

The intelligent technologies of electronic information system

Xianyu Li

Department of System Collectivity, Tian Chen Information Technology and System Engineering Institute, Beijing, China.
Email: 919wh_cn@sina.com

Abstract. Based upon the synopsis of system intelligence and information services, this paper puts forward the attributes and the logic structure of information service, sets forth intelligent technology framework of electronic information system, and presents a series of measures, such as optimizing business information flow, advancing data decision capability, improving information fusion precision, strengthening deep learning application and enhancing prognostic and health management, and demonstrates system operation effectiveness. This will benefit the enhancement of system intelligence.

1. Introduction

Electronic information system is a distributed man-machine system that effectively organizes related resources, conducts information processing and actualizes business activities. Service-oriented architecture can translate function units of different applications into information services among that interface and protocols are favourably defined, and the information services are the integration basis of electronic information system. Along with the continuous advancement of information technology, electronic information system need further satisfy the requirements of dynamic function evolvement and realization, and meantime the practices and development of information service system can provide available technical approaches for it [1][2].

Intelligence support and intelligent technology is necessary for electronic information system to improve performance level and advance decision advantage, and it has been an important technology emphasis during system development. System intelligence generally comprises computation intelligence, perception intelligence and cognition intelligence. Perception intelligence area is typical of the capability of image comprehension, identification and language translation. Computation intelligence area is characterized by the core of formalization or regularization operation such as scientific operation, logic processing and statistic inquiry. Cognition intelligence area emphasizes thinking and decision capability with the core of comprehension, reasoning and decision-making [3].

Intelligence comparison of electronic information system is drawn in table 1.

Table 1. Intelligence comparison of electronic information system.

Category	Objective	Function	Present State
Cognition intelligence	Comprehension, reasoning and decision-making	Decision support (to increase cognition speed)	Inferior
Computation intelligence	Computation, statistical analysis and inquiry	Elementary operation	businessRelatively preferable
Perception intelligence	Audition, seeing, speaking, action and response	Man machine interface	Better and hopeful to achieve a real breakthrough



2. Information Service Development

Information service attributes generally consist of the function attribute of kernel metadata and message format, and the non-function attribute of service state, service quality and user-defined [4]. Kernel metadata means the descriptive information that pictures the service characteristics of status, content and copyright; message format means the communication protocol that serves when service applicant transfer related services; service state is meant to describe whether present service is available; service quality means the capability of information service to meet user requirements or complete stated tasks, and includes the defined static parameters of robustness, scalability and security, and the supervised dynamic indexes of accuracy, delay and reliability; and user-defined is for the purpose of extending the description of information service.

Information service is the encapsulation entity of system function units, which comprises three logic layers such as description layer, entity layer and interface layer, as is shown in figure 1.

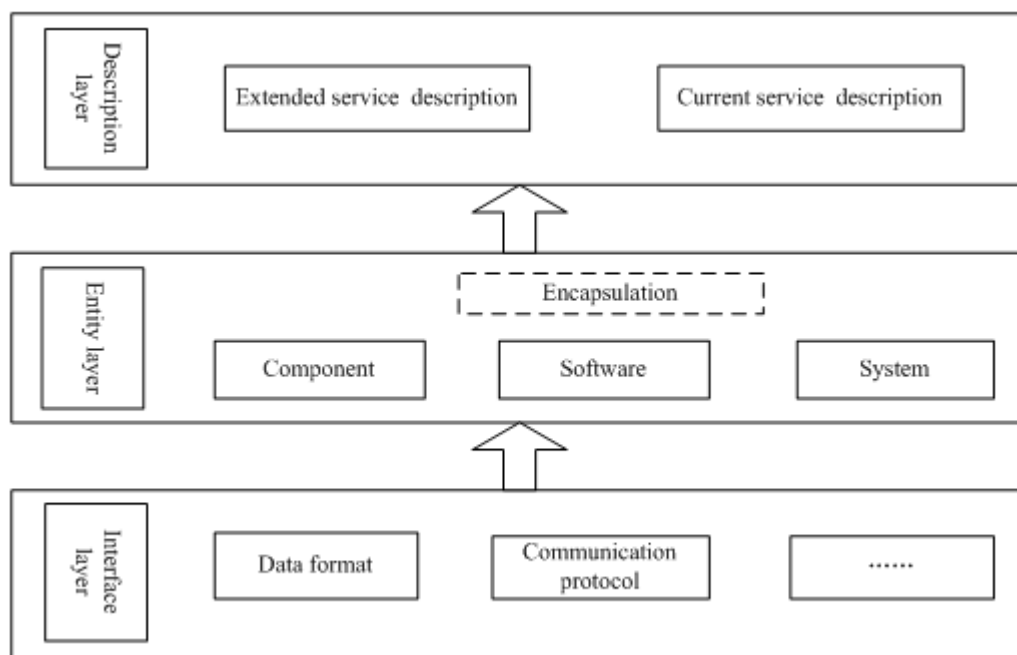


Figure 1. The logical organization of information service.

- Interface layer specifies the outer interfaces that comprise communication protocol and message format, and actualizes the separation between service interfaces and functions.
- Entity layer presents the related service applications, and is composed of function realization and resources encapsulation.
- Description layer provides the description information needed for the service discovery and transfer.

Information service system contains various integrative management and business services that sustain the related infrastructure on the basis of service oriented technology [5]. Service oriented electronic information system is substantially based on various information services distributed in a network in light of mission requirements, and integrated into a mutual operational system by means of service combination and transfer, alternation and cooperation.

The distributed functions and resources are illustrated and encapsulated into independent information services with unitive and feasible interface standards; the alternation and communication among services are devised via service bus topology to raise system data and function sharing; and the information services are recombined and aggregated according to certain operational business flow, and eventually transferred, alternated and collaborated so as to accomplish the desired intelligent and dynamic system.

3. Intelligent Technology Framework

Based upon information services, we follow the overall thread of resources-service-application, and set up intelligent technology framework. Intelligent technologies of electronic information system generally comprise intelligentized application technology, common service technology, kernel service technology, service engine technology and resources supervision technology [5] [6]. Intelligent technology framework of electronic information system is depicted in figure 2.

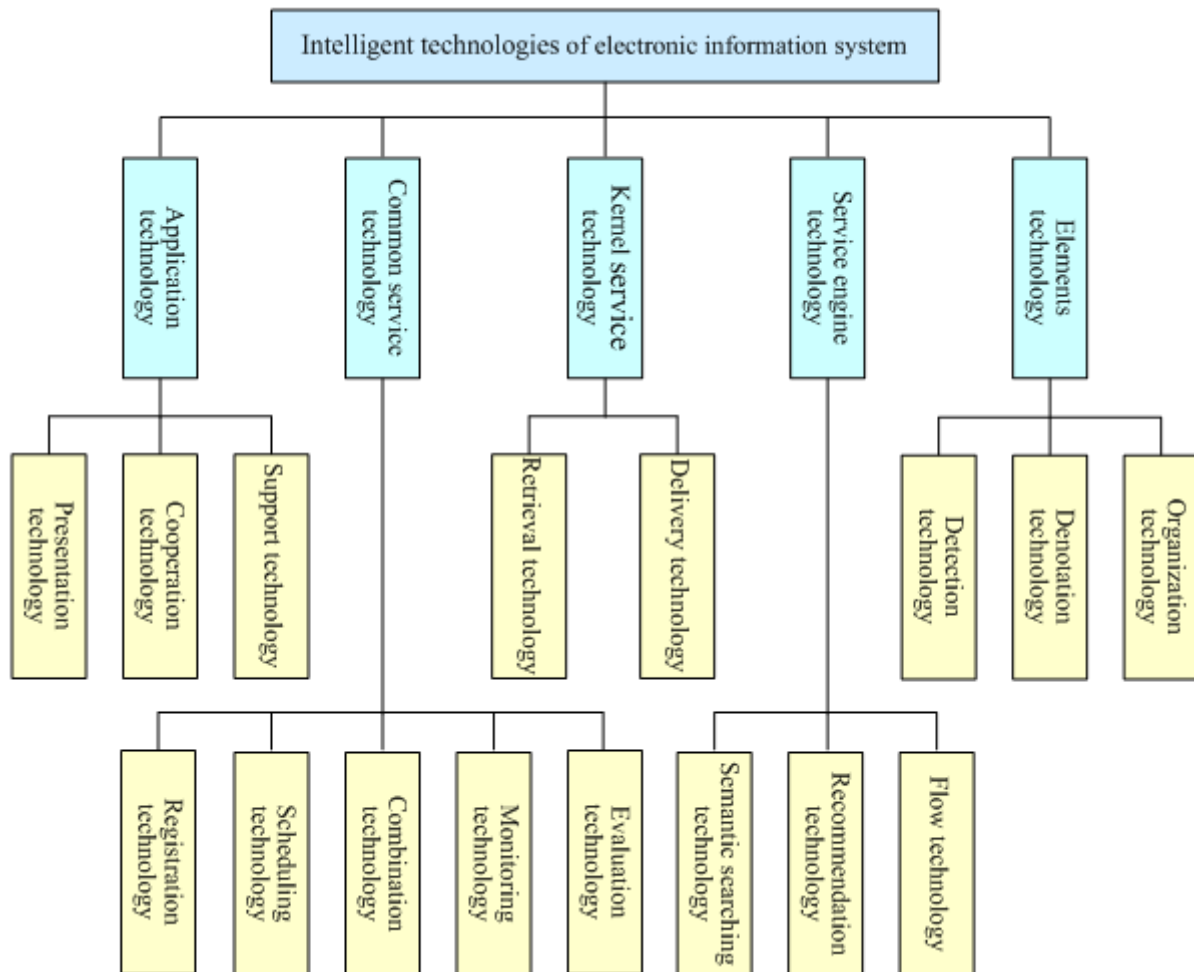


Figure 2. Intelligent technology framework of electronic information system.

- Intelligent application technology is to apply various services and resources to system functions and processes, and comprises intelligent presentation, cooperation and support technology.
- Intelligent common service technology is to reorganize and encapsulate distributed intelligent resources, investigate and construct required service models, and comprises registration, scheduling, combination, monitoring and evaluation technology.
- Intelligent kernel service technology is to achieve proper sharing, reuse and collaboration, and comprises intelligent retrieval and delivery technology.
- Intelligent service engine technology is to carry out entity modeling and semantic modeling, and chiefly consists of semantic searching engine, recommendation engine and flow engine technology.
- Intelligent elements technology mainly deals with the storage, management and maintenance of intelligent resources, is the basic of service and application, and includes detection, denotation and organization technology.

4. System Improvement Measures

According to the overall scheme and associated standards, we need take a series of practicable measures to smoothly accelerate system service capacity and improve system intelligence grade [6] [7] [8], and the related measures are primarily as follows.

4.1. Actualizing Business Flow Optimization

We should optimize business information flow with respect to the related processes of information collecting, transferring, processing, feedback and control in the light of new situation and requirements, make use of various technology means of parallel programming mode, distributed resource management, and carry out system architecture design, quality enhancement of software design and realization, and improvement of program algorithm efficiency so as to implement the intelligent engine and agile operation.

4.2. Advancing Data Decision Capability

Big data analysis, online analysis and data excavation technologies should be properly applied to databases from multi-sources so that decision information and decision knowledge can be produced to improve model database and knowledge database, and decision report is established to devote to business decision making, while business information is fed back to business department for further demand and to related database for new knowledge. Composite data structure can meet the application needs of field decision making, and trend analysis and pattern identification can supply mature data product and enhance decision service capacity.

4.3. Improving Information Fusion Precision

Information fusion technology is to synthesize redundancy information from various types and isomorphic and isomeric data sources, get hold of accurate evaluation of concerned object, and present proper judgement and decision. Information fusion consists of data level, character level and decision level, and continually obtains finer outcome by means of a series of optimized algorithms on the basis of method base, model base and knowledge base. It can enhance information dimensionality and dependability, and improve system performance and robustness.

4.4. Strengthening Deep Learning Application

Deep learning approach roots in traditional nerve cell network. It is to simulate the mechanism for simulating brain analysis and study by establishing multi connotative layer, and carry out independent study of brain character via rules that are set up based on a great deal of data and experience. Deep learning can implement abstract and comprehension of concept and law layer after layer by means of training for multilayer nerve network, and solidify the comprehension in a form of nerve cell network so as to intelligently advance system perceiving and operation capability.

4.5. Enhancing Prognostic and Health Management

Prognostic and health management is mainly to administer system state in real time, deal with and examine the collected information, and forecast system operation state and regulate maintenance work. We shall further investigate the related intelligent perceiving, data transfer, fault diagnosis, fault prognostics, decision support and interface technologies, and utilize performance parametric monitoring method and physics of failure model-based prediction method so as to enhance the self-support capability and intellectual level of electronic information system.

5. System Operation Effectiveness

Based upon the integration of intelligent technologies and associated measures by means of information service units, the operation capabilities of electronic information system are evidently increased as compared to the ordinary system, and it is mainly reflected in the three aspects of business processing delay-time, information sharing capacity and service availability [9][10][11]. And performance contrast of ordinary and intelligent electronic information system is drawn in table 2.

Table 2. Performance contrast of ordinary and intelligent electronic information system.

Category	Business Processing time	DelayInformation Sharing Capacity	Service Availability
Ordinary System	11.331 s	20	0.9971
Intelligent System	3.0820 s	100	0.9995

6. Conclusions

We novelly establish intelligent technology framework of electronic information system, and carry out effective improvement with respect to various system functions via intelligent technology utilization and information service integration. In the light of the new demands of electronic information system, we should further promote the application of information services and intelligent technologies to the system integration and development. In addition, we should continually optimize business information flow, advance data decision capability, improve information fusion precision, strengthen deep learning application and attach importance to prognostic and health management. It is the complete scheme, systemic technologies and appropriate standards of man machine intelligence and information services that would fully ensure system intelligent and collective capabilities.

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8. References

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