility and openness of facilities.

2. Research and Forecast
International charging infrastructure development. According to survey data, China's charging infrastructure development is at the forefront of the world. In 2017, China continued to maintain the number one market position for electric vehicles in the world, and at the same time, China also became the country with the fastest growing charging infrastructure. In 2017, China's electric vehicle sales exceeded 770,000, with a growth rate of more than 50% year-on-year. Electric vehicle sales accounted for 2.5% of car sales, and the number of vehicles owned was close to 2.3 million. The annual sales volume of electric vehicles in China accounts for more than 50% of the world's total, and the total number of electric vehicles in China also leads the world. At the same time, according to statistics of industry organizations, as of August 2018, the number of public charging piles constructed and operated was close to 280,000, including 123,295 AC charging piles, 92,871 DC charging piles, and 62,570 AC and DC integrated charging piles. From September 2017 to August 2018, the monthly average of about 7728 new public charging piles increased by 50.0% year-on-year in July 2018. The number of public charging facilities in China's charging infrastructure ranks first in the world. With the continuous advancement of new energy vehicle manufacturing processes and related technologies of battery energy density, the continuous application of new materials, while the information platform service refines the particle level improvement, the public is constantly updating and using the concept of new energy vehicles. With the strong support of various national policies, the development of new energy electric vehicles shows a steady growth trend, and the demand for the construction of electric vehicle charging infrastructure will be more urgent.

3. The Urgency of the Development of Information Platform Interconnection
Policies show that by 2020, more than 5 million electric vehicles will need to be charged. The newly constructed residential parking spaces should be built with 100% charging facilities or reserved for installation and installation conditions. The proportion of parking spaces in large public buildings equipped with parking lots, social public parking lots for construction of charging facilities or reserved construction and installation conditions shall not be less than 10%. Every 2000 electric vehicles are equipped with at least one public charging station. By 2020, an intercity fast charging network covering most major cities will be initially formed. For the centralized electricity charging and swapping facilities that directly report the installation and connection of electricity to the grid operating enterprises, the price of electricity for large industries is implemented, and basic electricity charges are temporarily waived until 2020. Nowadays, major charging infrastructure operating enterprises and related units are actively constructing an information service platform to basically meet the basic service of finding, querying, and charging to form charging piles and APPs in order to meet the charging needs of the rapidly increasing electric vehicle charging users. Operation platform, settlement payment center, service center module, to meet the business needs of charging development. However, there are still many problems with the interoperability and efficient docking of truck piles. The main purpose of interconnection and intercommunication of charging infrastructure is to solve interconnection and intercommunication between charging piles and between cars and piles, so that users of electric vehicles can use charging equipment indiscriminately and can effectively complete payment and settlement. At the same time, in the future, through the formulation of professional standards and the improvement of technical level, users can make instant charging and settlement without feeling. Therefore, IT is necessary to get through the important links of charging equipment
interconnection and charging information data interconnection, in which the role of IT information platform is obvious. Based on the above, the interconnection and interoperability of the information platform must be fully utilized by means of intelligence and communication technology to effectively integrate the information resources of the charging service platform in the industrial chain, and promote the interconnection of different charging service platforms. Effectively achieve the interaction of basic information data, and provide strong support for further integration of information area chain transmission.

The open and integrated platform of interconnection and interconnection requires extensive access to charging pile manufacturers, charging and swapping facilities, self-built management and charging, and collection of more imported resources to build an ecological charging network. For the information platform implementation scenario, build a dialysis model, realize automatic charging, platform self-service optimization and other improved service management support, support open sharing and access to data, so as to achieve real interconnection and enhance user perception and experience.

In terms of technological iteration of innovative models, with the improvement of technological models, more and more solutions to users' convenient and smooth charging experience and more intelligent networked information interconnection are conducive to the continuous iterative progress of new technologies. According to the current environmental format, the integrated scanning of QR code charging is the first step in steadily improving the charging service experience, and at the same time provides charging operators with good information diversion service guidelines, which realizes the background in the daily charging service of users. Technical links such as technology management, interaction and execution. The plug-and-charge mode is the second step of development on the basis of interconnection and interworking technology. According to the standard interface communication, the daily charging of users can realize information interconnection and payment interconnection. It can better promote the application of new technologies and the process of information standardization, combined with the citizen credit mechanism, matching user data information, to achieve the user's indiscriminate charging experience, and realize the national welfare of science and technology serving people's livelihood.

4. Information Platform Application Technology

The IT information platform is an important means to support the field of charging infrastructure, realize the interconnection and interworking mechanism, and ensure the immediacy and application of technical services. The overall technology development can use advanced mainstream cloud computing models to realize the interactive application of big data information. At the same time, build an information service platform that integrates intelligent IOT, smart charging, navigation design, information statistics, data analysis, decision-making, and system configuration management. In the actual scenario, the software, hardware and network resources are combined and shared to provide enterprises and end users with a full range of granular information and data services. Through intelligent Internet of Things, data analysis and information evaluation, demand improvement is achieved, and the platform’s innovative ability is promoted. The production process, business model and information chain of the charging infrastructure industry are innovative to create a competitive ecosystem, and then realize the integration of information and data.

The current mainstream system platform architecture follows the characteristics of standard development language, unified interface standard, operating environment standardization, workflow engine, business process design, etc. to achieve data information sharing. The overall information platform can be divided into several aspects: front-end design, unified messaging, data analysis services, data visualization, and data invocation.

The overall framework is based on java development and design, to build a rapid development iteration platform that encapsulates high efficiency, high performance, and strong security. The development system technology application focuses more on permissions components, data dictionaries, core tools, view generation, workflow invocation, and code generation. And adopt
multi-level design, double verification, security coding, password encryption, access verification, data permission verification.
The front end includes: management terminal, vehicle machine user terminal, mobile APP terminal, management terminal uses icon plug-in, map software; JS framework, CSS framework, pringMVC framework, RabbitMQ, data table, etc. can be used. The service layer performs various information data extraction and processing to provide users with various services. For example: report service, query, path, pile finding service, data management service. The back-end includes core framework, view framework, server-side verification, log management and so on. The platform supports server middleware applications, the data layer uses MySql, Oracle, DB, statistics of various data required by the platform, in order to better support the service layer.

5. Information Service Platform Integration and Management Measures
The integration of information and data services is considered in terms of hardware, software, and security. First, the investment in hardware infrastructure is in accordance with the characteristics of stability, efficiency, and application, and it is moderately ahead. Second, the software information platform system provides good business continuity, high reliability, and rapid system application performance. Information system integration design and implementation of technical services follow the principle of reliability. Third, pay attention to the construction of information security system, improve the overall security of information infrastructure, and further ensure data security. It involves system management, architecture, technology and other aspects. Overall, it includes physical security requirements, network topology requirements, system application security requirements, and information exchange security requirements.
The information platform focuses on ensuring the following goals: basic business network security system, efficient transmission and stable interaction of data units. Establish an efficient and stable regional network architecture, effectively separate data requirements at different levels, ensure smooth and safe use of business applications, ensure high-performance, high-reliability data access for core application systems, and future flexible scalability requirements.
The integrated management of the information platform mainly starts from the aspects of operation management, basic management, data mechanism, virus protection, business application, and information control.

5.1. Operation Management
All types of computer equipment on the data platform are not allowed to write, modify, replace various software systems and change equipment parameter configurations without the approval of the person in charge. The maintenance, addition, deletion, and configuration changes of various software systems, and the addition and replacement of various hardware devices must be approved by the person in charge; they must be registered and recorded in detail in accordance with the regulations, and all kinds of software, on-site materials, files should be organized and archived. In order to ensure the safety and confidentiality of the data, both the interactive data and the processed data must perform the handover registration procedures in accordance with the relevant regulations. Formulate daily information security rules and regulations including security responsibility system, periodic inspection system, evaluation improvement system, security outsourcing system, accident reporting system, etc.

5.2. Server Management
Servers, routers, switches, and communication equipment are the key equipment of the information network. They must be placed in the data room. They cannot be configured or replaced by themselves, nor can they be used for other purposes. The data room must be kept clean and hygienic, and a dedicated person should be responsible for the management and maintenance. In addition to system repair and maintenance time, the server must be kept up and running 24 hours. Do not delete, move, or modify server data without authorization; do not intentionally damage the server system; do not modify the server system time without authorization. Regularly scan the server system, close suspicious ports and services in a timely manner, often check the server operation log, check the server
disk space (or other storage device) usage, and find and record the abnormal operation of the server in time.

The administrator should keep the server administrator account and password strictly confidential and modify it regularly to ensure the security of the system and prevent illegal intrusion into the system. Implement strict security and confidential management of server data to prevent the leakage, loss and destruction of system data. Handle all kinds of errors that occur in the operation of the server's software and hardware software system in time, and make detailed registration of all large and small faults that occur in the work, including the time of the fault, the fault phenomenon, the processing method and the result.

5.3. Virus Protection
The information platform management personnel should have a strong awareness of virus prevention, conduct regular virus detection, and find the virus to deal with immediately. No new software may be installed on the server without the permission of the superior management personnel. If it is indeed required to be installed, a routine virus detection should be performed before installation. Programs or data transmitted via remote communication must be tested and confirmed to be virus-free before they can be used. Pay attention to the virus prevention situation and prompts in the IT industry in a timely manner, adjust server security parameters according to industry prompts, and avoid server attacks.

Establish a virus protection system. Before the system performs operations such as copying and running, it detects whether the file is infected with a virus, and if the virus is found, it is automatically cleared or selected by the administrator.

5.4. Data Mechanism, Business Application and Information Control
The database must be backed up regularly, such as weekly or monthly backups of log files. The important data in the server system should be stored in different media to ensure that the system can be quickly recovered once the system fails. Regularly check the backup data, and if it is damaged, re-backup in time. Register and manage the backup data, backup can use storage media such as disk, mobile hard disk, U disk.

The information and data in the account in the authority are divided according to regulations, and users can read and use it according to the authority of their account. The user unit compiles and issues accounts according to the user's responsibility and authority. Each user corresponds to a unique account, and it is forbidden to use other people's accounts. The administrator account and authority in the system can only be used after the user unit has submitted it to the information center for authorization.

For different data input methods such as manual entry, batch import, and acceptance of other system data, the system will automatically check and verify the accuracy, validity, and completeness of the data. System management personnel should do a good job of information system security in strict accordance with the information security and confidentiality system. The passwords and passwords of each information system must be kept strictly confidential. Unauthorized changes or disclosure of system access authorization are strictly prohibited.

6. Security Management under Interconnection
An information platform is an information data system composed of multiple technical levels, multiple device categories, and a hierarchical system. In view of the massive data generation of different interfaces, it is necessary to pay close attention to the security issues that follow the application of new information technology to the construction of information platforms, build a security assurance system that adapts to the interconnection platform, and ensure that the background of full interconnection, resource integration and data fusion Under the security and reliability of information, improve the security of information and data. Information security infrastructure should provide access to other systems, provide a wide range of information support and services, and accelerate the construction of an improved information security system.

Starting from the aspects of informatization digital certification, information security evaluation, and information security level protection, standardize the development and management of core databases
and information systems. Improve the identity authentication mechanism under information interconnection, that is, standard identification, key generation, docking authentication, etc., so that the security of scene services can be standardized and improved. Security includes the platform's own system security, data security, and communication transmission security. The information platform plays a vital role in the daily operation and emergency handling of interconnected data exchange. This series of collections will have an impact on the consistency and quality of the system in the scene application, and will have a security impact. The safe operation of the interactive charging function will make the charging process safer and more efficient. Through the realization of basic communication network, charging pile and platform, and information platform to achieve interconnection and interoperability, we can better achieve the management, communication, monitoring and other processes of infrastructure. We take the information security of the main power grid connected to the CPS system in the charging infrastructure as an example. The electric power CPS is a multi-dimensional heterogeneous system that fully integrates the physical network and information network of the power system. Through computing equipment, sensing equipment, communication equipment, physical equipment, etc. To achieve the optimization of the overall operating performance of the power system. The power CPS architecture mainly includes three parts: multi-source power network, multi-information network and power CPS network[1]. Indexed cyberattacks define the three elements of cybersecurity. The American Institute of Standards and Technology (NIST) Report No. 7628[2] points out that the three elements of cybersecurity are confidentiality, integrity, and availability, referred to as network "CIA" security objectives. Confidentiality: Access to information is limited to authorized users or organizations, and any access through illegal channels should be detected and blocked.[3] The destruction of "confidentiality" will cause grid information leakage problems, and there is important information (such as user privacy), Property rights information, etc.) threats used by illegal elements.[4] Integrity: Maintain and guarantee the accuracy and consistency of data or information. Any unauthorized organization or data modification method shall not modify the transmission data (including rewriting, deleting, adding, replacing and other operations) and destroying it. The loss of "property" means that the data in the network is modified or destroyed, which in turn leads to incorrect power management decisions. Availability: Any information in the power grid can be accessed by a 100% authorized party in a reasonable way at any time. Even if there are unexpected events in the power grid (such as electrical accidents, attacks, etc.), users, power installations, control centers, etc. can still obtain the needs Information.[5] Once the "availability" is destroyed, it will cause problems such as data transmission interruption, and in severe cases will have a huge impact on power transmission. Cyber attack broadly refers to any kind of malicious attack behavior that destroys the security target of the network "CIA". Definition of cyber attacks in the field of power CPS: for the purpose of destroying or reducing the function of power CPS, the behavior of communication systems and control systems without permission (various power automation control components to ensure the normal operation of power systems and real-time data The working status of the process control components for collection, monitoring, and transmission) to track and exploit the vulnerabilities and security deficiencies (such as operating system vulnerabilities/communication protocol vulnerabilities/application software vulnerabilities, etc.) in the power information communication network to attack the system itself or resources. The following explains the definition of "electrical CPS function". The electric power CPS function is extended on the basis of the traditional power system function, which is embodied in the following aspects. Power CPS integrates mass system operation information, device information and external information, relying on communication networks and control terminals, to achieve deep embedding of measurement, perception, calculation, communication and other modules, and highly integrated primary and secondary equipment to make parameter self-state awareness More comprehensive. Power CPS is compatible with a variety of communication protocols and information models to meet the "plug and play" needs of the device, accurately transmit and identify information flows, improve
the overall performance of the system with more advanced control methods, and make the grid operation more flexible, more coordinated and smarter. More efficient.

Application of distributed collaborative control technology to achieve the organic combination of centralized system control and local autonomy, coordinate local distributed power output, user intelligent demand response, fast self-healing faults and other application functions, forming a "source-network-Dutch" friendly Interactive "centralized-distributed" collaboration.

The attack behavior with the purpose of destroying the "CIA" security target of the network is divided into network attacks with the purpose of destroying the usability, the purpose of destroying the integrity, and the purpose of destroying the confidentiality. The characteristics of the various attack types are shown in the following table.

| Table 1. Classification of Cyber-attacks Based on Targets. |
|-------------|-----------------------------|-----------------|
| Attack target | Attack effect | Means of attack | Typical way |
| Usability interruption/communication delay | Information | Block and delay communication | DoS attacks, black hole attacks, attacks that change the topology of communication networks |
| Completeness | False data/commands | Illegal tampering | Error data injection attack, man-in-the-middle attack, replay attack |
| Confidentiality | Monitor | Brute-force password cracking, malware and viruses |

Cyber attacks aimed at disrupting communication availability

This type of network attack mainly interrupts power transmission by hindering and delaying communication, resulting in unavailability of data/information, mainly related to the vulnerability of communication protocols, and there is a threat of interruption of data/information. Typical attack methods include DenialOfService DoS Attacks, black hole attacks, communication delays caused by changing the network topology, etc.

DoS attack

A DoS attack is a resource exhaustion attack that utilizes defects in the network protocol/software or sends a lot of useless requests to exhaust the resources (such as network bandwidth) of the attacked object, so that the server or communication network cannot provide services normally. The attacks are:

- Attack with protocol vulnerabilities (such as SYN Flood attack);
- Use software defects to attack (such as OOB attack, Teardrop attack, Land attack, IGMP fragmented packet attack, etc.);
- Send a lot of useless requests to occupy resources (such as ICMP Flood attack, Connection Flood attack, etc.);
- Deceptive attack that blocks the buffer (Such as IPSpoofingDoS attack).

Black hole attack
Black hole attacks, also known as packet loss attacks, often appear in self-organizing networks such as wireless sensor networks. During the attack, the routing of data packets should continue to be discarded. Black hole attacks in wireless networks can be authenticated and monitored and redundancy to defend.

Change the network topology

The attack method of changing the network topology refers to the physical attack, disconnecting the communication line, invalidating the important communication line, forcing the information to be transmitted via a farther path, and causing the delay of critical communication.

7. Integration Direction of Informatization Big Data Application

With the continuous introduction of national policy system documents, the charging infrastructure industry should establish an integrated public information service platform. Use Internet+, big data, cloud computing and other technical means to provide powerful information decision support for government management and public service methods in a timely manner, and increase the initiative and service viscosity of people's livelihood services through information data carriers. Further promote the integration and integration of data information and smart services. At the same time, IT information data is used to provide an interconnection and sharing mechanism to connect smart travel, new energy vehicles, smart charging, and use data link information to seamlessly interact.

Data resource utilization will be an important strategic resource for all industries and fields today and in the future. The efficient information exchange of charging infrastructure using IT information platform will become an important way for information value-added services and support for national system decision-making.

The "smart interaction" between the intelligent network connection and the charging infrastructure to realize automatic identification, identity authentication, secure retrieval, plug and charge, automatic mutual trust, and instant settlement will provide strong support for smart travel. With the interaction of data fusion and the interconnection of a large amount of information, it will inevitably bring revolutionary development in data mining, machine identification, AI intelligence, and security algorithms, and can be more conveniently used to improve the ease of use and expansion of information Sex. For example, Granular Computing is a new concept and computing paradigm in the field of artificial intelligence. It is a discipline that studies thinking methods, problem solving methods, information processing models and related theories, technologies and tools based on multi-level granular structure. , Belonging to the category of human higher level cognitive mechanism research[6].

The advantages of information data concentration are more conducive to guiding people's daily behavior and habits, and more development of the application of virtual reality technology in daily scenes, such as operation procedures, consumption guidance, and information interaction.

8. International Exchange of IT Information Platform

The current information shows that typical regions and countries such as Europe, the United States, and Japan are at the international forefront. At the same time, the European regional charging infrastructure development system is relatively complete, the charging standard technology system is advanced, and the charging information operation service chain is active. Integrate multi-party related resources, establish a professional charging operation platform to realize the interconnection of information data of automobile companies, charging operators, and third parties, and realize that each access to the charging pile of the information platform can provide convenient services for electric vehicle users. American ROEV is a trade association dedicated to improving the interoperability of different operators in the electric vehicle industry. It was released in 2016 by the three major charging operators in the United States. The platform does not reissue cards with radio frequency identification functions, but uses the radio frequency RFID cards already available to the cooperative operator.

International vehicle companies such as Audi, BMW, Mercedes-Benz, etc. have been developing platforms for electric vehicles at an early stage, including power battery systems, motors, electric control, and charging technologies. In the technical standards, planning, product development, and charging infrastructure construction, the follow-up sustainable development space such as the output
of charging facilities is considered, and the establishment of intelligent charging and V2G technology related systems is also considered. In 2017, Germany increased its support for charging infrastructure. From 2017 to 2020, 3 billion euros were allocated to support the development of charging infrastructure subsidies. Charging facilities applying for subsidies must comply with European standards; and must be connected to a charging operation platform; Norway has 10 major operators, and the market share of the top 10 operators accounts for 65% of the overall market. The top three are Kommune Oslo, Fortum and Tesla.

In the European regional market, users of electric vehicle terminal users also have problems with incompatible payment facilities of different operators in their daily charging experience. In order to solve the charging problem, BMW, Volkswagen, Daimler and other major auto companies co-founded Hubject in March 2012, integrating various operator platforms to establish a unified EU charging operation service network. For example, the characteristics of Hubject’s platform are that charging operators, automobile companies, etc. can join the complete Hubject network through a contract and an IT interface. Electric vehicle users can select a charging supplier from the Hubject network and can use multiple operators to charge the network is charged to realize the interconnection of all charging piles.

9. Conclusion
The sustained development of emerging industries is inseparable from the strong support of national policy guidelines, and at the same time it is the fulcrum of high-tech applications. The informatization and interconnection of the charging infrastructure of new energy electric vehicles is an important way to achieve serving people's livelihood, improving industrial processes and core technologies. Industry units are actively accelerating the development process of electric vehicle technology, mainly in the simultaneous development of charging technology, vehicle technology, infrastructure, intelligent network connection, safety and mutual trust, etc.; and increasing the construction of the charging ecological environment. Strengthen general technical specifications, interface communication, standard system construction, application scenario realization, international exchange and cooperation, and promote the development of charging infrastructure technology and IT information interconnection. Based on the technical support of the IT information platform, realize the large-scale application of information interaction, such as effectively adjusting the charging grid load in the V2G technology scenario, reducing redundant power generation capacity, and improving the effective utilization rate of the charging grid; intelligent safe driving under intelligent network interaction; Under the safe transmission of communication data, effectively realize inter-network collaboration and mutual trust and comprehensive management, instantaneously achieve good daily use of electric vehicle users, and experience the application advantages of information platform interconnection and interoperability.

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