

Super-metauniverse with cyber life as center in integrating cyber nature and cyber society sky-earth computing (III) beyond cloud computing

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Abstract. According to the analysis and design of this series of articles, with cyber life as the center, using big data platform, IOT, AI technology, and the super-metauniverse system engineering that we advocate to develop and implement, we integrate cyber natural system and cyber social system, and establish a super-metauniverse system (SMS) for the hyper cyber-world. cyber life system is a life system supported by IT and network technology, including cyber physiological system (CPS-2) and cyber psychological system (CPS-3); Cyber natural system is a natural system supported by IT and network technology, including cyber physical system (CPS-1); Cyber social system is a social system supported by IT and network technology, including cyber eventlogic system (CES). Therefore, it is necessary between the real ecosphere and the information ecosphere to organize and manage not only thousands of computers, mobile communication tools and robots thousands of computers, mobile communication tools and robots, but also thousands of people who use computers, mobile communication tools and robots, through the Internet of things, artificial intelligence technology, the bottom layer of big data computing platform, and the super-metauniverse system engineering proposed in this series of articles.

1 Introduction

As we all know, cyber physical systems (CPS) is a multi-dimensional complex system integrating computing, network and physical environment. Through the organic integration and deep cooperation of 3C (computation, communication, control) technology, it realizes the real-time perception, dynamic control and information service of large-scale engineering system.

In order to overcome the serious defects of information mechanism and promote the rationalization of resource allocation[1]-[4], this series of research proposes a super-metauniverse computing mode that combines the traditional computing mode in various professional application fields with the modern computing mode in the field of information network technology (it is represented by distributed computing, grid computing, cloud

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computing and cluster), which can be called "sky-earth computing". Here, "sky" (or heaven) metaphors the information world in the field of digital network technology, and "Earth" metaphors the real world in various professional application fields.

Now, in the analysis and design of this series, taking cyberlife as the center, using big data platform, IOT, AI technology, and the sky-earth computing system engineering that we advocate to develop and implement, we can integrate cybernatural system and cybersocial system into one, to establish a super metauniverse system (SMS) for the hyper cyber-world. Cyber life system is a life system supported by IT and network technology, including cyber-physiologic system (CPS-2) and cyber-psychologic system (CPS-3); Cybernatural system is a natural system supported by IT and network technology, including cyber physical system (CPS-1); Cybersocial system is a social system supported by IT and network technology, including cyber-eventlogic system (CES) [5]-[8].

The sky-earth computing proposed in this series of papers is first the intelligent integrated computing to combine natural intelligent computings with artificial intelligent computings, secondly the sky-earth computing to combine the actual world computing with the information world computing, and finally the interconnection computing of everything to combine the actual ecosphere with the information ecosphere. Through sensor technology, Internet of Things (IOT) technology and Internet of everything (IOE), super-metauniverse system engineering proposed in this series links natural intelligent system with artificial intelligent system to form intelligent integrated system, combines actual world system with information world system to form a composite world system, and connects actual ecosphere with information ecosphere to form the interconnected ecosphere of everything.

2 Integration of multi-process with cyber life as center

Under the analysis and design of this series, the ecosystem of a life is defined as an interaction system which takes a life as the center and is formed by all the factors that have direct and indirect connection with the life through the complex relationship structure. Under such a definition, every higher life has its own ecosystem. All the factors that have direct and indirect relationship with a user form an interconnected ecosystem through various relationships. In the figure, the dark gray circle represents a user, the light gray circle represents factors with direct relationship, and the white circle represents factors with indirect relationship.

In fact, the boundary of each ecosphere is often irregular, and the boundary of highly complex all-interconnected ecosphere is especially mixed, unclear and irregular. As shown in Figure 1, there is an ecosphere with irregular, indistinct and non-simple boundaries. The ecosphere includes complex multi-physical, multi-physiological, multi-information, multi-psychological and multi-social connections. Here, the arrow line has great limitations. It can only represent the distance and direction in time and space, but it can not represent the multi-links between the center (advanced intelligent life, such as users) and the influencing factors at each time and space point.

For us, the whole world is actually an extremely complex multi-level system, including: actual world - phenomenal world - image world - simulated world - virtual world.

For the all-interconnected ecosphere supported by network technology, a cybertech user is a center of intelligent fusion. He is not only the center of cyber physic system, but also the center of cyber physiologic system; It is not only the center of cyber psychologic system, but also the center of cyber eventlogic system. With cybertech users as the center, cyber physical system and its processes, cyber physiological system and its processes, cyber psychological system and its processes, and cyber eventlogic system (CES) and its processes are integrated into one, to form a super metauniverse system.



Fig. 1. A ecosphere with irregular, indistinct and non-simple boundary. An all-interconnected ecosphere with complex multiple physical, physiological, psychological and social connections.

By the analysis and design of this series, with the support of IT and network technology, a super metauniverse system, as the ecosphere in Internet of everything, can be developed and constructed into a new system with cybertech users as its center, integrating cyber physical system (CPS-1) and its processes with cyber physiological system (CPS-2) and its processes, cyber psychological system (CPS-3) and its processes, and cyber eventlogic system (CES) and its processes, as shown in Figure 2.

The sky-earth interface system and its channels enable users (individuals, organizations, and Society) to work with multi-channel programs in the physical world, the information world and the psychological world at the same time in their own world. The operation program of each channel runs in the user's own sky-earth channel, that is, in the graphics on the display screen. Most of the sky-earth channel systems allow channels to overlap, and provide users with standard operations to run, such as moving and changing the size of the visual gate, sending the visual gate to the foreground and background, or expanding or narrowing a sky-earth channel. The sky-earth channel interface system should have the network permeability ability of the interconnection of all things, and allow users to run the channel graphics application program on the remote machine.

Sky-earth fusion system (SEF) is a world system supported by sky-earth computing technology, which can be regarded as super metauniverse systems (SMS), that is to say, a fusion of cyber physical system (CPS-1), cyber physiological system (CPS-2) and cyber psychological system (CPS-3), cyber eventlogic system (CES), etc.

It is a multi-dimensional complex system that uses sky-earth computing technology and its system engineering to combine computing, network and world environment (including physical environment, physiological environment, psychological environment and eventlogic environment). Through the organic integration and deep cooperation of 3C (computation, communication and control) technology, it can realize the real-time perception, dynamic control and information service of large-scale engineering system in complex society. SMS based on sky-earth computing can carry out the integrated design of computing, communication with physical system, physiological system, psychological system and reasoning system, and realize the integration of various related systems, processes and elements more reliably, efficiently and cooperatively. Therefore, it has an important and wide application prospect.

By using sensor network technology, Internet of things technology, electronic virtual technology and other fusion technologies, through the screens on computers, mobile communication devices (including mobile phones), electronic worktables, etc, we can establish a interface system of sky-earth computing between the information world and the real world: establish a visual sky-earth gate to open the door to all kinds of world at all

levels for the society, regions, departments, institutions, organizations, enterprises, associations and individuals; and establish the visual sky-earth channel to provide channels to all kinds of world at all levels for society, regions, departments, institutions, organizations, enterprises, associations and individuals; and then establish the visual sky-earth space to divide the boundaries, fields, blocks and circles of all kinds of world at all levels for society, regions, departments, institutions, organizations, enterprises, associations and individuals^{[9]-[11]}.

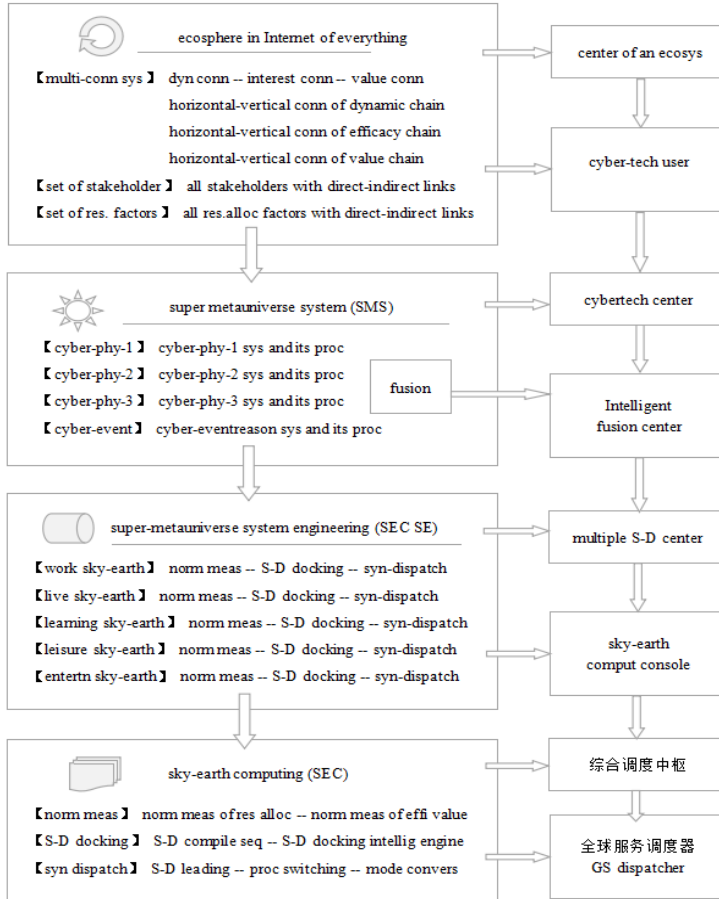


Fig. 2. Super metauniverse system which comes down to super-metauniverse system engineering.

3 Super-metauniverse system based on sky-earth computing

With the support of IT and modern network technology, the development of super-metauniverse system engineering requires that we should and must take various cyber technology users at all levels as the center, and face various interconnected ecosystems at all levels in Internet of everything^{[12][13]}.

In fact, as the center of various ecosystem system at all levels in Internet of everything, the goals, perception, supply-demand of various cybertech users at all levels are very complex and constantly changing with the change of time and space^{[13]-[16]}; The power, value and benefit of various cybertech users at all levels are also very complex and constantly changing with the change of time and space; Events, scenes and ecology

experienced by various cybertech users at all levels are especially complex and constantly changing with the change of time and space.

With the complexity changes of cybertech users (as the center of their own ecosphere in Internet of everything), such as movement, change, growth and evolution, the target system of cybertech users will also undergo corresponding complexity alteration such as transformation, change, derivation, deduction, and others.

With the support of IT and modern network technology, we should take various cyber tech users at all levels and carry out super-metauniverse system engineering for various ecospheres at all levels in Internet of everything. This requires that we should and must first turn to the center of various ecospheres at all levels in Internet of everything. Around the user's target system we study the perception system of each cybertech user; around the user's perception system, we study the supply-demand system of the user; around the supply-demand system of the user, we study the complex ecological connection of the user (the horizontal-vertical connection of dynamic chain, the horizontal-vertical connection of value chain, and the horizontal-vertical connection of interest chain); around the event distribution, scene system and ecological system of the user, we study the unified norm measurement system, the supply-demand docking intelligent system and the synergic dispatching center for the user; around the measurement system, docking system and dispatching center for users, we study the organization system, control system and service system for the user.

As shown in Figure 3: As a unity of computing process, physical process, physiological process, psychological process and eventlogic process, the super metauniverse systems (SMS) based on sky-earth computing is an advanced intelligent system integrating computing, communication and control into one. The super metauniverse system realizes the interaction between the digital information technology process and the real world process through the human-computer interaction interface. It uses the network space to operate a sky-earth fusional ecosphere in a remote, reliable, real-time, safe and cooperative way.

Here, there is a complex ecological chain in Internet of everything :

Firstly, in the multi-environments including physical, physiologic, psychological and eventlogic environments, there are multi-processes including physical, physiologic, psychological and eventlogic processes, thus forming multi-informations including physical, physiological, psychological and eventlogic informations;

Secondly, it is necessary to set up multi-sensors including physical, physiological, psychological and eventlogic sensors for cybertech users, who are the center of the ecosphere in Internet of everything, so as to obtain multi-data including physical, physiological, psychological and eventlogic data;

Thirdly, for multi-processes, multi-information and multi-data, it is necessary to set up a synthetic server in advanced intelligent comprehensive processing, so as to carry out resource combination, make task allocation and realize the whole process service. Therefore, it is necessary to set up multi-end devices including physical, physiologic, psychological and logical end devices, so as to facilitate data transmission;

Fourthly, on the basis of intelligent comprehensive processing, network services are carried out to feed back the results of data analysis, so the visual interface is presented to customers through the client.

Under the analysis and design of this series, the super metauniverse system (SMS / SEC) based on sky-earth computing includes the ubiquitous system engineering in the future, such as environment perception, embedded computing, network communication and network control, so that the physical system, physiological system, psychological system and eventlogic system have the functions of computing, communication, precise control, remote cooperation and autonomy. It focuses on the close integration and coordination of

computing resources with physical resources, physiological resources, psychological resources and eventlogic resources. It is mainly used in intelligent systems of various application scenarios, such as device interconnection, IOT sensing, smart home, robot, intelligent navigation, etc.

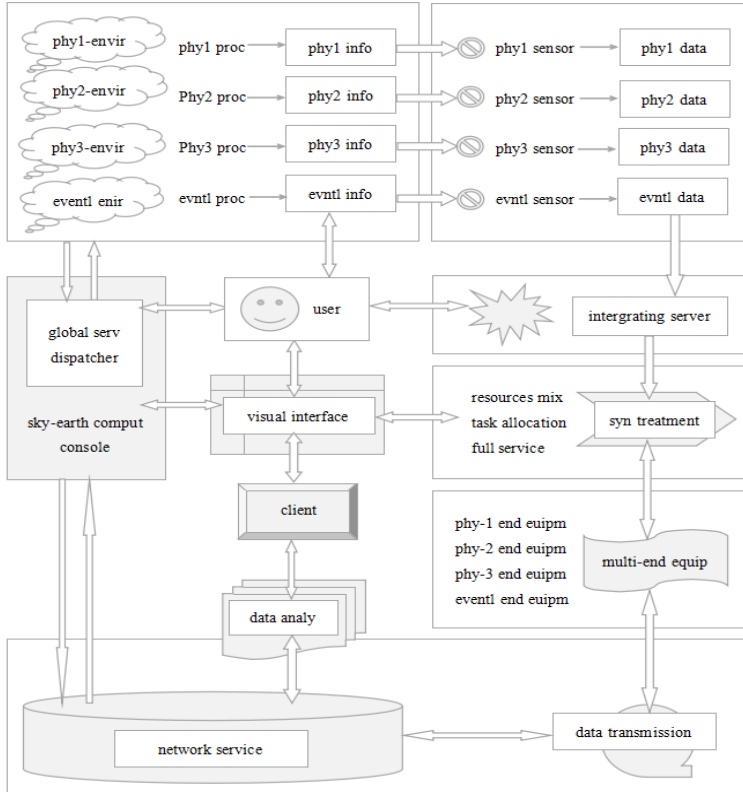


Fig. 3. Super metauniverse system based on sky-earth computing technology.

For the super metauniverse system supported by IT, network technology and super-metauniverse system engineering, this series of research proposes to develop, design and build an architecture of six layer. As shown in Figure 4: this system includes life layer (psychological layer and physiological layer), physical layer, social layer (eventlogic layer), network layer, application layer and environment layer.

The multi-sensing layer consists of multi-sensors, multi-controllers and multi-collectors. Multi-sensors include physical sensor, physiologic sensor, psychological sensor and eventlogical sensor; multi-controllers include physical controller, physiological controller, psychological controller and eventlogical controller; multi-collectors include physical collector, physiological collector, psychological collector and eventlogical collector.

In the complex multi-environment, especially in the multi-environment with IT and modern network technology, there are complex multi-sensors, multi-information data and multi-servers, which need a lot of multi-processing and multi-terminal equipment.

For multi-sensing layer, the fusion of multi-sensors, the fusion of multi-controllers and the fusion of multi-collectors is very important. This kind of integration should and must be centered around the cybertech users' ecosphere in Internet of everything, with cyberspace users as the center.

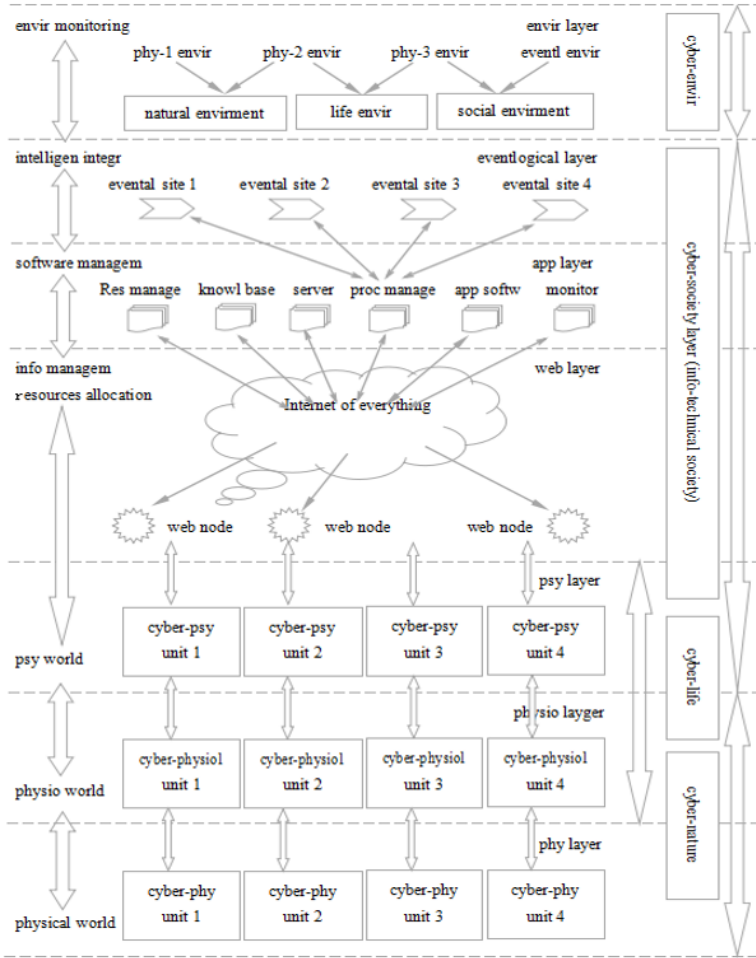


Fig. 4. Super metauniverse Systems (SMS) based on sky-earth computing technology.

In such a complex multi-environment, the perception of cybertech users is often a multi-perception system including physical perception, psychological perception, physiological perception and eventlogical perception.

For the converged network layer, the data transmission layer is a multiple data transmission system that not only faces the physical world connected with the info-world, but also the physical world, psychological world and eventlogical world connected with info-world. Here, information is multiple information with physical info, physiologic info, psychological info and eventlogic information. Therefore, network service should and must be a high-level intelligent integrated service with the cybertech users as its center, and around the ecosphere of cybertech users in Internet of everything.

For the application control layer, the cognitive layer is a very complex multi-cognitive system. Data analysis is a complex big data analysis for multi-processes including physical process, physiological process, psychological process and eventlogical process. Feedback is the complex feedback process for multi-processes including physical process, physiological process, psychological process and eventlogical process through multi-terminal devices, multi-perception system and multi-transmission system. The process of feedback must involve the integration of physical client, physiologic client, psychological client and

eventlogical client. The complex multi-information is fed back to the client through the visual interface.

Therefore, in the multi-environment in which IT and modern network technology are fully involved, the application control for various professional fields should and must be centered on cybertech users, and with the mobile, growth, change and evolution of cybertech users, it will continue to surround the user's ecosystem in Internet of everything, to carry out synergic control among multiple goals, multiple info, multiple perceptions, multiple processes, etc. Through the synergic control of advanced intelligence, the reasonable allocation of tasks and the reasonable combination of resources are realized, and excellent services are provided.

The interface system of sky-earth computing established between the information world and the actual world can be referred to as sky-earth uniconn. Between the actual world and the information world, we should face both offline activities and online activities. Around the demand and supply, set up the dispatching desk and set up the general controller. Through the supply and demand docking system (docking list and docking stack), navigation system and GPS positioning system, using compilation engine (including search engine) and corresponding measurement technology and calculation method, we make the measurement of allocation between virtual and real resources, the measurement of value between virtual and real values, and make trade-off decision between virtual and real benefits.

4 Internet of everything built between two ecospheres

As shown in Figure 5, the technology involved in big information ecosphere is more complex^{[17][18]}. The bottom layer is HDFS, which runs MapReduce/Tez/Spark on it and Hive and Pig on the higher level. Or run Impala, Drill, Presto directly on HDFS, which meets the requirements of medium and low speed data processing. There is a spark architecture that replaces mapreduce here. In addition to new features such as memory cache, the second generation Tez^{[18][19]}. Pig is a near script way to describe MapReduce, while Hive uses SQL. They translate scripts and SQL languages into MapReduce programs, and give them to the computing engine to calculate. Programmers can get rid of the tedious MapReduce programs and write programs in simpler and more intuitive languages. Hive has gradually grown into a core component of large data warehouses, and even many companies' pipeline job sets are described entirely in SQL. The commonly used means of data acquisition are: SQL/Python, in which SQL is a necessary skill of data analysis, Python is a plus sub-item. There are many data visualization products at home and abroad, such as Echarts/Tableau/ Excel/Python, etc.

Now, in front of mankind, the world is divided into the actual world (including physical-actual world and psychological-actual world) and the information world (including digital information world and analog information world), the ecosphere is divided into the actual ecosphere and the information ecosphere, so that the basic fields of human activities are divided into the natural intelligent system and the artificial intelligent system.

With big data platform (HDFS cluster, MapReduce / Tez / Spark ^{[17]-[20]}), Internet of Things (infor. sensor, Radio Frequency Identification (RFID), global positioning system, infrared sensor, laser scanner, intelligent embedding technology, etc.) and artificial intelligence technology (AlphaZero, GAN, new recursive cortex networks, etc.), it is between practical systems and cognitive systems to form the interaction, synergy and integration, or it is between natural intelligence systems and artificial intelligence systems to form the interaction, synergy and integration, all of which are exactly the basic intelligent integration proposed in this series of papers.

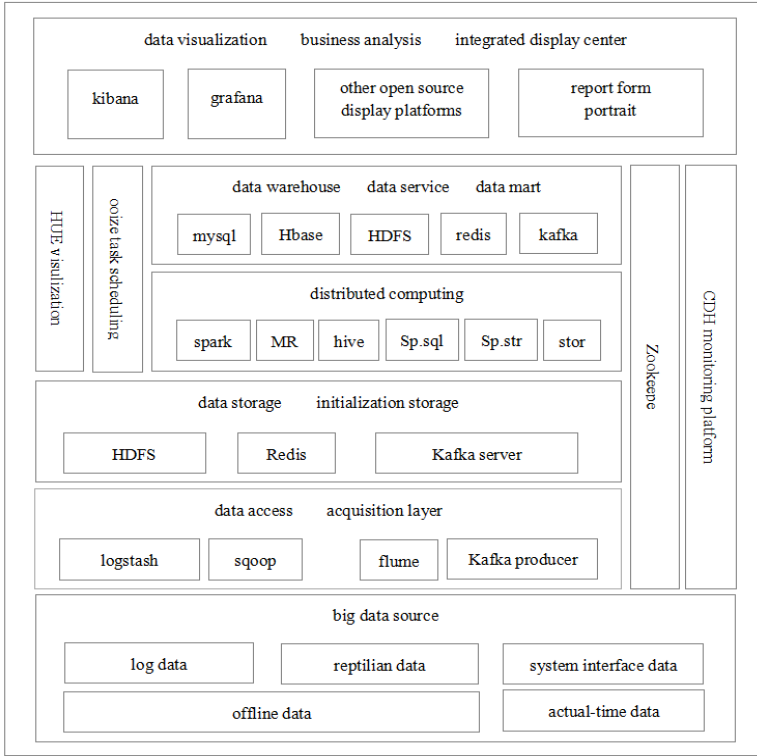


Fig. 5. Complex Technological Systems Involved in Big information ecosphere.

As shown in Figure 6, the integration between actual and information ecospheres is achieved through IOT, artificial intelligence technology and big data platform. In other words, the intelligent integration system formed between the actual ecosphere and the information ecosphere, or the intelligent integration system formed between the artificial intelligent computation of the information world and the natural intelligent computation of the actual world, consists of the intelligent integration subject (complex self-organization), the intelligent integration goal and the intelligent integration basis (facilities, reserves, ways), the intelligent integrated assistant system (strategies, technologies, devices, methods, tools, means), the intelligent integration object (practical objects and cognitive objects) and the intelligent integration environment (sum of internal and external factors). Whether in the information ecosphere or in the actual ecosphere, we should consider the horizontal and vertical game correlations on the allocation chain, the efficacy chain and the interest chain (value chain) of complex organizations.

Based on the analysis and design of this series of papers, between the information ecosphere and the actual ecosphere, between the actual physical world (and materialized actual world) and the virtual psychological world (and electronic virtual world), the super-metauniverse system engineering is carried out, and the Sky-Earth computing technology is established, so as to establish the Sky-Earth computing system, and then form the Sky-Earth computing network. This project involves various professional technical foundations, various system technical foundations, various network technology foundations, various professional application technology systems, as well as various comprehensive application technology systems and various environmental application technology systems. Intelligent Integration and its computing are oriented to five kinds of resources of actual ecospheres: energy resources, material resources, information resources, knowledge resources and

mental resources. The intelligent integration of the Internet of everything is the integration of the energy Internet, material Internet, information Internet, knowledge Internet and mental Internet.

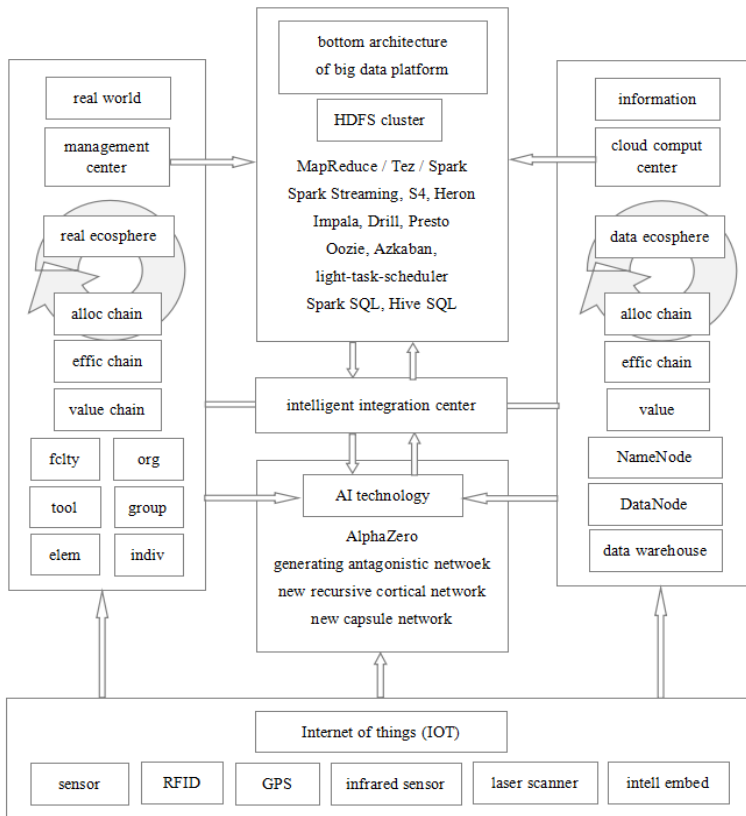


Fig. 6. Integration between actual and information ecospheres with IOT, Artificial Intelligence Technology and Big Data Platform.

Based on the Internet of ecospheres as the unified Internet integrating energy Internet, physical Internet, information Internet, knowledge Internet and mental Internet, the world ecosphere system engineering makes full use of the technologies, tools and modes such as 5G mobile Internet, big data, artificial intelligence, IOT, sensors, cloud computing, quantum computer and others, incorporating five kinds of resources (energy resources, material resources, information resources, knowledge resources and spiritual resources) of the ecosphere into a new unified measurement system, and combing various natural intelligent tools (human brain, language, sense organs, light waves, gestures, etc.) with various artificial intelligent tools (computers, notebooks, mobile phones, sensors, etc.) to form an intelligent integration technology (system), so that the unified planning, unified design, unified coordination, unified organization, unified control and unified management in the horizontal and vertical correlations of the allocation chain, the efficacy chain and the interest chain (value chain) are carried on the various resources (including various networks, equipment, storage, technology, application tools, services, etc.) of energy network, physical network, information network, knowledge network and spiritual network in the ecosphere.

An intelligent integration system is a complex self-organizing system that integrates two major fields of human activities, i.e. practical system and cognitive system, and links two

major fields of human intelligence, i.e., natural intelligence system and artificial intelligence system.

An intelligent integrated system is composed of intelligent activity subject, activity target, activity basis, assistant system, activity object and activity environment. The intelligent activity subject is an intelligent life system (individual, group and whole) with the ability of self-adaptive, self-learning and self-organizing. The intelligent activity goal is a system with multi-level structure. The intelligent activity base is mainly composed of facilities, resource reserve and ways. The intelligent assistant system is mainly composed of tactics, technology, equipment, methods, tools, means, etc. The intelligent activity object includes practice object and cognitive object, natural intelligence activity object and artificial intelligence activity object. The intelligent activity environment is the sum of internal and external factors.

Based on big data, IOT, cloud computing, composite-world computing and intelligent integration technology, etc., the intelligent integrated system engineering is a kind of new system engineering with various intelligent lives at all levels as its center for all levels of various intelligent lives' s practice system and cognitive system (from that of intelligent life individual, that of intelligent life group, to that of intelligent life cluster, that of intelligent life alliance), natural intelligence system and artificial intelligence system (from that of intelligent life individual, that of intelligent life group, to that of intelligent life cluster, that of intelligent life alliance).

I would like to express my sincere gratitude to the domestic and foreign researchers, my colleagues and relatives. Without their enlightening instruction, impressive kindness and help, I could not have completed my work.

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