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Study on Electrical Engineering-Oriented Research Cloud

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Abstract. this thesis mainly focus our researches on a series of differential features of institution for scientific research as distinct from enterprise, besides, Electrical Engineering-Oriented Research Cloud(EEORC) has distinct features from normal cloud services. On the basis of summarizing the experiences of Smart Research Park in the Institute of Electrical Engineering, Chinese Academy of Science (CAS), Electrical Engineering-Oriented 'Intelligent Institute' is researched. Knowledge and talent-intensive is the most important characteristic of the institute, through establishing a cloud service composition framework and an smart laboratory, many scientists and experts in electrical engineering-related fields are co-organized and the knowledge and talent-based services are provided to everyone by the cloud service framework, that is our EEORC. In the development process of the EEORC, with starting from the laws of scientific and technological innovation, concepts and ideas for cloud service composition framework are referred. The EEORC aims to take the results of scientific research as service, and integrate certain subject areas based on intrinsic relationship with each other, in this sense, collective intelligence in the cloud computing age laid the foundation for development of scientific knowledge services. The composition framework of EEORC system is also discussed in this paper, which mainly includes internet of research things and intelligent laboratory, the resources platform of knowledge and talent sharing, the cloud framework of sea-cloud coordination, and so on.

Keywords: Electrical Engineering-Oriented Research Cloud, Intelligent Institute, sea-cloud coordination, knowledge and talent sharing.

1. Introduction

Cloud computing is a kind of virtual resources pool which can achieve new configuration optimization according to dynamic load. Users and service providers sign service level agreement in advance, and users need to pay the bills when select and use the service [1]. Cloud computing will shift the economic landscape of information and communication technologies to the same magnitude as did the first wave of the internet. It will change the way people work and the way companies operate profoundly, allowing digital technology to penetrate all dimensions of economy and society [2]. Based on the idea of cloud computing, Chinese scholars professor Li Bo-hu put forward the concept of cloud manufacturing, which is a new intelligent network manufacturing mode-service oriented, high efficiency, low energy consumption and based on the knowledge [3].

Cloud computing is a form of internet service industries and business models, which brings to social, economic, and scientific research far-reaching effects, and one of the most preferred outcome defined in the web2.0 is social computing technologies and the establishment of collective intelligence [4]. The goal of e-Science is information sharing, and sharing of information led to changes of research from closed to open, from individual to collaborative, from a few to the public. Such open and collaborative science became a new service by internet: science as a service. If we take the results of scientific research as service, and integrate certain subject areas based on intrinsic relationship with each other, we can use the internet to form a virtual 'institute' to implement some research tasks which can't be fully achieved or need a lot of money before they can be carried out. The openness of scientific knowledge is the key feature of science as a service, and openness is not only reflected in the use of scientific knowledge, more importantly, in scientific

knowledge acquisition, validation, refinement and development groups to participate. In this sense, collective intelligence in the cloud computing age laid the foundation for development of scientific knowledge services.

Recently, 'wisdom Earth', 'internet of things' , and 'smart grid' become the focus of attention, and the key to achieve these ideas is not the access to information and communication, but rather a wide range of coverage and the use of uniform standards of open and sharing platform, in which any device, any person, from any locations, any local system data and software of the real-time simulation and forecasting models and early warning systems and so on can be immediately call the other equipment and systems, so we can build a set of full-time airspace observation, prediction, diagnosis and evaluation, and operational management and optimal control is equal to one of the intelligent systems [5].

Knowledge and talent-intensive is the most important characteristic of institutes, which provides a powerful impetus to institutes in scientific exploration. The EEORC has been set up in the Institute of Electrical Engineering, CAS, which allows experts and students in electrical engineering field acquire and share intellectual resources through this platform. Many complex issues can be easily solved by researchers through the platform. Can be expected, the speed of innovation and its output can be increased significantly.

2. Electrical Engineering-Oriented Research Cloud Has Distinct Features

2.1. Fundamental objective of the EEORC

Construction of safe working environment for scientific research, internet-based smart laboratory equipment and scientific instruments, intelligent of management and research production, scientific knowledge is condensed in the process of research and is inherited to contribute to the institute. Through intelligence-sharing system we can take advantage of the human resources fully of the institute, and in the field of electrical engineering and energy technology development for the community to provide professional mental cloud services, use our knowledge and intelligence to contribute to social development.

2.2. Main contents of the EEORC)

EEORC mainly includes the construction of security design of research cloud, the construction of smart laboratory, internet of research things, base platform of institute repository in electrical engineering related, framework of intellectual cloud services, remote research collaboration platform, personal spaces for experts and virtual community services.

Internet of research things is the conception that technology about internet of things is used to research device and equipment in the research process. we can study related technology about internet of research things to solve the key issues, physical perception and auto-control in the electrical engineering related fields, multi-network integration and intelligent information processing and other functions with the support of expert knowledge system in order to achieve increased system intelligence information, enhance the efficiency of research, and improve management model of institute.

Construction of institute document collaboration system for researchers aim to provide personnel storage space, and researchers can archive their data, research logs, test records, summaries, ideas, suggestions, survey / research reports, etc. On the one hand, the security of data stored can be improved by focusing store, on the other hand can be shared on a voluntary and mutually beneficial principles, cumulatively, it will become a great research resources and wealth.

Development of research cloud platform achieves expert knowledge intelligence system with the collaboration of the 'sea' to 'cloud'. Support and maintenance system makes the research cloud platform efficient and orderly operation, mainly including system development, personnel training, motivation and compensation and so on. Experts can collaborate through the expert intelligence exchange system, including pre-treatment on results of sea calculation, division of labor by the sizes and features of tasks, set policy for expert, and generate new cloud-processing requests submitted to cloud service. The cloud service layer is calculated through the aggregation, integration of research and collaboration, and formation of the internal and external cloud computing support and collaboration solutions, and scientific solutions to problems.

Development of remote collaboration platform for research base in the wild which network conditions is extremely hard, and we committed to explore and research for remote collaboration based on the thermal

power base (Yanqing, Beijing) to solve the 3G network video transmission technology bottleneck (the existing monitoring program time delay of about 3G 10s, which can't meet the presentation needs), we will provide a remote collaboration solutions for wild base without broadband network, which mainly include remote audio-visual and monitoring, data transmission and interactive operations, and technology supports for remote researches.

3. Key Issues In Electrical Engineering-Oriented Research Cloud

3.1. Architectures of Electrical Engineering-Oriented Research Cloud

Electrical research cloud is the cloud service based on 'knowledge and talent sharing', and based on the smart research park in the Institute of Electrical Engineering, Chinese Academy of Science (CAS), by exerting the principal role of repository and human resources in the institute of electrical engineering, take electrical science research as knowledge foundation, attract relevant experts and scholars, students participate in, carry out technological exchanges and research collaboration. Its essence is a "virtual" of the institute with providing research-based knowledge resources and equipment required for electrical research, supercomputing resource of GPU/CPU, software for simulation and calculation in electrical field. Many research cooperation partners and expert teams are invited to join the electrical research cloud system and achieve the interactive exchange. Many web development technologies are applied to the knowledge and intelligence shared system, such as WiKi, scientific micro-blog, Home space, expert's blog, virtual community and so on. As shown in Fig.1.

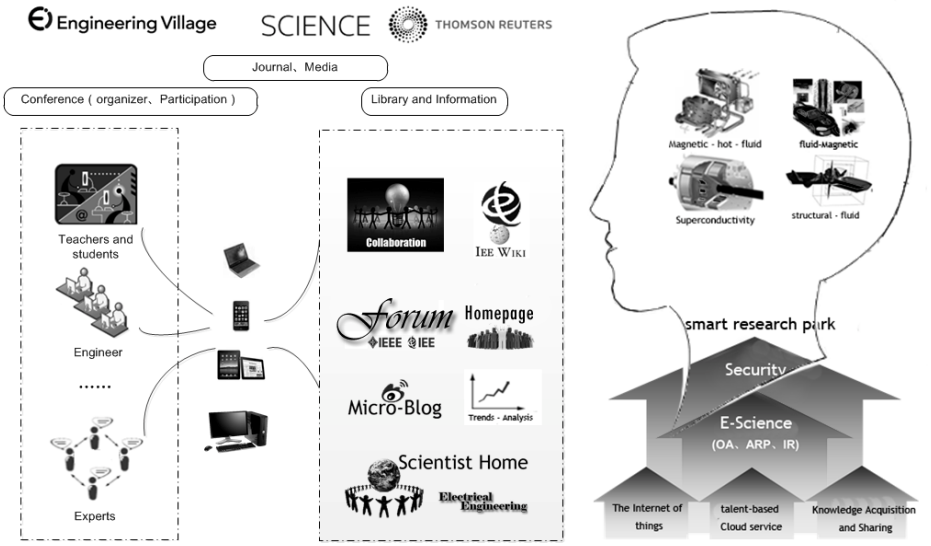

Fig. 1: Architectures of EEORC

3.2. Internet of research things and intelligent laboratory

Study on internet of research things takes research activities as core issue. Main objects include research assets, research instruments and equipment in research process. Through the development of smart card terminals, we achieve the sharing and management of research equipment by virtual private network, so maintenance of distributed and unified use of research instruments and equipment are combinated unity. Extend management information system for smart card supporting and achieve equipment inquiries, booking, and the other functions through smart card. According to our research direction and fields we determine the research priorities of internet of research things to master networking technologies gradually and establish technical standards of intelligent networking applications.

According to different research directions in Electrical Engineering-Oriented fields, our study provide information technology and support on laboratory development by using intelligent information technology, wireless sensor network technology, intelligent monitoring technology in research development process to improve precision monitoring and auto-control, increase contribution rate of intelligence information technology on research, such as evaporative cooling technique, intelligent detection technology, intelligent

superconducting applications, energy efficiency and smart-grid lab, smart solar thermal power generation and so on. As shown in Fig.2.

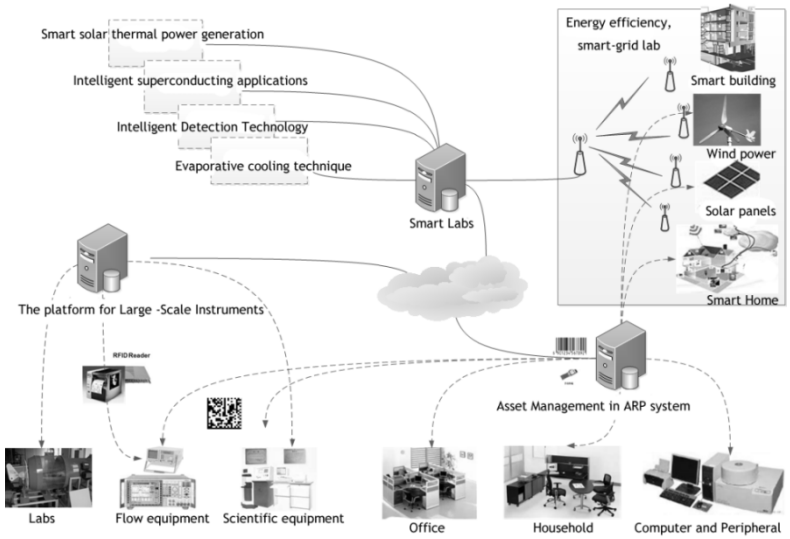

Fig.2: Internet of research things and intelligent laboratory

3.3. The resources platform of research and knowledge

Through the establishment of knowledge resource for scientific research in electrical engineering related, researchers will generate a variety of electronic documents and electronic resources in the research process, which produces three different types of data in different stages of the research process, mainly include results of database knowledge, research archives, scientific experimental data and process data. We established service in research and knowledge base of the cloud system, electronic archiving system, electronic document and collaborative systems. As shown in Fig. 3.

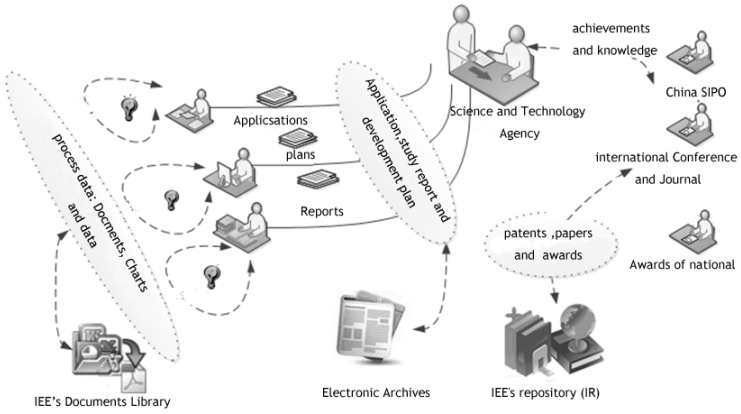

Fig.3: The platform of research and knowledge

3.4. The framework of sea-cloud coordination

The sea and cloud computing are two different levels in the future information processing systems. By using the sea computing users can publish his data and solutions through the large-scale networks and acquire these from others, and submit their task on the network in which each computer, by optimizing the distribution, which allows computers on the network co-processing and computing, return the result to provide users with powerful computing services. The cloud computing model represents a new paradigm shift in internet-based services that delivers highly scalable distributed computing platforms in which computational resources are offered 'as a service'. Key technology and division of sea and cloud computing in the task are different. Mass data are processed in sea computing (front-end), and integrated data analysis and information service is in cloud. Through the participation of experts in intelligence, information pretreatments, judgments and decisions are completed in the sea computing. So that only the tasks can't be resolved in 'sea' should be 'evaporated' to the 'cloud', which make the whole system have great wisdom.

Electrical Engineering-Oriented cloud services, based on the features of the 'sea-cloud' collaboration framework, need multiple departments in institute to collaborate, such as experts and teams in all electrical engineering fields, by which computing resources in electrical engineering field are integrated to form the basis of the sea computing. Besides, intelligent terminal software should be developed for personal sharing of individuals program and solutions in the electrical engineering field, such as 'magnetic -thermal-fluid', 'applied superconductivity', 'fluid-magnetic', 'thermal-fluid-structure', 'electromagnetic-thermal', and so on. Finally, based on web2.0, expert community system is developed to provide collaboration functions for all the users in electrical engineering fields, as shown in Fig.4.

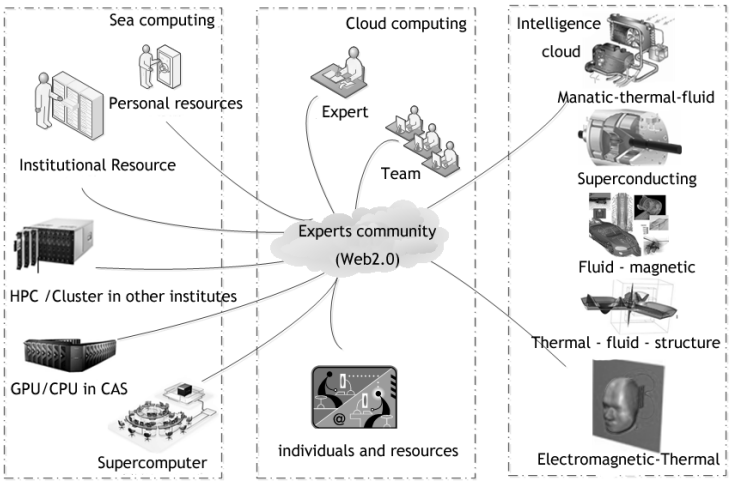

Fig.4: The framework of sea-cloud coordination

4. Conclusions

Knowledge and talent-intensive is the most important characteristic of institutes, so the openness of scientific knowledge and solutions of science issues in electrical engineering field are core features of the EEORC. Internet of research things and intelligent laboratories are the foundation concept that internet of things is used to research device and equipment in the research process, by which every experts can research collaboratively to solve the key technology issues, physical perceptions and auto-controls in the electrical engineering related fields and acquire remote collaboration solutions. The research cloud platform allowed experts to achieve solutions in electrical engineering field through knowledge intelligence system with the collaboration of the 'sea' to 'cloud', based on the Smart Research Park in the Institute of Electrical Engineering, Chinese Academy of Science (CAS), which is funded specially by the director. Many research cooperation partners and expert teams should be invited to join the electrical research cloud system and achieve the interactive exchange. By the system of EEORC, we aim to establish a comprehensive performance and collective intelligence in the cloud computing age which laid the foundation for development of scientific knowledge services.

5. References

[1] Vaquero L, Roderc-Marino L, Caceres J, et al. A break in the clouds: towards a cloud definition. SIGCOMM Computer Communication Review, 2009,39(1):50-55.

[2] Joachim Schaper. Cloud Services. 4th IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST 2010),2010:91.

[3] Yang Xin-yu, Li Wei-jia. Research and application of the management and control platform oriented the cloud manufacturing services. 2011 International Conference on System Science, Engineering Design and Manufacturing Informatization,2011:286.

[4] Guo Yike. e-Science 2.0: From Building Services for Science to Science-as-a-Service, China's e-Science Blue Book 2011,2011:56-64.

[5] Xiao Liye. Meeting the "intelligence explosion" era . China Science Daily.2011-4-25.