A Complex IT Model System Based on Hierarchical Semantic Network

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***Abstract*—With the continuous development of IT system in enterprises, the more complicated IT system framework rising up. IT system operation becomes more and more difficult. In order to improve the ability of IT management, a complex IT model system is built up along with establishing semantic network of complex IT system in this article. Here the semantic conflict is eliminated by model layer in this model system. This can instruct IT system operating industry as one methodology to build up its knowledge database, as well as representing its internal knowledge.**

Keywords-semantic network; semantic conflict; IT system operation; knowledge database; complex IT system

I. INTRODUCTION

With the competition going more drastically, IT system is demanded not only to support business operating, but also to create more values in many enterprises. In this kind of background, the more complicated IT system framework becomes, the deeper enterprise depends on IT system. So every fault in each chain may impact system's availability and its work efficiency. Operating risk becomes higher and higher. In this time, quantity and cost becomes the bottleneck to develop IT branch. Obviously, pure technique method can't settle the deep-seated problems behind both IT organization structure and branch management. It is wise for every enterprise to instruct and standardize by using theoretic. So this can improve the ability of IT management.

The successful experience that some intelligent decision support systems based on knowledge (known as expert system) is applied into such fields including sale and market, brings the first light of morning in resolving those problems mentioned above. But the first principle of knowledge engineering emphasizes that the first factor depends on the ability of resolving problems is knowledge database and the second factor is reasoning method. So the principle that expert system must obtain rich knowledge [1] has been accepted by more and more researchers in artificial intelligence field. Then many researchers bring forward different knowledge representation method to complete knowledge database well, such as first-order predicate, agent and Ontology [2]. Thinking of its non-linearity, uncertainness and inscrutability, it is difficult for complex IT system in describing its knowledge completely with traditional knowledge representation method. So a hierarchical semantic network model is put forward in this article to describe the knowledge in complex IT system. Here the model is stored in XML, in order to realize modeling complex IT system. And then it is easy for IT operational industry to introduce artificial intelligence system into its field.

II. SEMANTIC NETWORK AND ITS WEAKNESS

Semantic network was put forward by Quillian, as an explicit psychology model in mankind's associative memory. And in 1970, Simon brought forward semantic network conception and firstly discussed the relation between semantic network and first-order predicate. In semantic network, the relation of event, conception, state, action and object is described as directed graph, which is composed of nodes and edges marked with symbol. And the characteristic of knowledge database, represented by semantic network, is to describe the possible event by using directed graph with symbol. Here nodes stand for object, conception, event, state, action or objective attribute, edges with symbol describe the relation among all objects. So the modification of knowledge database is completed by inserting and deleting the objects and their relevant relation [3]. In a classic semantic network, shown as FIGURE I, node A and node B stands for two entities, and edge RAB stands for the semantic relation between the two nodes. And the node, which has incoming arcs but has no outgoing arcs, is called leaf node. And the other node, which has outgoing arcs but has no incoming arcs is called root node. It is possible that there is more than one root node in semantic network.

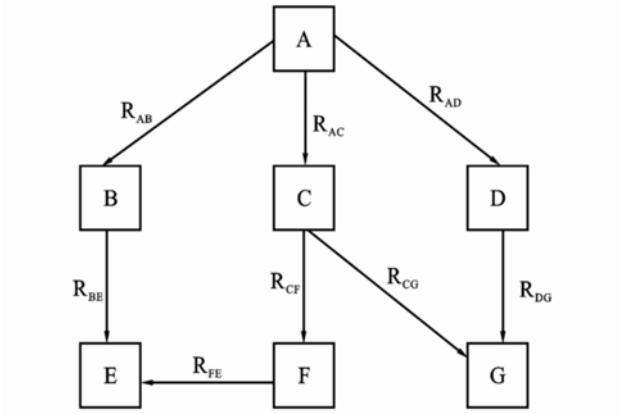

FIGURE I. structure demonstration of semantic network

Because of its advantage, such as structural ability, nature ability and associated ability, semantic network has become more and more popular in representing knowledge. And due to the uncertainty of complex IT system, it is hard to eliminate semantic conflict in describing IT system with simple

semantic network. The semantic conflict in natural language processing is defined that there is semantic inconsistency caused by the difference of two objects in description method, structure and content, when describing the same real object [5]. In the complex IT system, some a device probably is replaced by its name, alias, number and even its service IP address. At this time, grammatical situation, such as grammatical structure and context, is adopted to eliminate this kind of semantic inconsistency. And as the complex IT system operation industry is concerned, the semantic inconsistency can hardly be avoided due to the IT system structure, representation, understanding of the different point of view. Meanwhile, there is semantic inconsistency among different business information resource. And this results in all kinds of incomplete information or error information. If the artificial intelligence method is applied into complex IT system operating, the thing must be firstly done is knowledge representation and its processing pattern can well deal with semantic conflict. In this article, a complex IT model system is built up along with establishing semantic network of complex IT system. Here the semantic conflict is eliminated by model layer in this model system.

III. A COMPLEX IT MODEL SYSTEM BASED ON HIERARCHICAL SEMANTIC NETWORK

In order to eliminate the semantic conflict in researching knowledge representation of IT system with semantic network, the model system is divided into three layers, such as template layer, model layer and entity layer. And by using this hierarchical method, the scalability of model system can be well reached. In template layer, abstract element of application scenarios in IT model system can be defined dynamically. In model layer, all models can be established easily on basis of template layer by using the abstract element, mentioned above. And in entity layer, all abstract elements can be instantiated according to the framework established in model layer. For every layer, mentioned above, although it is constructed by the same criterion of semantic network. The support relation among the three layers has distributed semantic tags for all the entities in complex IT system. And by using these tags, the semantic conflict problem can be easily settled. Then on the basis of some a large OLTP system, the work mechanism of the three layers in complex IT model system is shown as followings:

A. Template Layer

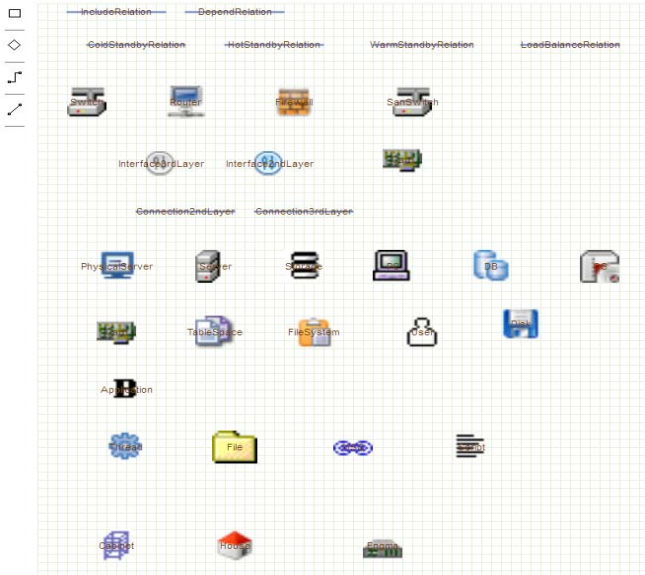

FIGURE II. template layer

Four templates are defined in template layer, which is described in detail in table 1.

Table I. four templates in template layer

Name	Symbol	Signification	General attributes	Instance
Entity elements	□	most abstract elements in IT system	Name, icon granularity(module, component) system(network, system) state(virtual, actual)	router, firewall, interface board, host, logic host, user
Interface elements	◇	the important elements, which can connect all the three layers together. Refer to second layer and third layer of OSI.	Name, icon granularity(module, component) system(network, system) state(virtual, actual)	Layer 2 interfaces: data link layer interface, corresponding to network cable interface. Layer 3: network layer interface, corresponding to IP address.
Link elements		the abstract elements in distribute system, which can realize signal transporting and data stream transporting. Instantiate the interface elements to realize both layer 2 link and layer 3 link.	Name, icon granularity(module, component) system(network, system) state(virtual, actual)	layer 2 link: data link, corresponding to network cable; Layer 3 links: network link, corresponding to the socket links between IP addresses.
Relation elements		link the instantiations of the three relation elements together. refer to the four relationships in UML and here it can be simplified into two relationships: dependency relationship, composition relationship	Name, icon granularity(module, component) system(network, system) state(virtual, actual)	dependency relationship, composition relationship

B. Model Layer

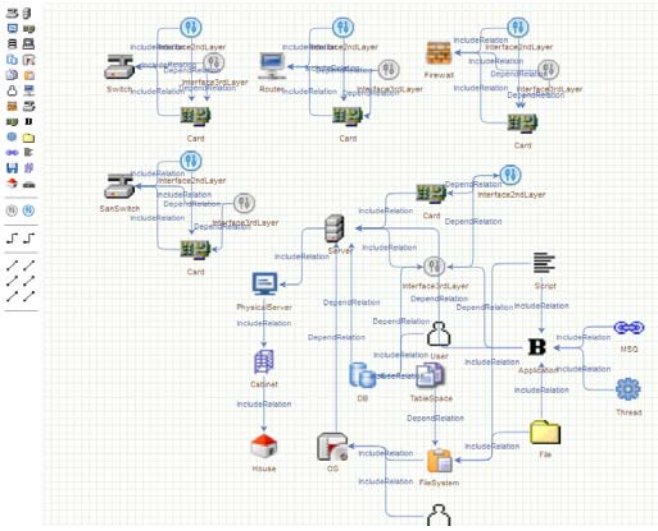

FIGURE III. composition model in model layer

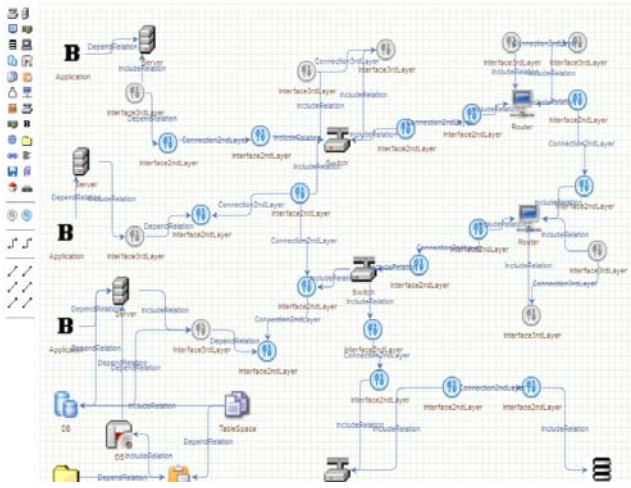

FIGURE IV. data stream model in model layer

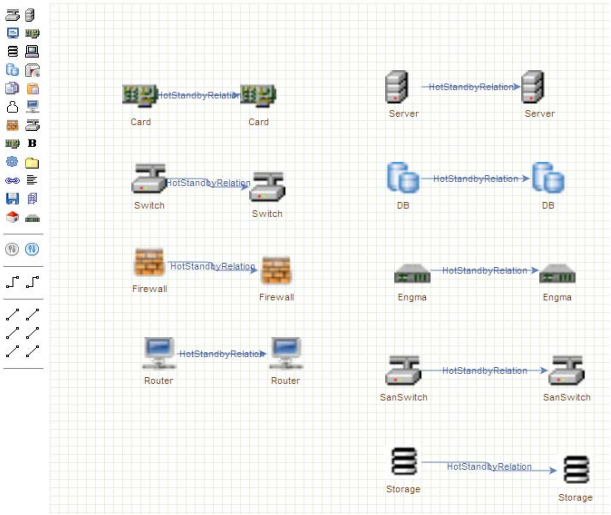

FIGURE V. high availability model in model layer

Here composition relationship model, data stream model and high availability model is respectively described in FIGURE III, FIGURE IV and FIGURE V. And all the three models are generated by the abstract elements in template layer, after instantiating the four templates. And it is suit for the character of distribute OLTP system.

1) Composition model solves the problem that the decomposed granularity of IT system is not consolidated. And this is main foundation in modeling some an IT system.

2) Data stream model abstracts the six common data streams in IT system and then represents them by using graphics mode. Here the six common data streams is shown as followings:

a) Communication among different application hosts connected by same switch.

b) IP routing communication in different sub-network with switch or router.

c) Accessing database operation in same sub-network.

d) Accessing database operation in different sub-network.

e) Accessing files in localhost.

f) Accessing files external storage.

3) Identify the Headings

High availability model marks those modules or components which have high availability relationship in IT system, with those four high availability relationships, such as load balance, cold standby, and hot spare and warm standby.

C. Entity layer

Entity layer is a real reflection of IT system. And in entity layer, all modules, components and compositions in IT system are labeled with different symbols. Even the network connection appears in entity layer. In daily operating work, entity layer is used as one platform by operators. And by using entity layer, volume data can be well exhibited. Meanwhile entity layer is main incarnation of the three models in model layer. By using entity layer, many administrative processes in IT operating can be easily realized. So it is graphic representation of operating knowledge database. Entity layer is demonstrated in FIGURE. VI.

IV. TAG

In this article, research on how to extend and expand IT system model is made sufficiently, thinking of main content and main contradiction faced with IT system operating. And then a complex IT model system is put forward, which is based on semantic network. In order to eliminate semantic conflict, the entities in IT system are marked with semantic symbols, with composition, data stream and high availability taken into account. And this can instruct IT system operating industry as one methodology to build up

its knowledge database, as well as representing its internal knowledge.

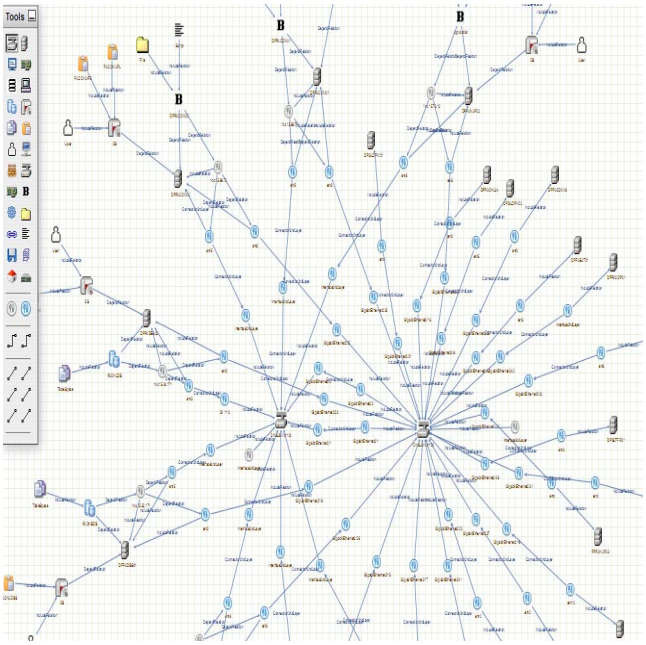

FIGURE VI. entity layer

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