

Super-metauniverse system engineering for ecosystem in internet of everything sky-earth computing (II) beyond cloud computing

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Abstract. With the support of IT and network technology, we can develop and build a new system centered on cyber-tech users, 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, as well as cyber-eventlogic system (CES) and its processes. It is proposed in this series of research to develop and produce a global service dispatcher (GSD) as the main component of a Sky-Earth computing console (SECC) for every user (individual, group, whole), and provide a customized world-wise brain. According to the analysis and design of this series of articles, through big data platform, Internet of things and artificial intelligence technology, we build intelligent integrated system, carry out data reconstruction system engineering, so as to establish the computer-like system (CLS) for big data processing. It combines all kinds of resource elements involved in computing in the information ecosystem with those involved in computing in the real ecosystem.

1 Introduction

In our view, artificial intelligence (machine intelligence) is based on computing in the information world, and natural intelligence (human intelligence) is based on computing in the actual world. The modern computing (mode) after the emergence of computer belongs to artificial intelligence computing. The modes of such computing include centralized computing, distributed computing, grid computing, cloud computing, cluster computing, fog computing, edge computing computing, etc^{[1]-[6]}. In the analysis and design of this series of papers, it is necessary with the big data platform^{[7][8]} (HDFS cluster, MapReduce / Tez / Spark), the Internet of Things^{[9]-[11]} (sensors, RFID, GPS, infrared sensing) and artificial intelligence technology^{[12][13]} (AlphaZero, generating antagonistic network GAN, new recursive cortical network, etc.), between the information ecosystem and the actual ecosystem, between the information world computing and the actual world computing, to construct the intelligent integrating system, and the carry out data reconstruction system engineering, thus establish the computer-like system for the processing of big data.

Further, we attempts to combine the cyber-physical system (CPS-1), cyber-information system (CPS-2), cyber-psychological system (CPS-3) and cyber-eventlogic system (CES),

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and then combine the computing technology system (CT), intelligent engineering system (IE) and social civilization system (SC), so that traditional and modern computing models are comprehensively expanded, and new computing paradigms, models and structures are explored and studied in a general way.

In this series of papers, a new computing beyond the information world is explored, so that the information ecosphere is linked with the actual ecosphere, the information world computing is combined with the actual world computing, and an interactive, integrated and synergistic sky-earth computing (celestial and terrestrial computing) or Super Metauniverse computing is presented. In traditional Chinese culture, "Sky" (or Heaven) and "Earth" are a pair of basic relative categories. In our view, everyone, every organization and every society has its own sky and earth, and the various sky-earth at all levels are the various world at all levels, as well as the various ecosphere systems at all levels.

The Sky-Earth computing technology and Super-metauniverse system engineering proposed in this series of studies to be vigorously developed, should take a user as their center, facing the all-interconnected ecosphere (AIE) of all kinds of users at all levels. One of the basic aspects of the sky-earth computing technology development to be launched in this series of studies is to develop and produce the world-wise brain, and each world-wise brain is a sky-earth computing console (SECC) serving users. This is a control system which serves every user in the whole process and takes the global service dispatcher (GSD) to be developed as the main component. Through this kind of development, a customized global service dispatcher (GSD) can be provided for each user (individual, group, whole). With the global service scheduler as the main component, we can further develop the world-wise brain (WWB) serving every user, and strive to achieve such an ideal scenario: with a sky-earth wisdom brain in hand, everything will be integrated and everyone will be accessible.

2 Super-metauniverse ecosphere with users as its center

The technology and system engineering of sky-earth computing proposed in this series of studies to be vigorously developed, should take a user as their center, facing the all-interconnected ecosphere (AIE) of all kinds of users at all levels.

In fact, any life, no matter individual or group, no matter natural life or social life, no matter simple low-level life or complex high-level life, has its own ecosphere^{[14]-[18]}. With any life (no matter individual, group or whole) as the center, all the elements directly and indirectly related to the life form an ecosphere according to a certain structure, which can be called the ecosphere.

The various sky-earth, worlds and ecospheres at all levels can be divided into two parts: the physical-actual and psychological-actual worlds and the digital and analog information worlds. Now, in the context supported by Internet, cloud computing and artificial intelligence technology, we can bring the category of "Sky-Earth" into a new system, metaphorizing the information world with "Sky" and the actual world with "Earth". Just as the cloud in cloud computing is a kind of metaphor with fuzziness, mobility and uncertainty, the sky and earth in sky-earth computing is a kind of metaphor with inclusiveness, interactivity and unity.

Each user (individual user, group user and whole user) can use the sky-earth computing console to obtain the global resource support on the all-interconnected ecosphere, as shown in Figure 1. As for the user's ecosphere in Internet of everything, we should make full use of the communication network for telephone, fax machine, telegraph system and satellite communication equipment, and the radio-TV network for television, radio, semiconductor radio and wireless headset, as well as the Internet for desktop computer, computing center,

large-scale computer, mobile phone, notebook computer, intelligent robot and e-mail, to connect various practical professional application fields.

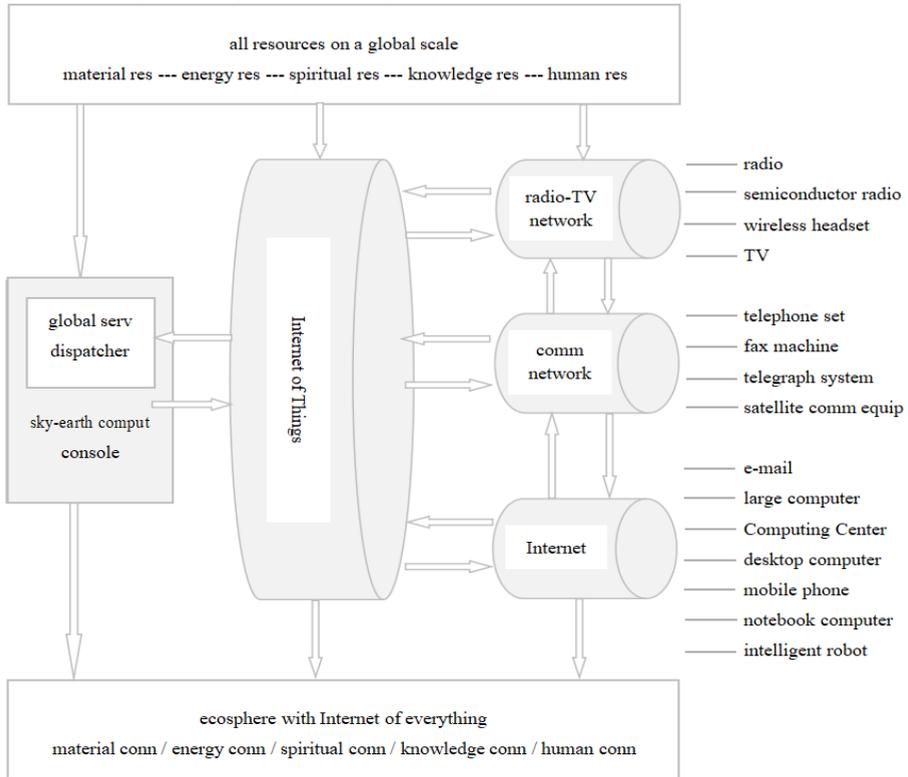


Fig. 1. Interconnected ecosphere with global services by using the sky-earth computing console.

By the analysis and design here, the all-interconnected ecosystem with the support of IT and network technology, can be developed into a complex system with cybertech users as its center. Here, it has a complex multi-connection system: dynamic connection -- benefit connection -- value connection, among which, the horizontal and vertical connection of dynamic chain, the horizontal and vertical connection of efficacy chain, and the horizontal and vertical connection of value chain. It is a collection with a cybertech user as its center and composed of all stakeholders who have direct and indirect contact with this cybertech user. It is also a set of resource allocation elements which have direct and indirect contact with a cybertech user.

Sky-earth fusion system (SEF) is a super-metauniverse system supported by sky-earth computing technology, which can be regarded as hyper-cyber world systems (HCW), 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. HCWS 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.

Through the technology development of super-metauniverse system engineering, a customized global service dispatcher (GSD) is provided for each user (individual, group, whole). As the main component of WWB, the global service scheduler should have at least three functional modules, as shown in Figure 2 :

(1)Unified normal measurement. This basic function is the computing technology of grand unified normalization, which can make a unified measurement of all kinds of resources across borders, domains and levels;



Fig. 2. Sky-earth computing console with global service dispatcher

(2) Advanced intelligent engine of supply-demand docking. This basic function is to provide customized menus for both supply and demand with the user's movement, and realize the intelligent docking of supply-demand matching as soon as possible through the supply-demand compiled search engine, so as to achieve the holo-synergic intelligent drive;

(3) Advanced intelligent-integrated dispatching system. This basic function is to form a dynamic sequence of ecosphere in the whole process according to the results of large-scale dynamic supply-demand intelligent docking, follow the user's mobile process in switching, and carry out mode conversion, so as to realize the support of global resources for the user.

The ultimate goal of the development of sky-earth computing technology is to establish a global support system for every user (individual user, group user and all users). in other words, to equip each user with a world-wise brain (WWB), let every user become the master of his life, the subject of his work, the leader of his entertainment and the protagonist of his social life.

Suppose that for a user, there is an ecosystem with Internet of everything. Here, there are 11 direct factors at different spatiotemporal points, and 15 indirect factors at different spatiotemporal points. If we number 26 spatiotemporal factor points, we can assume that:

at spatiotemporal factor pt 1, the user only has pure emotional link with this factor pt;

at spatiotemporal factor pt 2, the user has complex multiple interests with this factor pt, including economic interests, political interests, support and follow-up interests;

at spatiotemporal factor pt 3, the user has info and material link with the factor pt;

at spatiotemporal factor pt 4, the user has professional and econ links with this factor pt;

at spatiotemporal factor pt 5, the user only has pure material link with the factor pt;

at spatiotemporal factor pt 8, the user has emotional and cultural links with this factor pt;

at spatiotemporal factor pt 9, the user has political, professional and cultural links with this factor pt;

and so on.

3 Super-metauniverse system engineering for every user

In the research and design of this series, we should provide users with global service dispatcher and sky-earth computing console (World wise brain), and provide users with the support of sky-earth computing technical system. On this basis, with the user (individual user, group user, whole user) as the center, we carry out the real-time dynamic service in whole process for the user's ecosphere in Internet of everything, it is super-metauniverse system engineering.

In order to provide the technical foundation of super-metauniverse system engineering, it is necessary to organize the advanced R & D forces of the whole world, make full use of the technology, software (web-software, sys-software, app-software), system, platform, network (Internet, comm-network, radio-TV network) in the information field, and integrate the technology and knowledge (web-knowledge, sys-knowledge app-knowledge), system, platform and network (energy network, logistics network, capital network, human network, knowledge network, social network, etc.) in various professional application fields, to develop a comprehensive-integrated technology, software, system, platform, network, network architecture, link layer, network layer, transmission layer and application layer in the whole field, so as to dispatch the resources of centralized computing, distributed computing, grid computing, utility computing, load-balancing computing, parallel computing, as well as cloud computing, cluster computing, fog computing, edge computing. Sky-earth computing system engineering with the user as its center for the ecosphere in Internet of everything, is as shown in Figure 3.

The basic object of super-metauniverse system engineering is not only the Internet of everything, but also the all-interconnected ecosphere. For users staying at a certain

spatiotemporal point, the user's interconnected ecosphere is the deterministic ecosphere in Internet of everything; For users moving at different spatiotemporal points, the user's interconnected ecosphere is the whole migration ecosphere in Internet of everything.

The main content of super-metauniverse system engineering is to serve the user's resource allocation. In the complex ecosphere in Internet of everything, resource allocation can be divided into several major elements, such as seven elements: information, goods, personnel, capital, raw materials, services (including management) and organization. Corresponding to different elements, there are different Internet, such as information internet, goods Internet, personnel Internet, capital Internet, resource Internet, service Internet and organization Internet.

Using the global service dispatcher (GSD) and sky-earth computing console (SECC, i.e. world wise brain), we can provide users with aux-synergic design, aux-synergic R&D, aux-synergic organization, aux-synergic operation, aux-synergic cooperation, aux-synergic management, aux-synergic adjustment, aux-synergic detection and aux-synergic maintenance, thus users can become the design center, R&D center, organization center, operation center, cooperation center, management center, adjustment center, detection center and maintenance center of their own super-metauniverse system engineering. The super-metauniverse system engineering supported by information technology, computing technology and network technology is shown in Figure 3.

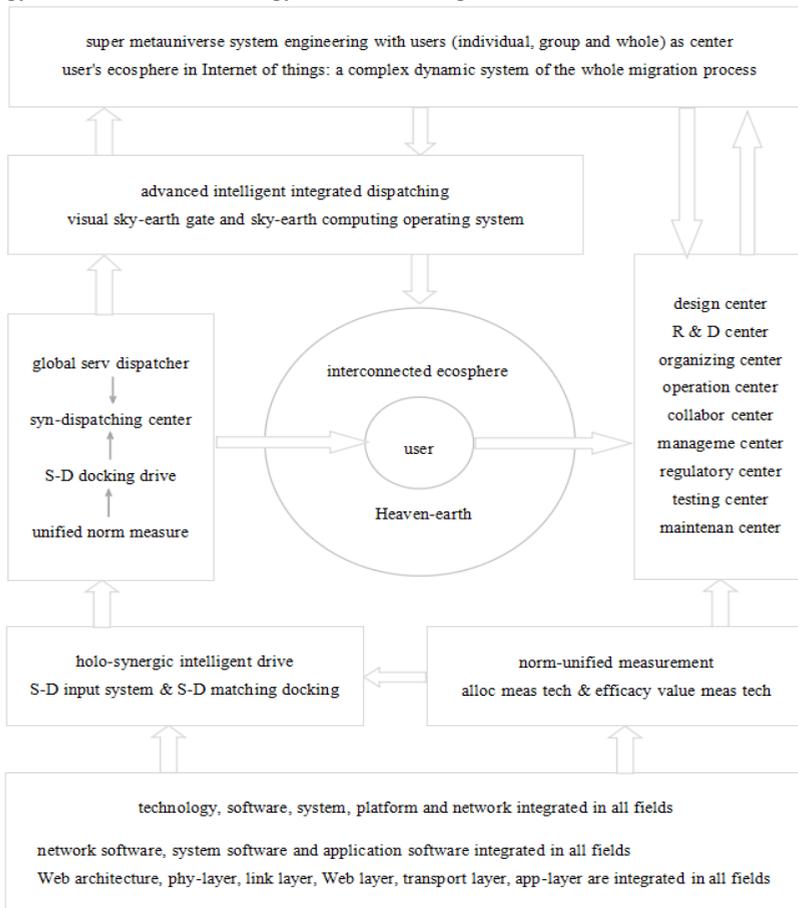


Fig. 3. Sky-earth computing console with global service dispatcher.

Each spatiotemporal point determines a certain space range and a certain time range. For figures 4 and 5, suppose that:

the space range and time range indicated by point A are: a residential area in Z community, Y District, X city, 5:30-7:30 in the morning;

the space range and time range indicated by point B are: block A, business building, K Industrial Park, H District, X city, 8:00-9:00 in the morning;

the space range and time range indicated by point C are: an office area of Z scenic spot in the suburb of X city, 9:30-10:30 a.m.;

the space range and time range indicated by point D are: temporary office area of P Development Zone, N District, M City, 12:00-2:00 noon.

Figure 4 shows the basic contents of user activities at different spatiotemporal points A, B, C and D in the interconnected ecosystem. As shown in Figure 4:

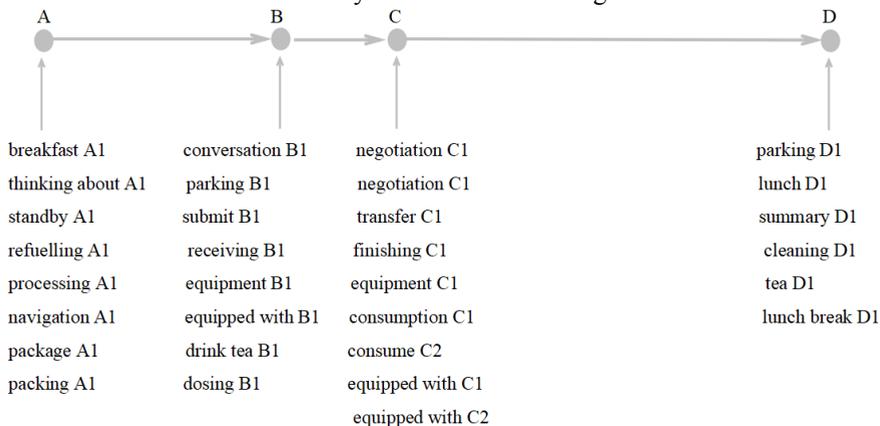


Fig. 4. Basic contents of user activities at diff spatiotemporal points A, B, C, D in interconn ecosphere.

at spatiotemporal point A, the main contents of user activities include: breakfast A1, thinking A1, car preparation A1, refueling A1, processing A1, navigation A1, packing A1, packing A1;

at spatiotemporal point B, the main contents of user activities include: talking B1, parking B1, submitting B1, receiving B1, equipping B1, equipping B1, drinking B1, and feeding B1;

at spatiotemporal point C, the main contents of user activities include: negotiation C1, negotiation C1, transfer C1, arrangement C1, eqpt C1, consumption C1, consumption C2, eqpt C1, eqpt C2;

at spatiotemporal point D, the main contents of user activities include: Parking D1, lunch D1, summary D1, cleaning D1, tea D1, lunch D1.

Figure 5 shows the various resources that users need to support at different spatiotemporal points A, B, C and D in the interconnected ecosphere. As shown in Figure 5:

at spatiotemporal point A, the main resources users need to support include:

food A1, document A1, truck A1, engine oil A1, information A1, suppl A2, suppl A2;

at spatiotemporal point B, the main resources users need to support include:

file B1, truck B1, data B1, data B2, eqpt B1, eqpt B1, beverage B1, and drug B1;

at spatiotemporal point C, the main resources users need to support include:

file C1, file C2, car C1, data C1, eqpt C1, suppl C1, suppl C2, suppl C3, suppl C4;

at spatiotemporal point D, the main resources users need to support include:

file D1, car D1, eqpt D1, suppl D1, suppl D2.

at spatiotemporal point A, the supports that users need service support include:

community A1, manufacturer A1, manufacturer A2, organization A1 and organization A2;

at spatiotemporal point B, the supports that users need service support include:

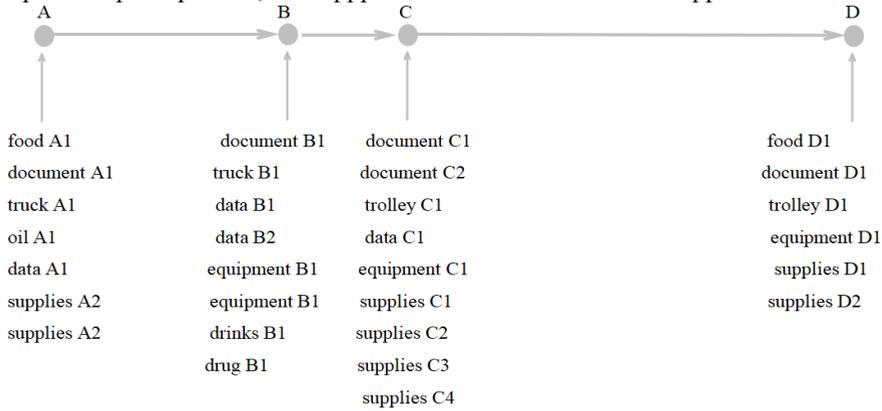


Fig. 5. Various res that users need to support.

at diff spatiotemporal points A, B, C, D in interconn ecosphere

4 Sky-earth computing as expansion of cloud computing

The overall framework of super-metauniverse system engineering is shown in Figure 6.

In this figure, indiv S-E gate expresses the visual gate of individual sky-earth, org S-E gate expresses the visual gate of organizational sky-earth, region S-E gate expresses the visual gate of regional sky-earth, soc S-E gate expresses the visual gate of social sky-earth; indiv S-E path expresses the visual path of individual sky-earth, org S-E path expresses the visual path of organizational sky-earth, region S-E path expresses the visual path of regional sky-earth, soc S-E path expresses the visual path of social sky-earth; indiv S-E space expresses the visual space of individual sky-earth, org S-E space expresses the visual space of organizational sky-earth, region S-E space expresses the visual space of regional sky-earth, soc S-E space expresses the visual space of social sky-earth.

According to the overall framework designed in this series of research, the basic composition of the technology system of sky-earth computing is as follows:

Sky earth wise brain is mainly for computing in the information world and computing in the actual world. It is mainly composed of sky-earth compilers, allocation measurement platform, value measurement, supply-demand docking stack, dynamic analyzer and fair trade-off device;

The sky-earth wisdom database is a collection of new thought system, new science system and new technology system facing the new civilization world;

The integrated processor is mainly composed of totalizer, controller and arithmetic unit. Its function is sky-earth information processing and execution of integrated instructions. Its summary mainly includes classification, synthesis and allocation;

The sky-earth central processor is mainly composed of the sky-earth integrated processor, the scene-conversion central instrument (integrated browser) and the integrated scheduler that we are organizing to develop;

The sky-earth computing platform mainly consists of five plates, namely, knowledge innovation plate of new civilization, sky-earth computing plate of new civilization, wisdom experience plate of new civilization, comprehensive service plate of new civilization and technology development plate of new civilization.

The sky-earth integrated dispatcher is mainly composed of the big-vision operating system, sky-earth wise brain, central dispatching console and central controller that we are organizing and developing;

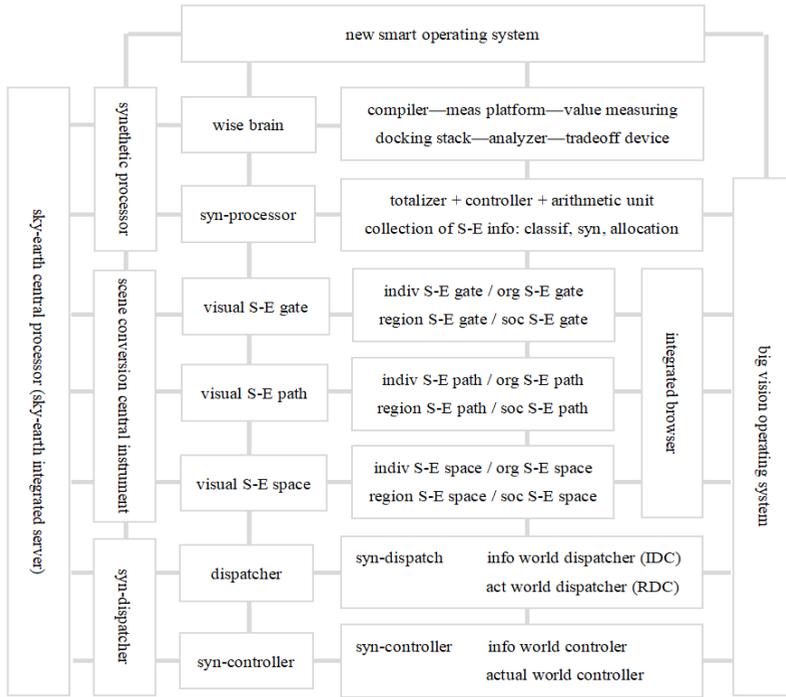


Fig. 6. Overall Framework of super-metauniverse system engineering.

Sky-earth operating system includes big-vision operating system and new wisdom operating system;

The sky-earth activity center includes the sky-earth experiential center and sky-earth dispatching center;

The basic components of sky-earth experiential center are as follows:

Sky-earth visual gate is divided into social sky-earth gate, regional sky-earth gate, organizational sky-earth gate, personal sky-earth gate, etc;

Sky-earth visual channel is divided into informational world channel (I channel) and actual world channel (R channel);

Sky-earth visual space is divided by boundary, field, block and circle;

Sky-earth dispatch center is mainly composed of dispatching console and controller which we are organizing to develop;

Sky-earth central dispatch console is divided into the info-world dispatch console (IDC) and the actual world dispatch console (RDC);

The basic functions of sky-earth controller include programming, searching elements, navigation, scheduling and command. It is divided into information world controller (I keyboard) and actual world controller (R keyboard). The two types of controllers are mutual instructions, guidance, assistance and support for each other;

The network platform of sky-earth computing can be regarded as the synergistic-control platform for the Internet of everything. It refers to the various service support systems of sky-earth computing network based on the Internet of everything. It not only faces the information world (the digital and analog information world), but also faces the actual world (the physical and psychological real world);

The cluster system of sky-earth computing website is divided into central websites, system websites, department websites, regional websites, basic websites, user websites and so on;

The sky-earth integrated processing center covers command platform, operation platform, control platform, organization platform, management platform, etc. it not only faces the offline operation system, offline control system, offline organization system and offline management system of the actual world, but also faces the online operation system, online control system, online organization system and online management system of the information world.

Through the HDFS cluster (MapReduce / Tez / Spark, Storm, Spark Streaming, S4, Heron, etc., or Impala, Drill, PRESTO) of the underlying architecture of big data platform, many NameNodes, a large number of DataNodes, and a large number of computers, mobile communication tools, data warehouses (using Spark SQL, Hive SQL, Pig, etc.) and artificial intelligence components (for example, AlphaZero, generate countermeasure network GAN, Vicarious's new recursive cortical network, Geoff Hinton's new capsule network), super-metauniverse system engineering can realize the unified scheduling (currently assisted by Oozie, Azkaban, light task scheduler, Zeus, etc.), unified processing (currently assisted by SQL) and unified computing (currently with HDFS cluster and Spark, Storm, Heron, etc) of various data.

The basic structure of science and technology of super-metauniverse system engineering is shown in Figure 7. The sky-earth computing is not only the sky-earth computing everyone, but also the sky-earth computing of every organization, and even the sky-earth computing of the whole society. Taking users (individuals, organizations, and society) as the computing center, it faces the various application scenarios of users (the scenario is a system composed of objects, tools, facilities, platforms and resources, including actual scenes and informational scenes; or, physical scenes, informational scenes and psychological scenes; or, natural scenes and social scenes), and then faces the various environments of users (actual existing environment and information environment; or physical environment, informational environment, psychological environment; or natural environment and social environment).

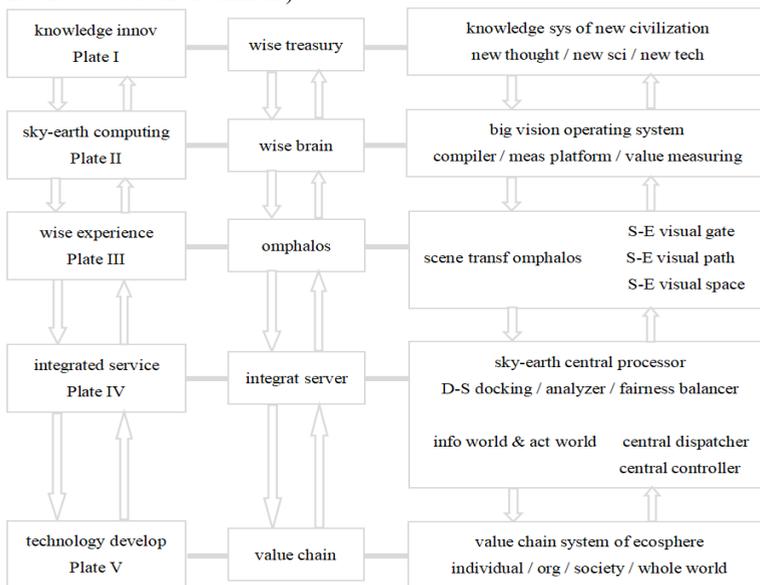


Fig. 7. Science and Technology System of super-metauniverse system engineering.

Different from traditional computing and modern computing, the subject of sky-earth computing is a special man-machine (human and computer, mobile phone, robot) agent, and in our view, man-machine agent is a typical intelligent-integration subject. Through

single and many human-computer agents, we can turn every person, every group, every organization, every department, every region and every society into intelligent-integration subject. In addition to the rest time, every individual, every family, every organization, every community, every sector, every town, every region, every country, every international organization and every global organization, as a social intelligent computer system at all levels, carries out calculation (information processing and data analysis) all the time, and this kind of calculation (information processing and data analysis) is often closely related to the life, work, leisure and other activities carried out by all kinds of subjects at all levels.

Different from traditional computing and modern computing, the super-metauniverse system engineering is to take each person, every organization and every society as the center, combine the natural intelligent computation based on manual computation with the artificial intelligence computation based on computer, and create the sky and earth of each person, organization and society through the expanding and reproducing Internet of everything, and the various sky-earth at all levels are the various world ecospheres at all levels.

Here, organizational mobility is carried out in the cross-border and cross-level flow of all stakeholders of the organization, including "insiders" and "outsiders" in the traditional sense. The mobility of organization is the that of real-time, real-time, long-term and super long-term organization. It involves the mobility of the whole staff among components, combinations, modules, platforms, networks, various scenes at all levels, and various ecospheres at all levels, and various worlds at all levels.

The development from IT technology to DATA technology is a great progress and improvement, while the development from data technology to the hyper-cyber world synthesize technology proposed in this series of researches is a great leap and revolution. Everything in the world, whether physical, energy, or spirit, knowledge, or information and data, can be incorporated into the system framework of various types of world ecospheres at all levels for unified processing, unified calculation, unified analysis and unified scheduling.

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