

ECO State Machine and Its Applications

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Keywords: ECO model-driven technology; ECO state machine; Application

Abstract. This paper introduces ECO model-driven technology and analyzes the functions、architecture、 execution sequence and components of State Machine of ECO. By the case design, including the making of static model and dynamic model, it illustrates that ECO logic model ensures the consistency of the data, using state machine to develop application program accords with practical regular rules of the problem-solving, and improves efficiency of exploitation.

1. Introduction

At present, the developers in the IT industry encountered many difficulties in the development of products; application system complexity increase every day, demand change is also accelerating, the emergence of ECO model-driven technology and the application of state machine to speed up the pace of solving these problems.

Object management organization (OMG) release a new framework on the base of UML for soft development - Model Driven Architecture(MDA) in July,2001[1].MDA is a kind of organization and management enterprise system architecture supported by automated tool [2], method for service to define model and promote transformation among different model type, the basic principle of MDA is to improve the level of abstraction [3], the core of MDA is modeling and model mapping technology [4]. Enterprise Core Objects (ECO) is practice on UML technology object relation mapping architecture that base on Model Driven Architecture/Design Driven Architecture (MDA/DDA) theory; It maps line in relation data base as program language object, it built on .Net platform, blend with service frame、 OR Mapping(Object Relational Mapping)、 visual model design interface、 program code automatic generation, object pooling mechanisms and lots of advanced technology ,etc. Developer design static models and dynamic models through visual model design port; in running period, According to statement of the business logic of OCL and action language ECO Space perform、 manage the static model and dynamic model, including transaction processing and object caching, and realize the mapping relationship between objects; ECO component implements visual link and function maintenance on.Net platform in technology. It allows us to have a more accurate view of the business domain problem, by using a variety of class diagram technology can be more easily, and more quickly to establish the correct software system [5]. ECO architecture development and application system with object oriented, relationship oriented, component based and visual function can improve the efficiency by 5 to 10 times.


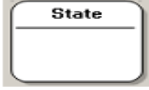


2. ECO State Machine

State diagram in UML emphasize on sequence of event object behavior, on the response of external event and state transition, describe a system under certain condition will do and in what order to do, help to the mapping of reactive system[6].ECO state machine is state diagram practice in ECO, the type and state machine in ECO respectively constitute static model and dynamic model of the model driving.

ECO state machine control the validity of conversation, prevent object transfer to illogical status. ECO state machine tie up with class to display the status switch of class object. A class can be certain more state machine. A state machine has more elements shown in TABLE I. Each state machine have an initial state, the initial state is not represent the state of any object, just indicate start the

implementation from the status. Starting from the initial state, there can be one or more transfer to one and more status, but the transfer could not to have the trigger. Each state node can have one or more transfer point to other state nodes or end status. The trigger can be turn on the transfer execution, but frequently under the condition, the condition is known as guard, more transfer that starting from the same state can contain the same trigger, but not contain the same guard. Transfer execution result open program port for the developer, make the application more flexible. The state machine attached to the class, each state node has its own name, the name will be reflected in the status attribute of the state machine subordinate class dependent on the class execution sequence, enter and exit action in the state node is trigger execution action on the order of nodes in the state to enter the action and action is left in and out of a state, the code can be OCL language or action. its architecture is illustrated in Fig.1.

TABLE I. COMPONENTS OF STATE MACHINE

Components	Explanation
	It indicates the initial state. Its state starts at this point when the state machine of the ECO application starts.
	It indicates a state node which can contain a child state. Each state can have a name, an Enter/Exit action.
	It indicates a transition path between nodes of a different state, which can define state transition conditions (Security), execution effects and triggers.
	End state, it is optional.

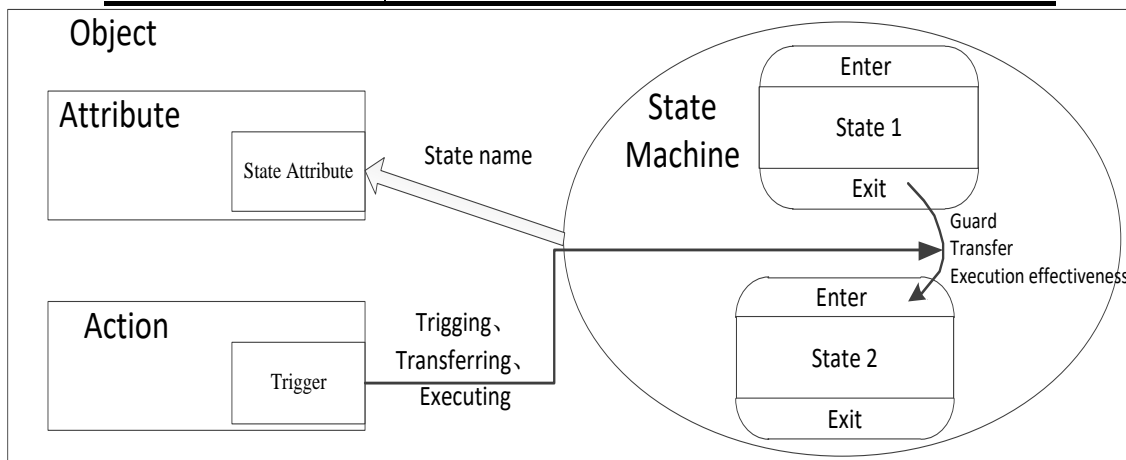


Fig.1. Architecture of state machine

When touch the trigger, the process of transfer from one state to the next state, the execution action sequence as follows:

- The previous status as current status;
- The transferred regard expression would be checked, if the condition is false, all transfers should be cancel;
- The left action of the previous status should be execute;
- The transferred effect expression should be execute;
- Class object status property as the next status name;
- The next status insert action is taken.

3. Applications of State Machine

Publishing is a interactive system that follows of step、 monitoring control, with using model driving technology of ECO to build business logical to improve development efficiency, and more in line with the actual things of the processing. The system solved two questions as follows:

- Establish relationship between author and written books , namely static model;
- Establish state machine for control the publish processing,namely dynamic model .

3.1 Designing State Model

According to analyze of the system, mapping UML model with ECO, class graph is a packet named Package_1, that two class in it including Author and Book. Setting relevance in the class diagram between class. Generally the relevance has three types: one to one, one to more, more to more. In system, one author has many books for to published, so the relationship of author with books is one to more. The system static logical model as shown Fig.2, then, to the book, the result could not happen that not belong with the author, once delete all author’s books ,the author could be delete, protect the data consistency.

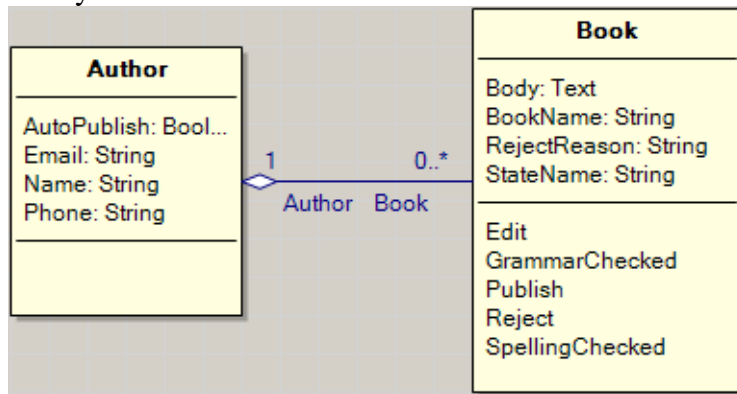


Fig.2. Bayesian neural network training flow chart

After build business logical model, company logical model directly generate database with ECO, to OR Mapping. Based on ECO database development of revolution is permit developer directly on the strength of UML class diagram map in relational database store, without having to manually through the code conversion. The relationship inter-object display relevance in ECO, as show TABLE II.

Aggregate is a special case of incidence relation, it displays the relation of the whole and the part having, and it is a method for delete rules. Using currency Man-ager Handle component in visual program to express master-slave relationship too, associate application component and setting as shown TABLE III, to ensure amend data association.

TABLE II. RELEVANCE

Name	Expression	Remove action
None		Object (Book) at the end of the connection unlinks from the object (Author).
Aggregate		If the aggregate object (Book) is present, the non aggregated object (Author) residing at the end of the link will not be deleted.
Composite		The combination object (Book) at the end of the connection is considered to be a part of the parent object (Author), and delete the parent object is deleted and the corresponding its portion is deleted as well.

TABLE III. APPLICATION COMPONENTS

Components	Function	
Expression Handle1	Manipulate Author class objects	
DataGrid	Display Author and Book class objects	
currencyManagerHandle1	Attribute	value
	BindingContext	dataGrid1 (For displaying Author)
	RootHandle	expressionHandle1 (Manipulate Author)
expressionHandle2	RootHandle	currencyManagerHandle1
	Expression	self.Book

3.2 Building Dynamic Model

The state of the ECO can be stored in the database, so that the operation sequence can be expressed. According to the published book review process, state machine design as illustrated in Fig. 3. There are five trigger include Edit、GrammarChecked、Publish、Reject and SpellingChecked, the transfer they touch and the concern status plan the system interaction process. Firstly, two transfers action from Authoring status, Publish trigger, but guard condition different, AutoPublish property means auto publish or not in the Author class, Boolean type, it can be interaction setting whether true or false. The transfer condition self.Author.AutoPublish touched the Reviewing state (including sub-state), on the country touched Published state. If AutoPublish is false, after interaction operation trigger Publish, transfer to CheckSpelling status. Then, SpellingChecked and Reject trigger could be choice for customer. Self.RejectReason:='Spelling' is the executive outcome transfer CheckSpelling_Rejected from CheckSpelling, point out the reject reason. After the transfer touch Rejected state, only Edit can be do, it means author need to submit a new view. If along with SpellingChecked trigger, it means pass the spell check, syntax check begin. Of course, grammar check is not passed, could be reject, notice editor again; if pass, then transfer to Published state.

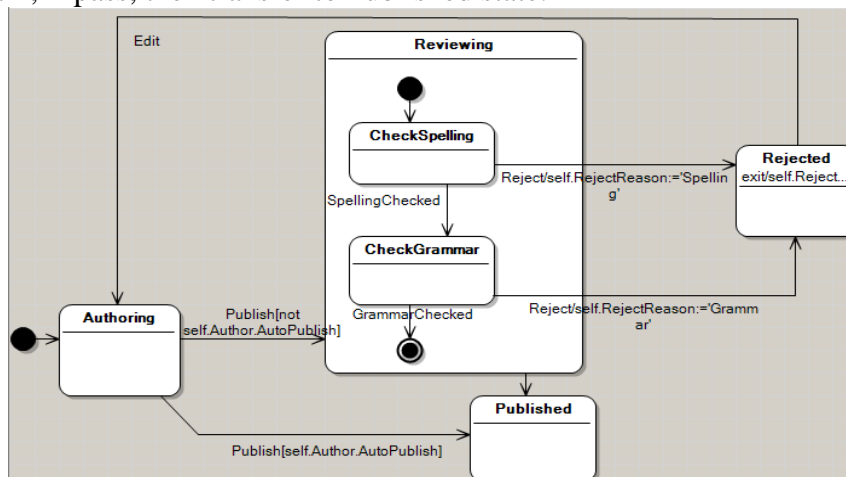


Fig.3. State Machine

when system is running, the trigger can be activate on custom participation with The ECO AutoForm function. AutoForm is ECO prototype test tools, it can be used to input data and show relevance, and provide trigger interaction, operate results can be stored too. Setting AutoForm property of showed data components DataGrid is true, then start AutoForm function, as shown Fig.4, double keys the first line in DataGrid, AutoForm is action, start AutoForm before add Book collection data, book state and trigger are showed, reflect results on book display components.

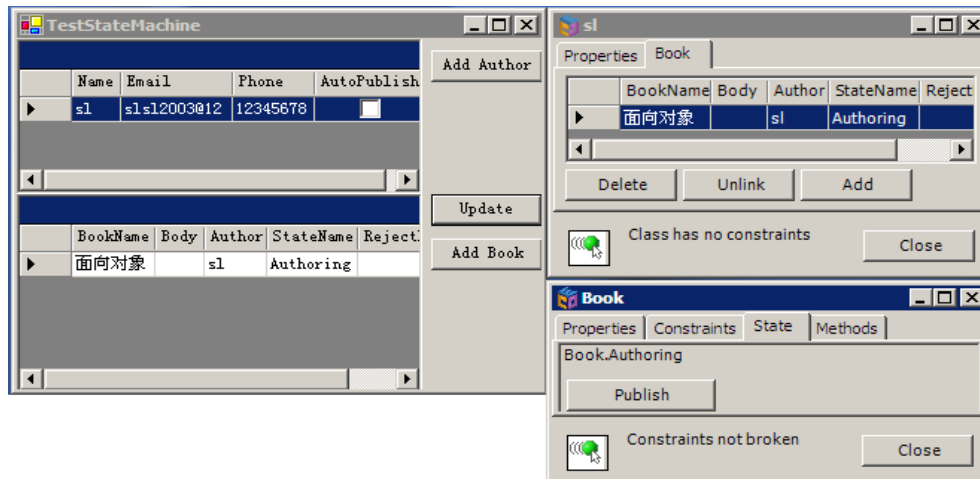


Fig.4. State machine execution demo AutoForm

4. Summary

ECO is achieved by an object-oriented database development framework based on UML model driven and combining OR mapping, graphical user interface binding, object service framework and many other rich features, and implemented software engineering in.NET platform. ECO state machine describe the state sequence of the class object of the application in the survival, which causes the transfer and accompanied by action, and the procedures of auxiliary design of the actual operation. on the basis of the actual situation of the library publishing a, this paper the design static and dynamic model of publishing system, which reflects the highly practical structure and sequence of ECO state machine, which greatly simplifies the application development.

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