SeamCAD 1.x: User's Guide

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__Abstract__: **The enterprise architecture's goal is to integrate business resources and IT resources in order to improve an enterprise's competitiveness. Our goal is the development of an object-oriented enterprise architecture method, called "SEAM". As part of SEAM, we have developed the CAD tool "SeamCAD". SeamCAD enables the modeling of hierarchical systems (spanning from business down to IT) at different levels of detail (e.g. from large business transaction to detailed interactions). This document is the user's guide of SeamCAD 1.x. It first gives an overview of the foundations of our method and then illustrates the functionalities of the tool.**

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1 Introduction

For our enterprise architecture methodology, we have developed a CAD[1] tool called SeamCAD. Our enterprise architecture method is called SEAM (for “seamless” integration between business and IT, or for “Systemic Enterprise Architecture Methodology”) [1]. The main originality of our tool is its capability to manage hierarchical models. SeamCAD is a web-based application implemented in Java.

Section 2 gives an overview of our method, of the tool interface and an example of a hierarchical model. This section helps the readers in getting acquainted with our method and with the tool. Section 3 presents how to install the tool and how to start it. Section 4 presents how to navigate a model. Section 5 explains how to create a new model. Section 6 presents miscellaneous functions. The tool architecture is briefly described in Section 7.

An appendix presents two prototypes that were developed before the first functional version of SeamCAD. This appendix is relevant for readers who want to learn about the research and development history of SeamCAD.

2 SEAM Overview

This section gives an overview of SEAM. Subsection 2.1 gives an overview of the foundation of the method, especially of its modeling language, and points out some related approaches. Subsection 2.2 briefly presents the goal of the tool and then defines the tool-related terms that users should be acquainted before actually using SeamCAD. Subsection 2.3 relates the SEAM concepts given in 2.1 with the tool concepts presented in Subsection 2.2. This is done by presenting a SEAM model of an on-line bookstore. Section 2.4 presents the legal considerations about the tool usage.

2.1 Method Overview

The enterprise architecture’s goal is to integrate business resources and IT resources in order to improve an enterprise’s competitiveness. Enterprise architecture (EA) deals with hierarchical systems that typically span from business entities (market, company, department…) down to IT components (e.g. applications, applets, servlets, bean, COM…). Our goal is the development of an object-oriented enterprise architecture method, called Systemic Enterprise Architecture Methodology (SEAM) [1]. This method is based on the Miller concept of level [2], on the Reference-Model of Open Distributed Processing (RM-ODP) [3] and on a few philosophical principles. This section presents these bases and some considerations related to the SEAM notation.

Miller’s Living System Theory:

James Greer Miller made a thorough cross-discipline analysis and synthesis of the functions and behavior of living systems to develop a theory called “General Theory of Living Systems” or “Living Systems Theory” (LST) [2]. The main goal of LST is to unify all scientific disciplines that study and model livings systems. In particular, LST integrates structural and behavioral sciences but still keeps some of the specificities of the individual disciplines. One of the most important concepts is that of *level.* According to Miller “…the universe contains a hierarchy of systems, each more advanced or ‘higher’ level made of systems of the lower levels”. He identifies seven distinct levels for living systems: cells (free-living cells and aggregated cells), organs, organisms (such as humans…), group (such as families, workgroups…), organization (such as commercial companies…), society (such as countries) and supra-national systems (such as inter-governmental organizations …). This level distinction is tightly linked to people’s experience in perceiving and studying the world of livings systems. Depending on the goal of the modeler, it is possible to have more or less levels.

To be able to fully model enterprises, the model should not be limited to the IT and software-intensive systems but should also represent the business-related systems. To be able to distinguish between these different aspects, SEAM has a concept of **organization level** (which is similar to Miller’s level). These organizational levels exist within an ***organizational level hierarchy***.

[1] We call it a CAD (Computer Aided Design) tool as opposed to CASE (Computer Aided Software Engineering) tool because it deals with not only software modeling but also business modeling.

Reference Model of Open Distributed Processing:

Within the organization levels, we use RM-ODP to represent what is perceived as relevant for the project. RM-ODP is a standard that defines the concepts necessary to model “distributed information processing services to be realized in an environment of heterogeneous IT resources” [3]. RM-ODP also proves to be suitable for general modeling [4].

According to RM-ODP part 2 (i.e. the foundations part of RM-ODP), an entity is any concrete or abstract thing of interest in the universe of discourse. An entity can be considered as atomic or as non-atomic (i.e. composed of components of the same kind). An entity is represented in the model as a model element. So, a model element can be seen as whole or as composite. A system may be referred to as an entity. We define a system as a set of entities that have relationships between them; that are perceived as relatively, and that create, for an observer, emergent properties. A component of a system is itself a system, so it is called a sub-system. The model element that corresponds to a system is an object. An object can be seen as whole (i.e. this corresponds to the external view of the object, also called model-based specification [5]) or as composite (i.e. this corresponds to the internal view, or implementation, of the object). Other kinds of entities can be modeled as action and state. Actions and states can also be seen as whole or as composite. An action or a state seen as composite can be broken down into component actions or states. These component actions or states can be further broken down into smaller component actions or states. This hierarchy of actions and states corresponds to the ***detail level hierarchy***. The detail level hierarchy includes ***detail levels***. This hierarchy is orthogonal to the organizational level hierarchy defined in the previous section (in which an object is broken down into its component objects). In each organizational level, multiple detail levels can exist.

According to RM-ODP part 3 (i.e. the architecture part of RM-ODP), a system specification has five viewpoints: enterprise, information (made of information objects), computational (made of computational objects), engineering and technology viewpoint. In RM-ODP, these five viewpoints describe one IT system. The information viewpoint (describing the IT system specification) and the computational viewpoint (describing the IT system logical components) are somewhat central. The enterprise viewpoint summarizes the business issues. The engineering and technology viewpoints summarize the IT implementation issues. In SEAM, as our goal is to model in systematic manner systems that spans from business down to IT, we distinguish between the business, the IT system and the IT system components by having different organization levels. However, in each level, the relevant systems can be described by their information and computational viewpoints. So, in SEAM, we model organization levels made of ***computational objects*** (i.e. an object that represents a system). The computational objects can be specified by either an information viewpoint (of the computational object seen as a whole) or by a computational viewpoint (of the computational object seen as a composite).

A computational object as a whole is represented by ***information objects*** (IO) and ***localized actions*** (LA). The information objects are like attributes and represent the states of the computational objects. The localized actions represent the computational object’s responsibility. The information objects represents either the fact that a localized action executes (information objects called transactions) or parameters exchanged with the environment (information objects called parameters) or elements of “knowledge” (information objects called concepts). The “knowledge” of the computational object is about itself or about other computational objects belonging to the same organizational level.

A computational object as composite is represented as component computational objects and actions happening between them that we call ***joint actions*** (JA).

Note that as RM-ODP part 2 just defines the term action, we have to define the localized actions and the joint actions. The names of these actions are taken from Catalysis [6].

Philosophical Principles:

SEAM is based on a few important philosophical principles that explain how we perceive reality [7]. The main two are: constructivism and teleology.

Constructivism is the principle stating that “knowledge is the product out of social practices and institutions or of the interactions and negotiations between relevant social groups” [8]. Concretely this principle explains why people hierarchical levels and what is perceived to be in each level. This is the result of the practices taught and used in all disciplines involved in an enterprise architecture project.

Teleology is one way people give meanings to the behavior of the systems they observe. Teleology is defined as “the philosophical doctrine that all of nature, or at least intentional agents, are goal-directed or functionally organized" [8]. So, according to the teleological principle, the modelers need to be able to assign goals to the systems they model. In SEAM, we consider that the computational objects represent entities that are goal-directed in the sense that they have some goals when collaborating one with another (or that their designers have goals to be fulfilled by the entities). We consider two kinds of goals: detail- level related goals and organizational-level related goals.

For example, the modeler can decide to make the information viewpoint of the computational object. The information viewpoint shows information objects modified by localized actions, which are initially represented as whole. The modeler can decide to make a more detailed information viewpoint with a localized action as composite (made of many smaller ones). These two information viewpoints correspond to two detail levels. The first one corresponds to the specification of the goal and the second one to the specification of the means. This corresponds to ***goals/means relationship along the detail level***.

The modeler can also decide to make the computational viewpoint of the computational object. This viewpoint shows the component computational objects that make the computational object of interest. This is another of goals/means relationship that we call ***goals/means relationship along the organizational level***. Some people call this a specification/implementation relationship. We do not use these terms because they contain an implicit reference to a development process. In fact, the information and the computational viewpoints are complement to each other. Both viewpoints exist independently of any development process.

Terminology and Notation:

Our core business is the hierarchical modeling of systems. Our definition of system is generic and can be applied to characterize any systems such as markets, business systems, companies, IT systems, etc… Our experience showed that people gets easily confused with the term system when used in a generic manner (as it is difficult to ignore the specific instance of system that they know). For this reason, SEAM uses the term ***holon*** instead of system. We term holon was defined by Kostler in [9] and its use is recommended by Checkland [10]. The term holon is the elementary unit of the fundamental holistic element. It is the combination of "hol" from holisitic and ends with "on" as electron, proton, and neutron.

As explained above, an entity representing what we consider as a generic system is represented in the model as a computational object. For sake of simplicity, we use the term holon for the computational objects. To be rigorous, we should have called the computational objects *model of holon*. The holon is a system perceived in the reality and the model of a holon is its representation of in the model. To be practical, we call all of them holon. Bottom line, in SEAM, we have organizational levels in which holons are represented either as whole or as composite. A holon represented as whole is synonymous to the information viewpoint of a computational object. A holon represented as a composite is a synonymous to the computational viewpoint of a computational object.

Our tool allows changing the shape of the representation of the holons. This is useful as it allows using a graphical element that acts as a reminder of organizational level shown. For example, holons in the business-related levels are shown as a Porter's arrow [11]. In the IT related levels, a system is represents by a UML sub-system. Both graphical elements are considered the same for the CAD tool, only the appearance differs. Our tool also allows placing pictures or drawings next to the holon. This is useful to make the model more concrete.

The notation we used is inspired by Unified Modeling Language (UML) [12]. However, we use our own meta-model (which is the formal definition of the RM-ODP concepts to which we added few concepts such as organization level, detail level, localized action, joint action…). The relation between our meta-model and the UML meta-model is explained in [13]. The main graphical elements are

- Holon represented either as a UML sub-system, or as a Porter's arrow or as a stickman;
- Information object: rectangle like UML class (without attributes or methods);
- Joint action: ellipse as a UML collaboration
- Localized action: rounded rectangle as a UML action state (in activity diagrams)

Comparable Approaches:

Our method can be compared to other object-oriented methods that address hierarchical modeling, such as: Catalysis [6], Kobra [14], SysEng [15] and OPM [16] [17]. For a comparative analysis, please refer to [18]. Catalysis did inspire SEAM. The main difference lies in the foundations of SEAM (explained above) that do not exist in Catalysis. Thanks to these foundations it was possible to build a CAD tool that deals in a systematic way with a potentially unlimited number of the organizational levels. It was also possible to understand how to represent Catalysis models in UML. Kobra and SysEng are based on UML. As the meta-model of our notation is simpler and more systematic than the original UML meta-model, we can provide a simpler and more systematic way to represent hierarchical systems than Kobra and SysEng. In addition, these methods use traditional UML tools and these tools have problems to deal with the full generality of hierarchical system modeling (and have problems such as contextual naming). Last, OPM is quite close to SEAM. It illustrates well the principle of hierarchical system modeling. Unfortunately, OPM has few shortcomings that SEAM does not have (such as, for example, the difficulty to deal with the modeling of multiple systems in parallel). However, OPM is the only method - other than SEAM - that has a CAD tool that can truly represent hierarchical systems. This CAD tool uses a notation which is quite different from UML.

The main difference between SEAM and the Zachman framework [19], popular in EA, is that SEAM is object-oriented and Zachman is not object-oriented. Our choice of an object-oriented approach is justified by our attempt to have a consistent modeling paradigm between IT and business organization levels. In software engineering, objects are widely used and UML has made a significant impact. All the concepts existing in Zachman can be found in SEAM. Thanks to its foundations, SEAM can make explicit the relations between these concepts. This is a very important advantage as it makes SEAM simpler to use in practice than the Zachman framework. It is conceivable to generate Zachman models from a SEAM model.

2.2 Tool Overview

This section presents our goals for the tool as well as the main elements of the tool user interface.

Our goals:

Our experience in hierarchical modeling of systems shows that existing CAD tools have important shortcomings. The presentation of these shortcomings is out of the scope of this paper. However, we can still mention the main and most frequent one. It is the CAD tool difficulty to manage contextual names (i.e. when a same name can appear in multiple contexts). SeamCAD does address this issue (by keeping trace in which holons the names are defined).

To be able to illustrate, teach, and practically apply hierarchical modeling, we were forced to develop our own CAD tool. This manual describes our first functional version (more on the tool history in the Appendix).

We have three applications for SeamCAD:

- SeamCAD as a research tool: the tool allows our group to test the SEAM foundations and to develop a graphical interface that lets users cope with the complexity of hierarchical models. The tool can also generate XML code that can be imported in other tools such as model checkers or simulators. This is useful to validate how the SEAM models can be related to other modeling techniques (such as formal languages, like AsmL [20], or as system dynamic models [21]).
- SeamCAD as a teaching tool: the tool allows teaching students and professionals about abstractions (e.g. organization level hierarchy or detail level hierarchy). It allows illustrating the foundations underlying any modeling languages (such as UML). Even if UML is used in a project, the knowledge of SEAM is useful to understand the fundamental principles underlying modeling. By its capability to export models to other tools (such as model checkers and simulators), SeamCAD can be used to illustrate how the different modeling techniques can be related to each other.
- SeamCAD as a possible “commercial” enterprise architecture tool: the tool can be used in real enterprise-wide projects. It is used currently for small projects. Its main use is not for modeling the entire project but rather for modeling some key aspects of the projects.

Main user interface elements:

The tool works as a client-server application. The client can be downloaded and execute as a Java application, which has the Java Swing (TM) user-interface. The client communicates with the server via a web protocol. All models are centrally managed by the server.

The modeler should be familiar with the following terminologies before practicing the tool:

- **Modeler**: the user of the tool. She is called the modeler because she uses the tool to model something in reality.

- **Model**: a model (sometimes called a project) created by a modeler. A model consists of model elements. For example, a model about the car may consist of elements such as wheel, engine, color, brand name, start, brake, accelerate… Refer to Subsection 2.1 for the definition of different kinds of model elements.
- **Tool administrator**: person in charge of managing the tool and the models. The administrator creates user accounts, grants user rights, makes backups and can delete/rename models.

The tool has windows:

- **Main window**: this window, which has menu and toolbar, appears after the modeler successfully logged in. It displays the modeler's information as well as the hierarchy of the model being manipulated. This window is unique (only one instance of the window exists in a modeling session). The menu and the toolbar of the main window allow the modeler to open/export/save her models and of course to logout/exit to end the current session. Very important: the modeling windows can be opened from the main window.
- **Modeling window**: a window that display the hierarchy of the model being manipulated on the left and the visual model on the right. This window also has some menu and toolbar to help the modeler manipulate her model and her diagram. Many modeling windows can coexist in one session. This allows showing different views of a same model (and to see how changes percolate from one part of the model to another part of the model).
- **Output window**: a text-based window displaying the messages issued by the tool for typical actions such as opening, saving, creating, deleting… These messages are useful for the modeler especially in case of problem.

The windows have panels:

- **Navigation panel**: a tree view displaying the hierarchy of the model opened. The tree is made of tree nodes that represent holons and joint actions. The root node represents the name of the model. The unique child node of that root node represents the "top" holon of the model. The child nodes of this node represent the component holons of the main holon plus the joint action they participate in. This representation is carried out until the "deepest" holons and joint actions are reached. The navigation panel is painted on the left of the main window and in all modeling windows. All navigation panels represent the same model – the model being opened. In the modeling windows, the modeler can interact with the navigation panel to view the model in the way she wants on the graphical panel.
- **Property panel**: a panel consisting of text fields that allow the modeler to edit the selected model element in the diagram in terms of name, description, stereotype… Every modeling window has a property panel at the bottom-left corner. Note that the main window has also a property panel that enables modification of the model related information.
- **Graphical panel**: a panel visible only in the modeling window and that shows the model in a graphical way.

The windows have menus:

- Menu bar: each window has a menu bar in the upper part of the window. Most commands can be reached by the menu bar and by the contextual pop-up menus.
- **Contextual popup menu**: in the graphical panel and navigation panel, each model elements has a popup menu that allows the modeler to interact with the selected model element.

2.3 Example

This section illustrates how to work with SeamCAD 1.x through an example about a bookstore company whose management decides to sell books via Internet. In this example, an enterprise model is developed. An enterprise model is a hierarchical model that represents a company, its market and its internal organization. The bookstore's enterprise model is made of levels. Figure 1 shows an informal representation of what is in the enterprise model.

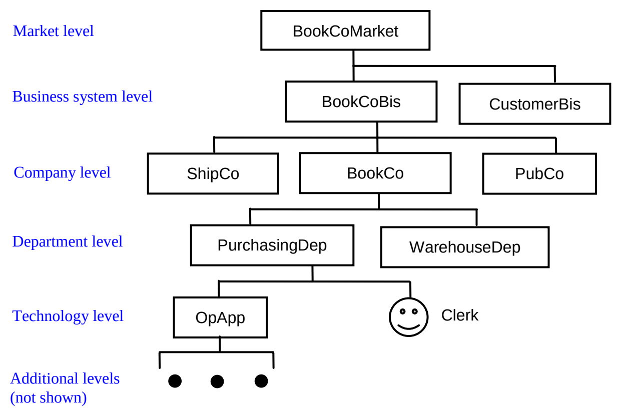
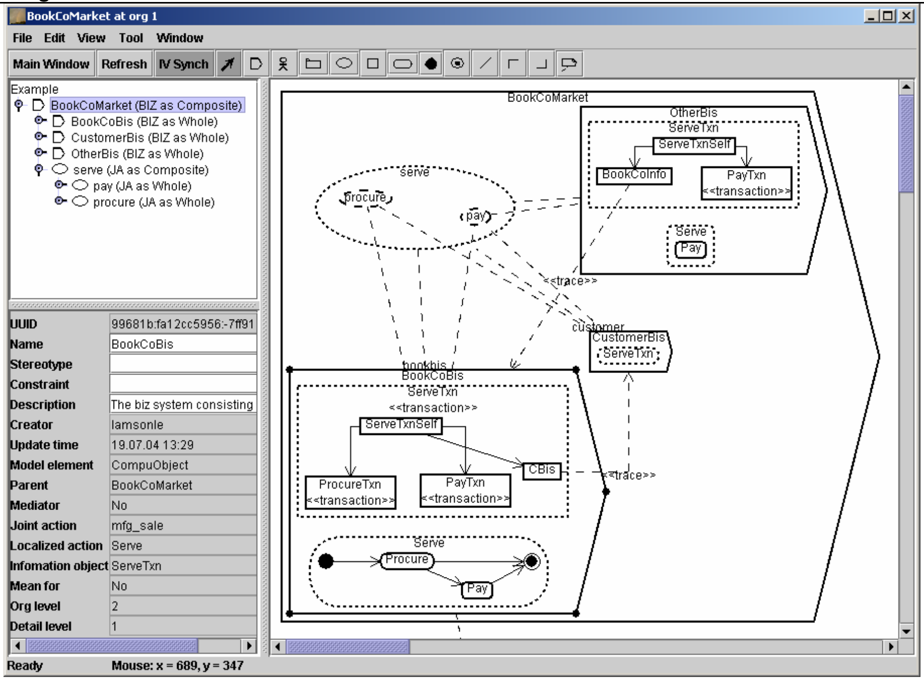
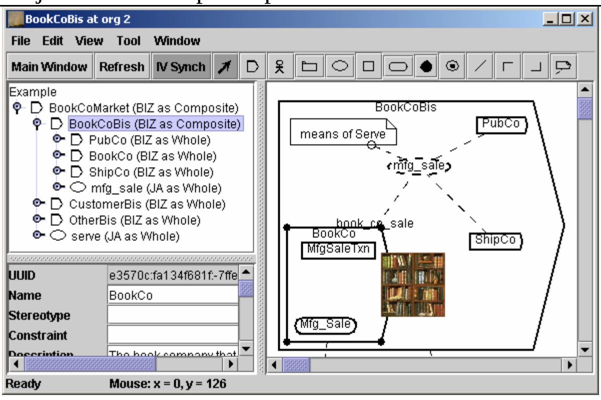


Figure 1. Hierarchical representation of the systems represented in the enterprise model

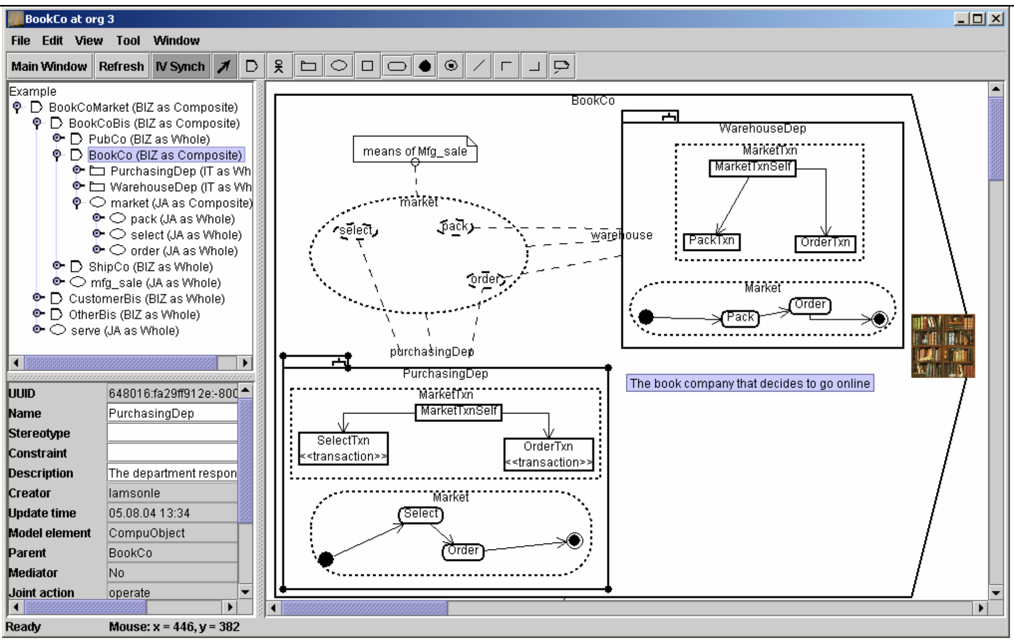
The market level represents `BookCoMarket` composed of the business systems `BookCoBis` and `CustomerBis`. The business system level represents companies or individuals working together to achieve a commercial goal. In our example, the business system of the on-line book company (`BookCoBis`) is composed of the book publisher (`PubCo`), of the company itself (`BookCo`), of the shipping company (`ShipCo`) and of the bank. The business system of the customer is composed of the end customer, the bank and the shipping company that delivers the books (not represented in Figure 1). The company level represents the departments operating inside the companies. More specifically, in this example, `BookCo` has a purchasing department (`PurchasingDep`) that collaborates with the warehouse department (`WarehouseDep`) for processing the customers' orders. The department level represents employees and IT systems. In our example, the purchasing department consists of a clerk and of an order processing application (`OpApp`). One of the main goals of the project is to redesign `OpApp` to add e-commerce capabilities; but the project also needs to redefine the responsibilities of the employees and of the departments. Note that it would be possible to have additional levels for describing the IT system implementation (e.g. server level, component level and programming language class level).

Table 1 lists screenshots of SeamCAD in modeling the online bookstore throughout 5 organizational levels described above. Note that each row in Table 1 has a diagram corresponding to a specific organizational level. In each level, the selected holon (`BookCoBis`, `BookCo`, `PurchasingDep`, `OrderProcessing` and `SearchServlet`) becomes the context holon in the subsequent level. The main joint action in each level (except the market level) is attached a note indicating that it is the implementation of the main localized action of the selected holon in the previous organizational level. The last row shows the main window that manages all 5 modeling windows opened.

Table 1. Modeling windows and the main window in SeamCAD for the model of the online bookstore

Market level	 BookCoMarket at org 1 Example BookCoMarket (BIZ as Composite) BookCoBis (BIZ as Whole) CustomerBis (BIZ as Whole) OtherBis (BIZ as Whole) serve (JA as Composite) pay (JA as Whole) procure (JA as Whole) UUID: 99681b:fa12cc5956:-7ff91 Name: BookCoBis Stereotype: Constraint: Description: The biz system consisting Creator: lamsonle Update time: 19.07.04 13:29 Model element: CompuObject Parent: BookCoMarket Mediator: No Joint action: mfg_sale Localized action: Serve Infomation object: ServeTxn Mean for: No Org level: 2 Detail level: 1 Ready Mouse: x = 689, y = 347 File Edit View Tool Window Main Window Refresh IV Synch BookCoMarket OtherBis ServeTxn ServeTxnSelf BookCoInfo PayTxn <<transaction>> serve procure pay Serve Pay <<trace>> customer CustomerBis ServeTxn bookbis BookCoBis ServeTxn <<transaction>> ServeTxnSelf CBis ProcureTxn <<transaction>> PayTxn <<transaction>> <<trace>> Serve Procure Pay In the market level, `BookCoBis`, `CustomerBis` and some other business systems (`OtherBis`) collaborate through a joint action called `serve`, which is broken into two smaller actions named `procure` and `pay`. Action `procure` represents that fact that `BookCoBis` processes the orders issued by `CustomerBis`. `BookCoBis` collaborates with OtherBis to make payment (action `pay`). `BookCoBis` has two sub-transactions (`ProcureTxn` and `PayTxn`) and two component localized actions (`Procure` and `Pay`) corresponding to the 2 joint actions it participates in.
Business system level	 BookCoBis at org 2 Example BookCoMarket (BIZ as Composite) BookCoBis (BIZ as Composite) PubCo (BIZ as Whole) BookCo (BIZ as Whole) ShipCo (BIZ as Whole) mfg_sale (JA as Whole) CustomerBis (BIZ as Whole) OtherBis (BIZ as Whole) serve (JA as Whole) UUID: e3570c:fa134f681f:-7ffe Name: BookCo Stereotype: Constraint: Description: The book company that Ready Mouse: x = 0, y = 126 File Edit View Tool Window Main Window Refresh IV Synch BookCoBis means of Serve PubCo mfg_sale book_co sale BookCo MfgSaleTxn Mfg_Sale ShipCo In business system level, joint action `mfg_sale` represents the collaboration between `BookCo`, `PubCo` and `ShipCo`.

Company level



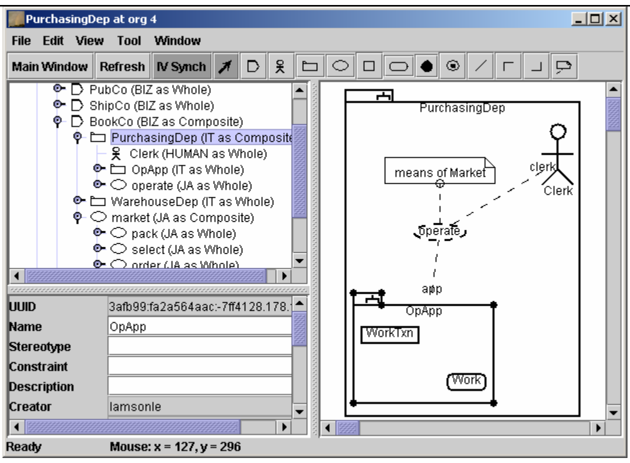
Example
- BookCoMarket (BIZ as Composite)
  - BookCoBis (BIZ as Composite)
    - PubCo (BIZ as Whole)
    - BookCo (BIZ as Composite)
      - PurchasingDep (IT as Wh
      - WarehouseDep (IT as Wh
      - market (JA as Composite)
        - pack (JA as Whole)
        - select (JA as Whole)
        - order (JA as Whole)
    - ShipCo (BIZ as Whole)
    - mfg_sale (JA as Whole)
  - CustomerBis (BIZ as Whole)
  - OtherBis (BIZ as Whole)
  - serve (JA as Whole)

UUID	648016:fa29ff912e:-800
Name	PurchasingDep
Stereotype	
Constraint	
Description	The department respon
Creator	lamsonle
Update time	05.08.04 13:34
Model element	CompuObject
Parent	BookCo
Mediator	No
Joint action	operate

Ready Mouse: x = 446, y = 382

In the company level, the main joint action `market` between the two departments are broken down into `select` (identifying the demanded books), `pack` (preparing the demanded books for shipping) and `order` (doing the paper-work for the orders coming from the customers). In the diagram of the company level, `PurchasingDep` has sub-transactions and component localized actions for joint action `select` and `order`. `WarehouseDep` has sub-transactions and component localized actions for joint action `pack` and `order`.

Department level

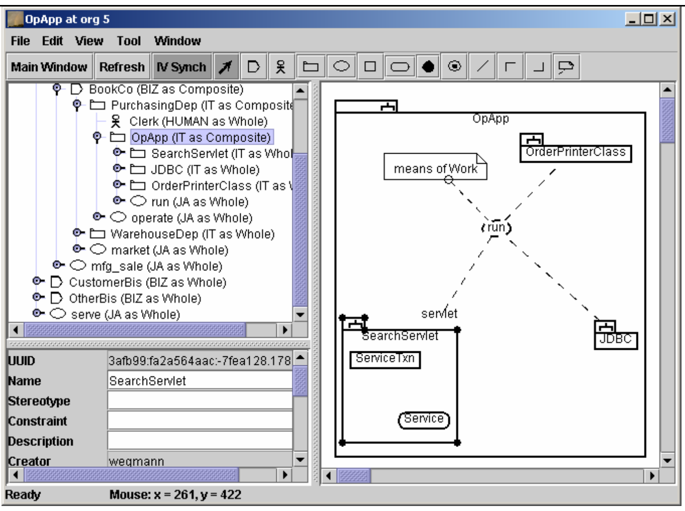
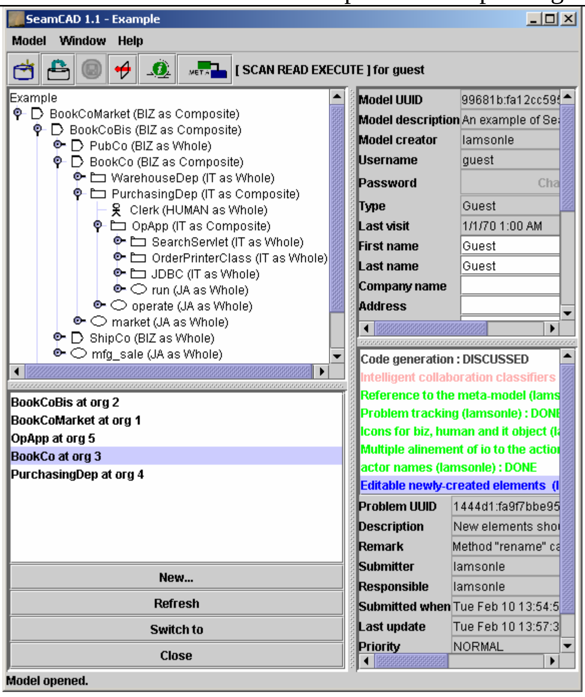


- PubCo (BIZ as Whole)
- ShipCo (BIZ as Whole)
- BookCo (BIZ as Composite)
  - PurchasingDep (IT as Composite
    - Clerk (HUMAN as Whole)
    - OpApp (IT as Whole)
    - operate (JA as Whole)
  - WarehouseDep (IT as Whole)
  - market (JA as Composite)
    - pack (JA as Whole)
    - select (JA as Whole)
    - order (JA as Whole)

UUID	3afb99:fa2a564aac:-7ff4128.178.
Name	OpApp
Stereotype	
Constraint	
Description	
Creator	lamsonle

Ready Mouse: x = 127, y = 296

In the department level, the clerk operates the application `OpApp`, which searches for the demanded books in the inventory and processes the orders coming from the customer.

Technology level	 OpAp at org 5 File Edit View Tool Window Main Window Refresh IV Synch OpApp means of Work OrderPrinterClass run servlet SearchServlet ServiceTxn Service JDBC BookCo (BIZ as Composite) PurchasingDep (IT as Composite Clerk (HUMAN as Whole) OpApp (IT as Composite) SearchServlet (IT as Whol JDBC (IT as Whole) OrderPrinterClass (IT as \\ run (JA as Whole) operate (JA as Whole) WarehouseDep (IT as Whole) market (JA as Whole) mfg_sale (JA as Whole) CustomerBis (BIZ as Whole) OtherBis (BIZ as Whole) serve (JA as Whole) UUID 3afb99:fa2a564aac:-7fea128.178 Name SearchServlet Stereotype Constraint Description Creator wegmann Ready Mouse: x = 261, y = 422 In the technology level, `OpApp` consists of the servlet `SearchServlet` responsible for searching books in the database and the Java Bean `OrderPrinterClass` responsible for printing the orders.
Main window	 SeamCAD 1.1 - Example Model Window Help New... Refresh Switch to Close [SCAN READ EXECUTE] for guest Example BookCoMarket (BIZ as Composite) BookCoBis (BIZ as Composite) PubCo (BIZ as Whole) BookCo (BIZ as Composite) WarehouseDep (IT as Whole) PurchasingDep (IT as Composite) Clerk (HUMAN as Whole) OpApp (IT as Composite) SearchServlet (IT as Whole) OrderPrinterClass (IT as Whole) JDBC (IT as Whole) run (JA as Whole) operate (JA as Whole) market (JA as Whole) ShipCo (BIZ as Whole) mfg_sale (JA as Whole) BookCoBis at org 2 BookCoMarket at org 1 OpApp at org 5 BookCo at org 3 PurchasingDep at org 4 Model UUID 99681b:fa12cc59 Model description An example of Se Model creator lamsonle Username guest Password Cha Type Guest Last visit 1/1/70 1:00 AM First name Guest Last name Guest Company name Address Code generation : DISCUSSED Intelligent collaboration classifiers Reference to the meta-model (lams Problem tracking (lamsonle) : DONE Icons for biz, human and it object (l Multiple alinement of io to the actio actor names (lamsonle) : DONE Editable newly-created elements (I Problem UUID 1444d1:fa9f7bbe95 Description New elements sho Remark Method "rename" c Submitter lamsonle Responsible lamsonle Submitted when Tue Feb 10 13:54:5 Last update Tue Feb 10 13:57:3 Priority NORMAL Model opened. In the main window, the modeler can open a new modeling window and switch to or close existing modeling windows. The main window also reminds the modeler of the hierarchy of the model being opened.

2.4 Legal Considerations

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3 Installing and starting SeamCAD

SeamCAD is packaged as a JAR file. The modeler just downloads it and then starts… It is recommended to use the tool on a large display screen with a resolution of at least 1280 x 1024. It would be great if the computer on which SeamCAD is executed has two displays (for instance, an external monitor can be connected to a laptop and recognized as an extended display in Windows 2000/XP).

3.1 *Downloading the Client*

The client of is a Java application which can be downloaded and executed at any Java2 (TM)–enabled platform.

If you are not sure about which Java Virtual Machine (JVM) is in your machine, you should:

- Open the command line (in MS Windows (TM), use the “Start” menu, select “Run…” and then type “cmd” as the program to run, press “OK” to open the command line window).
- Type “`java –version`” to check its version.

Note: running “`java –version`” should yield “Java (TM) 2 Runtime Environment”. Otherwise you need to install the new JVM (http://www.java.com)

To run the application, you should:

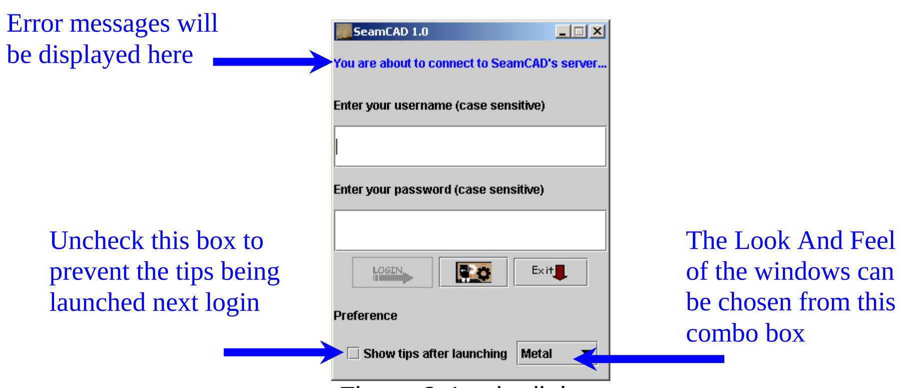
- Download your favorite version (probably the newest one) of the client into one of your local directory from SeamCAD’s homepage http://seamcad.epfl.ch.
- Open the command line (in MS Windows (TM), use the “Start” menu, select “Run…” and then type “cmd” as the program to run, press “OK” to open the command line window).
- Change to the directory where you have downloaded the client (using the command “`cd`” with that directory as the parameter).
- Type “`java –jar SeamCAD.jar`” to start the client

Note: under MS Windows (TM), if JVM is correctly installed, it is enough to download the client and to double click on the jar file.

3.2 *Login*

Figure 2 shows the login dialog that you get when starting SeamCAD. If you are registered user, type your username and password and then press “Login”. If you are not a registered user, you can log with the “guest” username and the “guest” password. As guest, you are only allowed to view the model “Example”. Instead of typing “guest”, you can also press the button having a human icon. If you wish to become a registered user, you can send an email to the administrator of SeamCAD (listed in SeamCAD’s homepage, see Subsection 3.1) to get the username and password.

Note: it is possible to choose the favorite Look and Feel before logging in.


Error messages will be displayed here
Uncheck this box to prevent the tips being launched next login
The Look And Feel of the windows can be chosen from this combo box
SeamCAD 1.0
LOGIN
Exit

You are about to connect to SeamCAD's server...

Enter your username (case sensitive)

Enter your password (case sensitive)

Preference

☐ Show tips after launching — Metal

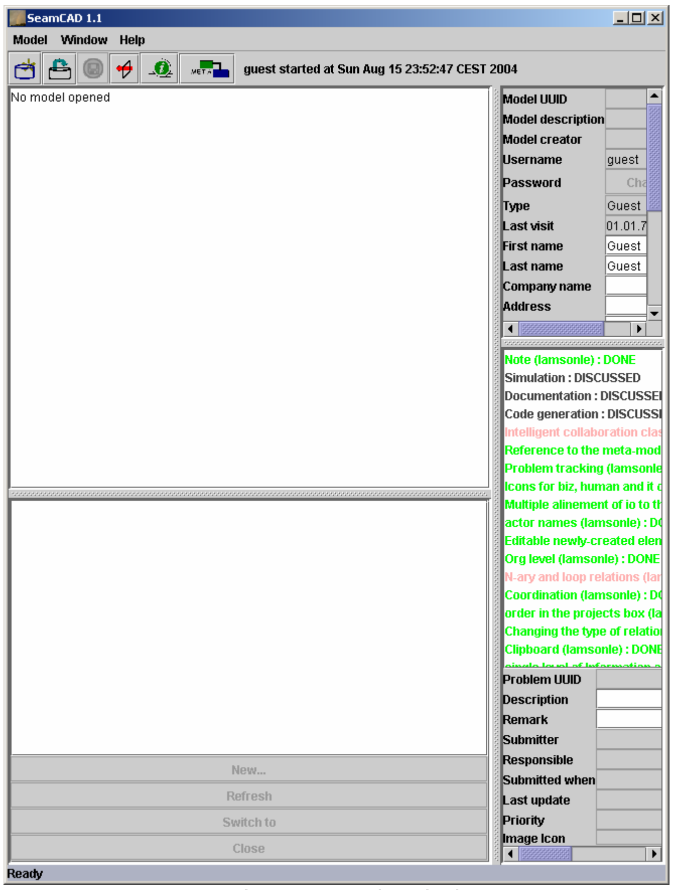
Figure 2. Login dialog

An error message is issued in the following cases

- There is no account with the specified username
- The password is wrongly typed
- Somebody has logged in with the username you typed
- Your machine is not connected
- The server of SeamCAD is down

3.3 Using the Main Window

After having successfully logged in, the modeler gets the main window as shown in Figure 3 (In fact, tips of the day may be launched for the first login, see Subsection 3.8 for more details). The main window has 4 panes that are divided by one vertical splitter and two horizontal splitters. The splitters can be moved to resize the panes. The upper-left pane is used for displaying the hierarchy of the model opened (see Subsection 4.1). The lower-left pane help the modeler manage modeling windows (see Subsection 4.2). The upper-right pane shows the information of the modeler and the model opened (see Subsection 3.4). The lower-right pane presents the status of the submitted problems (see Subsection 3.5).



guest started at Sun Aug 15 23:52:47 CEST 2004

No model opened

Model UUID	
Model description	
Model creator	
Username	guest
Password	Cha
Type	Guest
Last visit	01.01.7
First name	Guest
Last name	Guest
Company name	
Address	

Note (lamsonle) : DONE
Simulation : DISCUSSED
Documentation : DISCUSSE
Code generation : DISCUSS
Intelligent collaboration clas
Reference to the meta-mod
Problem tracking (lamsonle
Icons for biz, human and it c
Multiple alinement of io to th
actor names (lamsonle) : D
Editable newly-created elen
Org level (lamsonle) : DONE
N-ary and loop relations (la
Coordination (lamsonle) : D
order in the projects box (la
Changing the type of relatio
Clipboard (lamsonle) : DONE

Problem UUID	
Description	
Remark	
Submitter	
Responsible	
Submitted when	
Last update	
Priority	
Image Icon	

Ready

Figure 3. Main window

For normal use, we recommend reducing the width of the right panels to save screen space. The right part of the main window is only rarely used.

3.4 Filling User Information

Information about SeamCAD's users is stored on the server. This information helps the administrator contact the users in case of problems. The user (only when logged in a non anonymous way) should fill in the text fields in the upper-right pane of the main window and then press button "Save user info" to store their contact information.

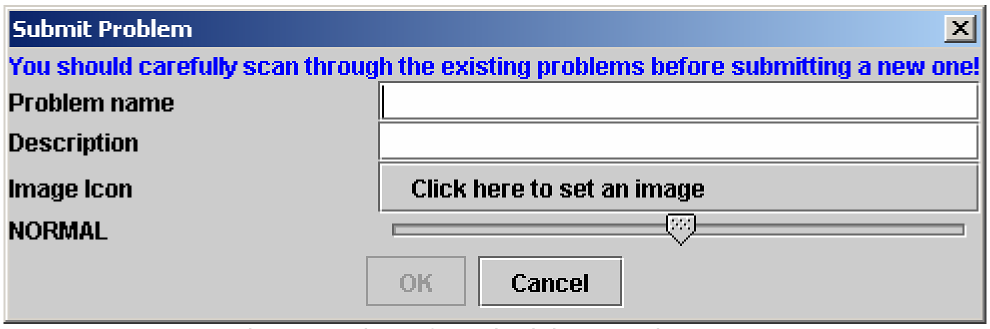
3.5 Submitting a Problem

The registered users are encouraged to submit problems they found. SeamCAD has a function to keep track of all problems submitted as a means for the interaction between the user and the developer. Each problem has 4 possible statuses: DISCUSSED, IN-PROGRESS, DEBUGGING and DONE. A problem initially has status DISCUSSED when it is submitted. It is then discussed by the developers of SeamCAD on whether to be solved or not. It is changed to IN-PROGRESS if the developers decide to solve it. When it is completely finished, it is marked as DONE. Sometimes it is marked as DEBUGGING if the developers are debugging it. Only the administrator can update the problem status. All problems are presented in the lower-right pane of the main window so that the modelers can learn about the development of the tool.

The users should notice that it is important to carefully scan through the existing problems in the lower-right pane of the main window to avoid submitting a new problem that is the same as or similar to an existing one. A problem is either a bug or an essential functionality that is missing in the current version of the tool.

The following steps should be taken in order to submit a problem

- Identify a bug or an essential functionality that is missing in the current version
- Read through the existing problems in the lower-right pane of the main window to see if there has already been a problem with similar or the same description.
- In the main window, follow menu “Help | Submit” a problem to open a dialog
- Enter the name of the problem, the description (as much precise as possible) and adjust the priority of the problem (see Figure 4).
- If necessary, attach an image (like a screenshot made by pressing “PrtSrc” under MS Windows (TM) and copied into an image processing application. To upload the image, press the button “Click here to set an image” in the dialog (see Figure 4).
- Press “OK”


Submit Problem

You should carefully scan through the existing problems before submitting a new one!

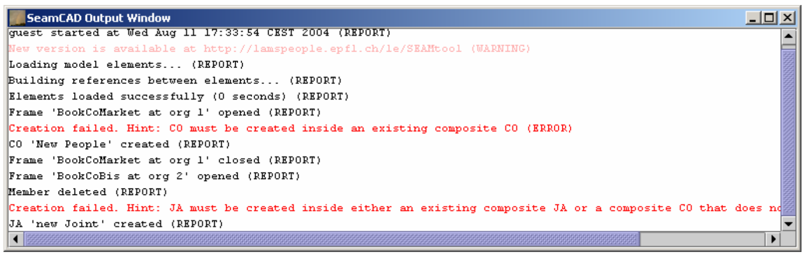
Problem name	
Description	
Image Icon	Click here to set an image
NORMAL	

Figure 4. Dialog for submitting a problem

At the beginning of each modeling session (see Subsection 3.2), SeamCAD counts the problems that have been completely solved to be able to inform the modeler if the newer version is available for downloading.

3.6 Getting Info with the Output Window

If the modeler does not fully understand the SEAM modeling language, she sometimes finds that the tool behaves in a strange manner. It is essential to look at the Output Window to see what happen (see Figure 5). The Output Window is shown immediately after her login. It reports activities such as creating, deleting model elements. The modeler can hide it either by manually closing it or by unchecking menu item “Window | Output window” of the main window. Once hidden, it can be shown by checking that menu item again.


SeamCAD Output Window

```
guest started at Wed Aug 11 17:33:54 CEST 2004 (REPORT)
New version is available at http://lamspeople.epfl.ch/le/SEAMtool (WARNING)
Loading model elements... (REPORT)
Building references between elements... (REPORT)
Elements loaded successfully (0 seconds) (REPORT)
Frame 'BookCoMarket at org 1' opened (REPORT)
Creation failed. Hint: CO must be created inside an existing composite CO (ERROR)
CO 'New People' created (REPORT)
Frame 'BookCoMarket at org 1' closed (REPORT)
Frame 'BookCoBis at org 2' opened (REPORT)
Member deleted (REPORT)
Creation failed. Hint: JA must be created inside either an existing composite JA or a composite CO that does n
JA 'new Joint' created (REPORT)
```

Figure 5. Output Window typically reports logging in, creating and deleting

Messages are classified into 3 categories: report (black), warning (pink) and error (red). Note that error messages always come out with a beep sound!

3.7 Quick Meta-model

The modeler can have a quick look at the meta-model of SEAM's modeling language displayed in a modal dialog (see Figure 6) by following menu item "Help | Meta-model" of the main window. The terms used in the meta-model are given in Subsection 2.1.

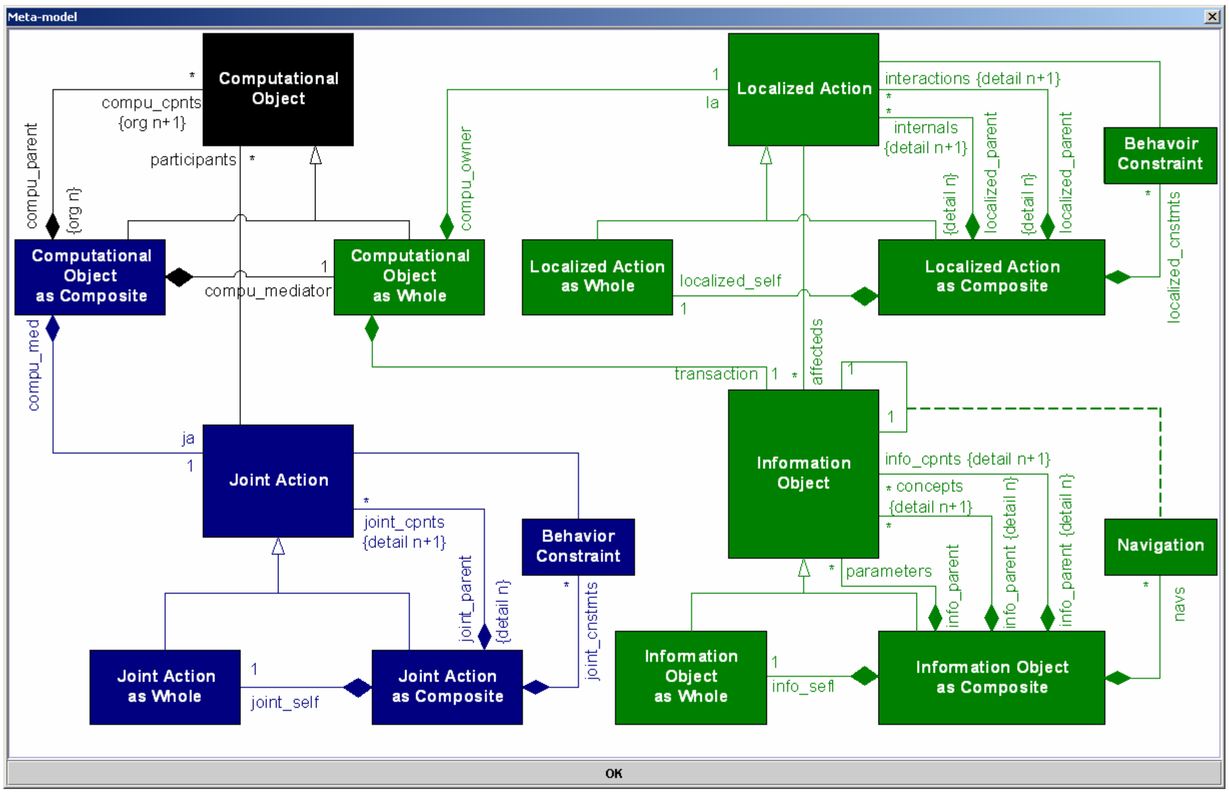
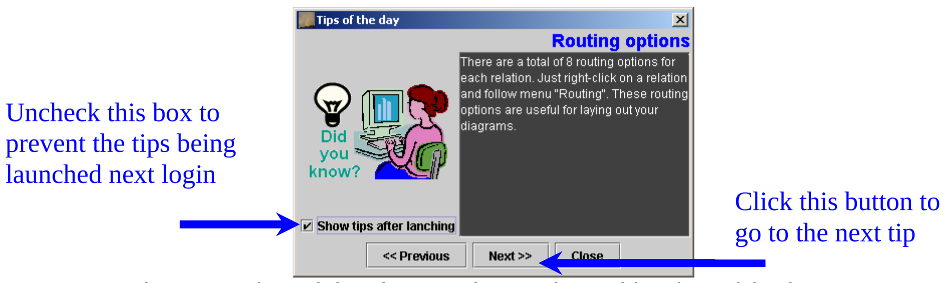


Figure 6. Dialog displaying the Meta-model

3.8 User's Guide and Tips of the Day

The modeler can open the electronic copy of this user's guide in the default browser during her modeling section by following menu item "Help | User's Guide" of the main window.

In addition to this user's guide, "Tips of the day" may give useful answers to most frequently asked questions about the tool. They may initially be shown when the modeler successfully logs in (see Subsection 3.2). The modeler can launch them anytime again during her modeling session by taking menu item "Help | Tips of the days" of the main window.



Tips of the day
Routing options
Did you know?
Show tips after lanching
<< Previous
Next >>
Close
Uncheck this box to prevent the tips being launched next login
Click this button to go to the next tip

There are a total of 8 routing options for each relation. Just right-click on a relation and follow menu "Routing". These routing options are useful for laying out your diagrams.

Figure 7. Tips of the day can be navigated back and forth

4 Navigating an Existing Model

To effectively work with SeamCAD, the modeler should get used to navigating her models with modeling windows. This section presents how to open and navigate an existing model.

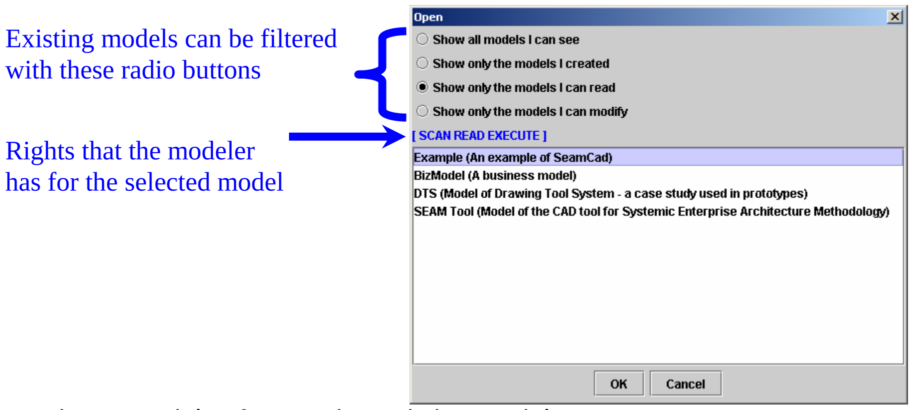
4.1 *Opening an Existing Model*

To open an existing model, you should use menu “Model | Open Model” or the equivalent button in the toolbar of the main window. Then a dialog listing existing models (see Figure 8) will appear and allow you to select the model to be opened.

Note that for each model, a modeler has certain right that is actually a combination of the following basic rights

- SCAN (the model is listed in the list box but may not be opened)
- READ (the model can be opened)
- READ & WRITE (the model can be modified and saved afterwards)
- EXECUTE (reserved for the future)

The right that the modeler has for selected model is display in blue just above the list of models. The modeler is prompted if she does not have READ right for the model she wants to open.


Existing models can be filtered with these radio buttons
Rights that the modeler has for the selected model
Open
OK
Cancel

Show all models I can see
Show only the models I created
[✓ Show only the models I can read]
Show only the models I can modify

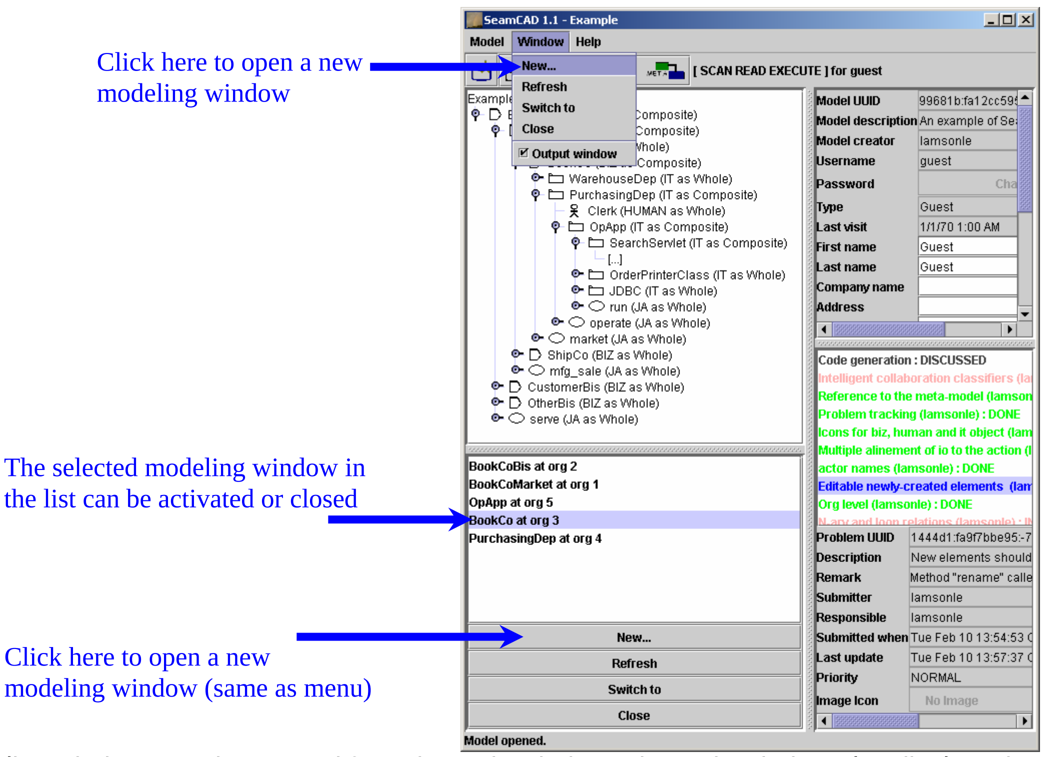
[SCAN READ EXECUTE]

Example (An example of SeamCad)
BizModel (A business model)
DTS (Model of Drawing Tool System - a case study used in prototypes)
SEAM Tool (Model of the CAD tool for Systemic Enterprise Architecture Methodology)

Figure 8. Dialog for opening existing models

4.2 *Working with Modeling Windows*

SeamCAD allows the modeler to have multiple modeling windows showing different parts of one model. After having opened an existing model or created a new one, the modeler can open a new modeling window by pressing button “New…” or menu “Window | New…” (see Figure 9). All modeling windows are listed in the middle of the left pane of the main window. From this list, the selected window can be activated or closed.


Click here to open a new modeling window
The selected modeling window in the list can be activated or closed
Click here to open a new modeling window (same as menu)
SeamCAD 1.1 - Example
Model
Window
Help
New...
Refresh
Switch to
Close
Output window
[SCAN READ EXECUTE] for guest
New...
Refresh
Switch to
Close
Model opened.

Example
- WarehouseDep (IT as Whole)
- PurchasingDep (IT as Composite)
  - Clerk (HUMAN as Whole)
  - OpApp (IT as Composite)
    - SearchServlet (IT as Composite)
      - [...]
    - OrderPrinterClass (IT as Whole)
    - JDBC (IT as Whole)
    - run (JA as Whole)
  - operate (JA as Whole)
- market (JA as Whole)
- ShipCo (BIZ as Whole)
- mfg_sale (JA as Whole)
- CustomerBis (BIZ as Whole)
- OtherBis (BIZ as Whole)
- serve (JA as Whole)

BookCoBis at org 2
BookCoMarket at org 1
OpApp at org 5
BookCo at org 3
PurchasingDep at org 4

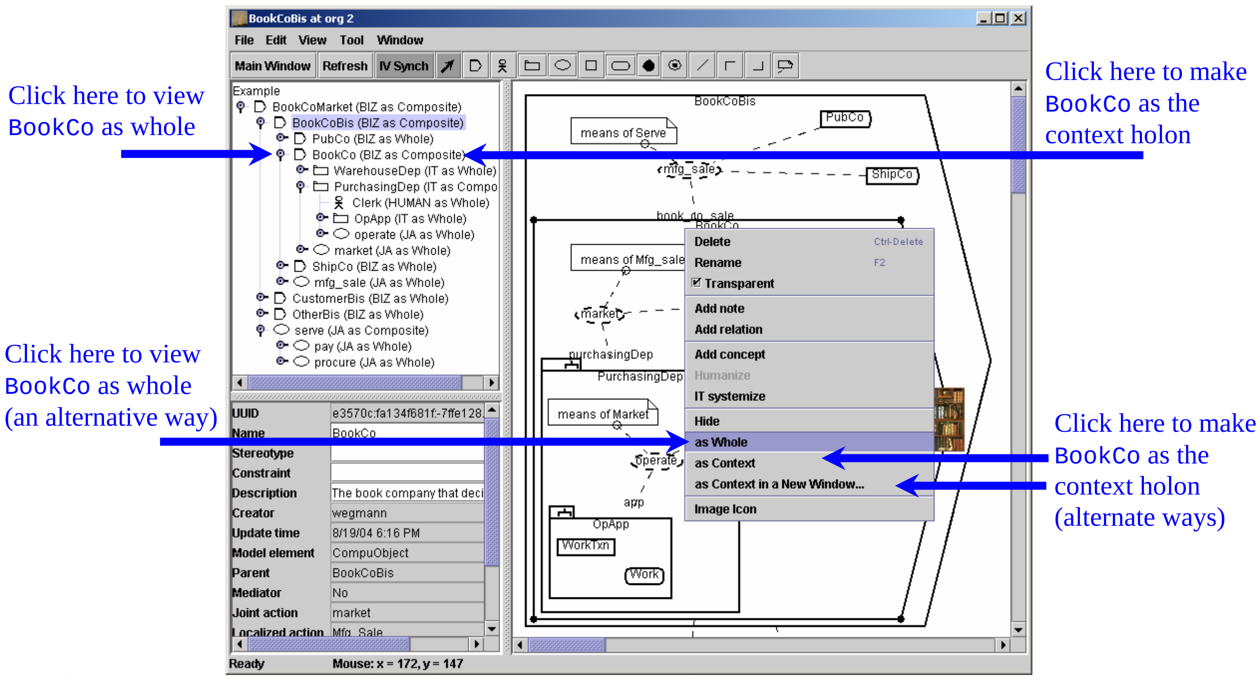
Model UUID	99681b:fa12cc59
Model description	An example of Se
Model creator	lamsonle
Username	guest
Password	
Type	Guest
Last visit	1/1/70 1:00 AM
First name	Guest
Last name	Guest
Company name	
Address	

Code generation : DISCUSSED
Intelligent collaboration classifiers (la
Reference to the meta-model (lamson
Problem tracking (lamsonle) : DONE
Icons for biz, human and it object (lam
Multiple alinement of io to the action (l
actor names (lamsonle) : DONE
Editable newly-created elements (lan
Org level (lamsonle) : DONE

Problem UUID	1444d1:fa9f7bbe95:-7
Description	New elements should
Remark	Method "rename" calle
Submitter	lamsonle
Responsible	lamsonle
Submitted when	Tue Feb 10 13:54:53
Last update	Tue Feb 10 13:57:37
Priority	NORMAL
Image Icon	No Image

Figure 9.Modeling windows can be opened from the main window. The main window also displays the hierarchy of the model being opened.

The hierarchy of the opened model is displayed on top-left of the main window (as well as on the modeling windows). In the modeling window, selecting a node that corresponds to a holon will make it the context holon in the diagram on the right. This can also be done by right-clicking on the graphical element in the diagram and then using popup menu “as Context”. For example, selecting tree node `BookCo (BIZ as Composite)` makes `BookCo` as context object consisting of `WarehouseDep` and `PurchasingDep` and action `market` in the diagram. Right-clicking inside `BookCo` (but outside `WarehouseDep` and `PurchasingDep`) will show a popup menu. Using popup menu “as Context in New Window…” will open a new modeling window where `BookCo` is represented as the context object (see Figure 10).



Example
- BookCoMarket (BIZ as Composite)
  - BookCoBis (BIZ as Composite)
    - PubCo (BIZ as Whole)
    - BookCo (BIZ as Composite)
      - WarehouseDep (IT as Whole)
      - PurchasingDep (IT as Compo
        - Clerk (HUMAN as Whole)
        - OpApp (IT as Whole)
        - operate (JA as Whole)
      - market (JA as Whole)
    - ShipCo (BIZ as Whole)
    - mfg_sale (JA as Whole)
  - CustomerBis (BIZ as Whole)
  - OtherBis (BIZ as Whole)
  - serve (JA as Composite)
    - pay (JA as Whole)
    - procure (JA as Whole)

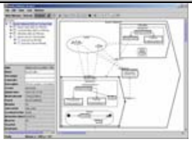
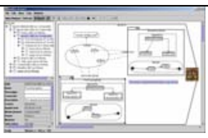
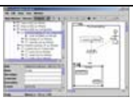
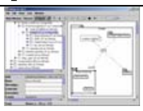
UUID	e3570c:fa134f681f:-7ffe128
Name	BookCo
Stereotype	
Constraint	
Description	The book company that deci
Creator	wegmann
Update time	8/19/04 6:16 PM
Model element	CompuObject
Parent	BookCoBis
Mediator	No
Joint action	market
Localized action	Mfg_Sale

Figure 10. Holons can be viewed as context object in the current modeling window or in a new window. They can also be toggled between the whole and the composite.

Collapsing or expanding a tree node will make the corresponding holon or joint action as whole or as composite, respectively. For example, collapsing tree node `BookCo (BIZ as Composite)` will view `BookCo` as whole (containing information object `MfgSaleTxn` and localized action `MfgSale`) in the diagram. This can also be done by using popup menu "as Whole" of `BookCo`. Once `BookCo` is viewed as whole, menu item "as Composite" is available in its popup menu. The corresponding tree node is synchronously renamed to `BookCo (BIZ as Whole)` too. Following "as Composite" will view `BookCo` as composite again. This is actually equivalent to expanding tree node `BookCo (BIZ as Whole)` in the hierarchy view (see Figure 10).

The modeler can open as many modeling widows as she wants. For the model of the online bookstore, from the main window she can open the 5 modeling windows as demonstrated in Table 2. The modeler can interact with any of those 5 modeling diagrams. The tool assures the consistency among them.

Table 2. Opening modeling windows in SeamCAD for the model of the online bookstore

Screenshot	Instruction
 Market level	- From the main window, choose menu item "Window | New…" or press button "New…" at the bottom-left corner - Select `BookCoMarket (BIZ as Composite)` in the navigation panel and make sure that `serve (JA as Composite)` is expanded
Business system level	- From the main window, choose menu item "Window | New…" or press button "New…" at the bottom-left corner - Select `BookCoBis (BIZ as Composite)` in the navigation panel
 Company level	- From the main window, choose menu item "Window | New…" or press button "New…" at the bottom-left corner - Select `BookCo (BIZ as Composite)` in the navigation panel and make sure that `market (JA as Composite)` is expanded
 Department level	- From the main window, choose menu item "Window | New…" or press button "New…" at the bottom-left corner - Select `PurchasingDep (IT as Composite)` in the navigation panel
 Technology level	- From the main window, choose menu item "Window | New…" or press button "New…" at the bottom-left corner - Select `OpApp (IT as Composite)` in the navigation panel

4.3 Simplifying Model Representation

Holons and joint actions can be hidden (and then shown again) to simplify the diagrams. Use popup menu "Hide" to hide them! The corresponding tree nodes are then grayed. To show them again, right-click on their tree node and take menu item Show.

The modeler can also hide the main information object and/or localized action of a holon seen as whole. Just take menu item "Hide info" and/or "Hide action" from it popup menu. To show the main information object and/or localized action again, take menu item "Show info" and/or "Show action" from the popup menu.

5 Building a New Model

A model can be built up incrementally after it has been opened (see Subsection 4.1) or created (see Subsection 5.1). The modeler incrementally inserts new model elements into the model she is working on. She can also modify them. This section presents how to create a new model, how to interactively insert new model elements into the model and how to modify existing elements.

Note that the toolbar of the modeling window has buttons for creating different kinds of model elements. Each button has an equivalent menu item in menu "Tool | Insert" of the modeling window. Success or failure in creating a model element is always reported in the Output Window.

5.1 Creating a New Model

The following steps should be taken in order to create a new model

- Menu "Model | New…" or the equivalent button in the toolbar of the main window
- In the popup dialog (see Figure 11), type the name and description of the model to be created as well as the name of the root holon.
- Press "OK"

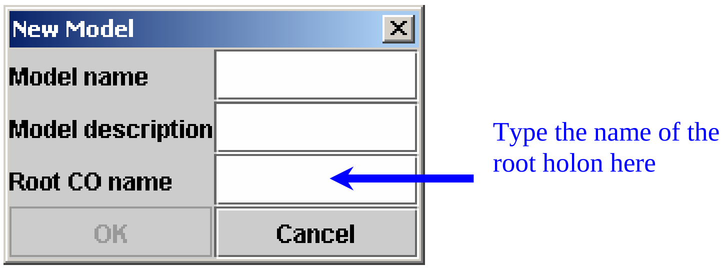


Figure 11.Dialog for creating a new model

Note that the newly created model is not stored in the server database until it is explicitly saved (menu "Model | Save <model name>" or the equivalent button of the toolbar).

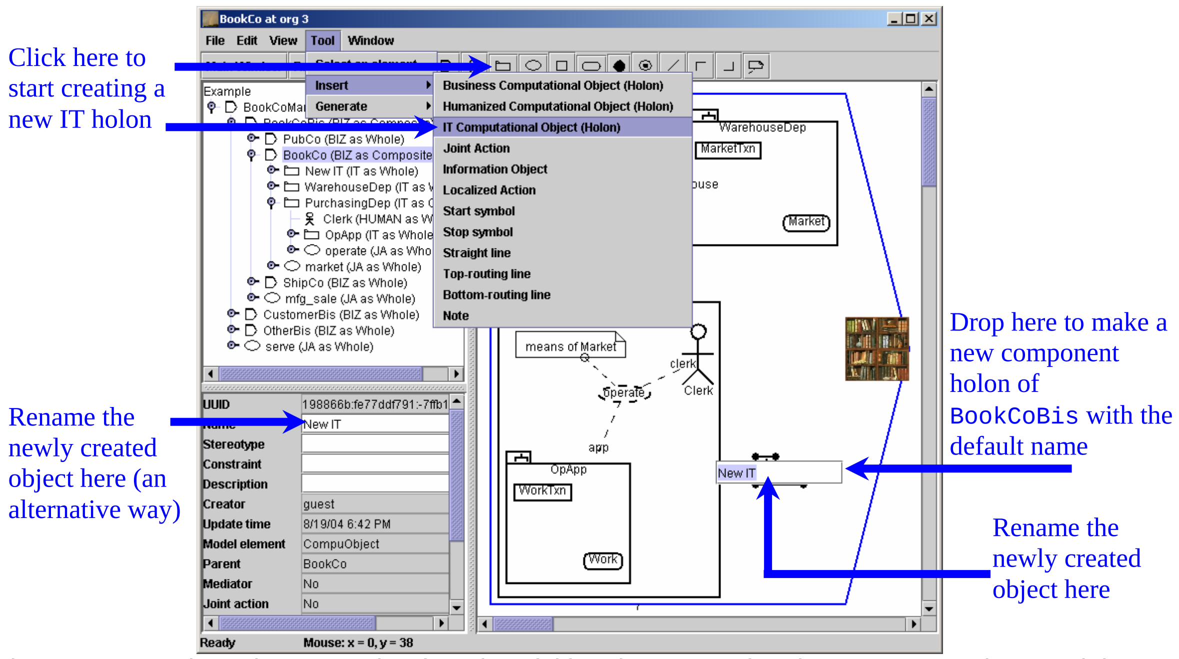
5.2 Inserting a Holon

There are 3 kinds of holon: business (Porter arrow), IT (sub-system) and human (stickman). They differ only in the notation. The following steps should be taken in order to insert a holon:

- First, click on the button or menu item that corresponds to the object to be created.
- Then drop into a holon seen as composite in the diagram. Note that the potential container object is highlighted in blue color.
- The newly created holon is given a default name and is ready for being renamed.

For example, to create a new IT department of `BookCo`, click on the button having a sub-system icon or menu item "Tool | Insert | IT Computational Object (Holon)" and then drop into `BookCo` as composite (see Figure 12).

Note that it is possible to change the type of an existing holon (see Subsection 5.8).



UUID	198866b:fe77ddf791:-7ffb1
Name	New IT
Stereotype	
Constraint	
Description	
Creator	guest
Update time	8/19/04 6:42 PM
Model element	CompuObject
Parent	BookCo
Mediator	No
Joint action	No

Figure 12. Inserting a holon can be done by clicking the appropriate button or menu item and then dropping into an existing holon as composite.

5.3 Inserting a Joint Action

The following steps should be taken in order to insert a joint action:

- First, click on the button having an eclipse icon or menu item “Tool | Insert | Joint Action”.
- Then drop into a joint action seen as composite in the diagram. Note that the potential container action is highlighted in blue color.
- The newly created joint action is given a default name and is ready for being renamed.
- Probably relate the newly created joint action to the appropriate holons (see Subsection 5.6)

5.4 Inserting an Information Object

The following steps should be taken in order to insert an information object:

- First, click on the button having a rectangle icon or menu item “Tool | Insert | Information Object”.
- Then drop into an information object seen as composite in the diagram. Note that the potential container object is highlighted in blue color.
- The newly created information object is given a default name and is ready for being renamed.
- Probably relate the newly created information object to the localized actions that affect it (see Subsection 5.6)

5.5 Inserting a Localized Action

Localized actions and start/stop symbols can be created in the same way. The following steps should be taken in order to insert a localized action:

- First, click on the button having a rounded rectangle icon or menu item “Tool | Insert | Localized Action”.
- Then drop into a localized action seen as composite in the diagram. Note that the potential container action is highlighted in blue color.
- The newly created localized action is given a default name and is ready for being renamed.

The following steps should be taken in order to insert a start/stop symbol:

- First, click on the button having a filled circle or menu item “Tool | Insert | Start symbol”.
- Then drop into a localized action seen as composite in the diagram. Note that the potential container action is highlighted in blue color.
- The newly created symbol has no name.
- Probably relate the newly created localized action to other localized actions (to make up the activity) and some information objects that it affects (see Subsection 5.6)

5.6 Relating Model Elements

Existing model elements can typically be put in relation to define the semantics of the model. A relation connecting two model elements can be an association, a generalization, a dependency, an activity transition or a collaboration link depending on the source and destination element. They look different in terms of the line pattern. The modeler just visually connects two model elements by a line. The tool then determines the kind of relation based on the source and destination element. (For example, when the modeler connects a holon to a joint action, the resulting relation becomes a collaboration link.) The modeler can create a new relation with one of 3 most frequently used routing options (straight line, top-routing line and bottom-routing line).

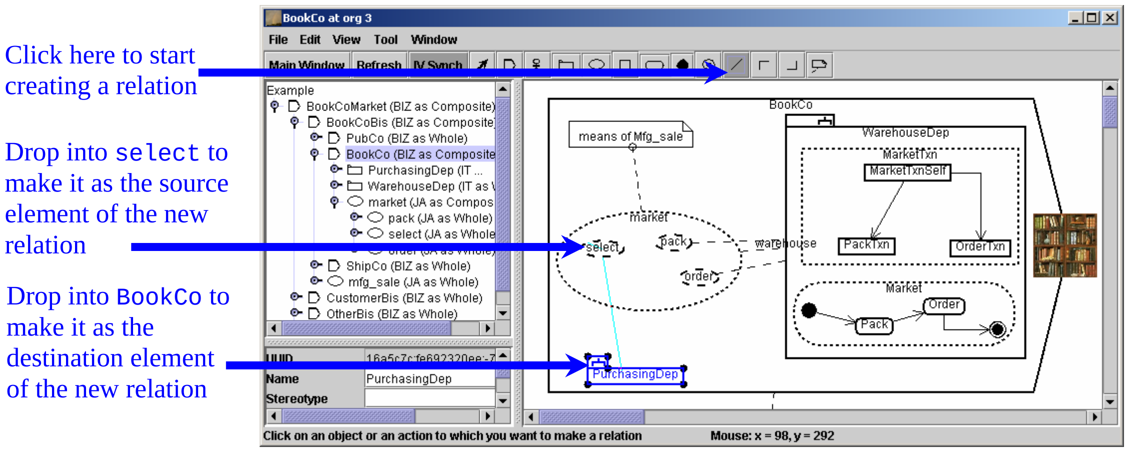
IV Synchronization:

According to the SEAM modeling language (see Subsection 2.1), the information objects and localized actions of a holon characterize its information viewpoint. Since there could be several holons being viewed as whole, the diagram would be complicated if their information viewpoints are fully displayed. It is thus essentially to display only information objects and localized actions that are relevant to the joint actions. This kind of relevancy is determined by aligning information objects and localized actions to some joint action. We call this functionality the synchronization between the joint actions and the information viewpoints. The alignment is mainly applied to transactions and interaction localized actions. In fact, the modeler may find it tedious to manually align them. For this reason, the tool can create one transaction and one localized action for a computational object when the modeler drops a link between it and some joint action. This transaction and localized action is then automatically aligned to the proper joint action. Once this alignment is maintained, the localized actions are always named by capitalizing the first letter of the joint action they are aligned to. The corresponding transactions are named by appending the postfix “Txn” to the name of that localized action. The modeler is therefore recommended to name the joint actions using verbs in lower case (e.g. move, select, add…). If the modeler renames the joint action, all aligned transactions and localized actions are correctly updated.

The following steps should be taken in order to relate 2 model elements:

- First, click on the button having a line icon or menu item “Tool | Insert | Straight Line” (or “Tool | Insert | Top-routing Line” or “Tool | Insert | Bottom-routing Line”)
- Then drop into the source model element. Note that the potential source element is highlighted in blue color.
- Next, drop into the destination element. Note that the potential destination element is highlighted in blue color.
- The newly created relation has no name.
- The tool determines the relation based on the source and destination element. If it is a collaboration link and the IV Automation is turned on, a transaction and a localized action are created with appropriate names for the participating object. IV Automation is turned on by default and can be turned off by pressing button “IV Auto” in the toolbar of the modeling window.

For example, to make `PurchasingDep` participate in joint action `select` (and so joint action `market`), first the modeler click on the button having a line icon (see Figure 13 a). Next, she drops into `select` and then `PurchasingDep`. In effect, the information viewpoint of `PurchasingDep` is created (see Figure 13 b) up the detail level where joint action `select` is (detail level 2). In this case, dropping into `select` first or `PurchasingDep` first does not matter. Note that the modeler has to arrange the created information objects and localized actions at her convenience because they are partially overlapped when created by the tool.

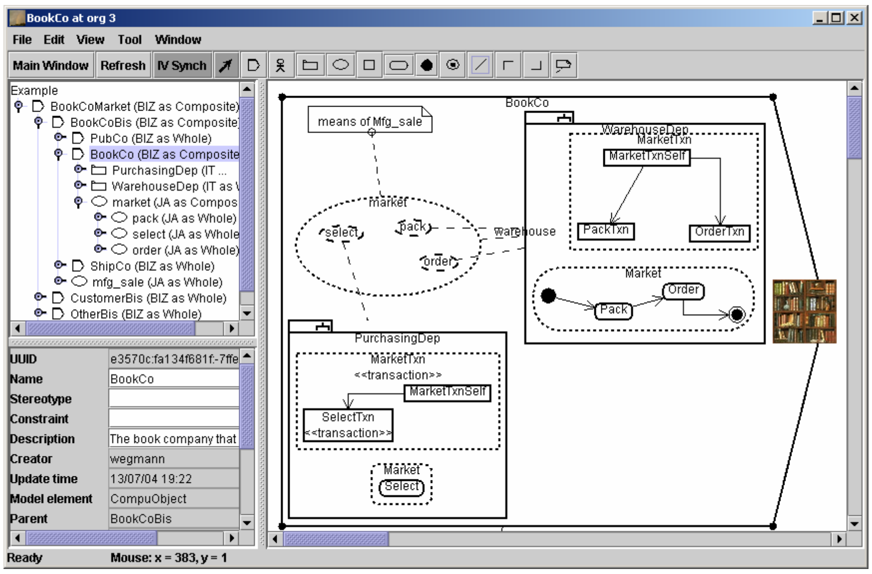

Click here to start creating a relation
Drop into select to make it as the source element of the new relation
Drop into BookCo to make it as the destination element of the new relation
BookCo at org 3
File Edit View Tool Window
Main Window Refresh IV Synch
means of Mfg_sale
BookCo
WarehouseDep
MarketTxn
MarketTxnSelf
market
select
pack
order
warehouse
PackTxn
OrderTxn
Market
Pack
Order
PurchasingDep

Example
BookCoMarket (BIZ as Composite)
BookCoBis (BIZ as Composite)
PubCo (BIZ as Whole)
BookCo (BIZ as Composite
PurchasingDep (IT ...
WarehouseDep (IT as \
market (JA as Compos
pack (JA as Whole)
select (JA as Whole
order (JA as Whole)
ShipCo (BIZ as Whole)
mfg_sale (JA as Whole)
CustomerBis (BIZ as Whole)
OtherBis (BIZ as Whole)

UUID	16a5c7c:fe692320ee:-7
Name	PurchasingDep
Stereotype	

Click on an object or an action to which you want to make a relation   Mouse: x = 98, y = 292

Figure 13 a). Connecting joint action `select` to holon `BookCo` results in a new collaboration link.



UUID	e3570c:fa134f681f:-7ffe
Name	BookCo
Stereotype	
Constraint	
Description	The book company that
Creator	wegmann
Update time	13/07/04 19:22
Model element	CompuObject
Parent	BookCoBis

Figure 13 b). The information viewpoint of holon `BookCo` are automatically created up to the detail level where joint action `select` is (level 2).

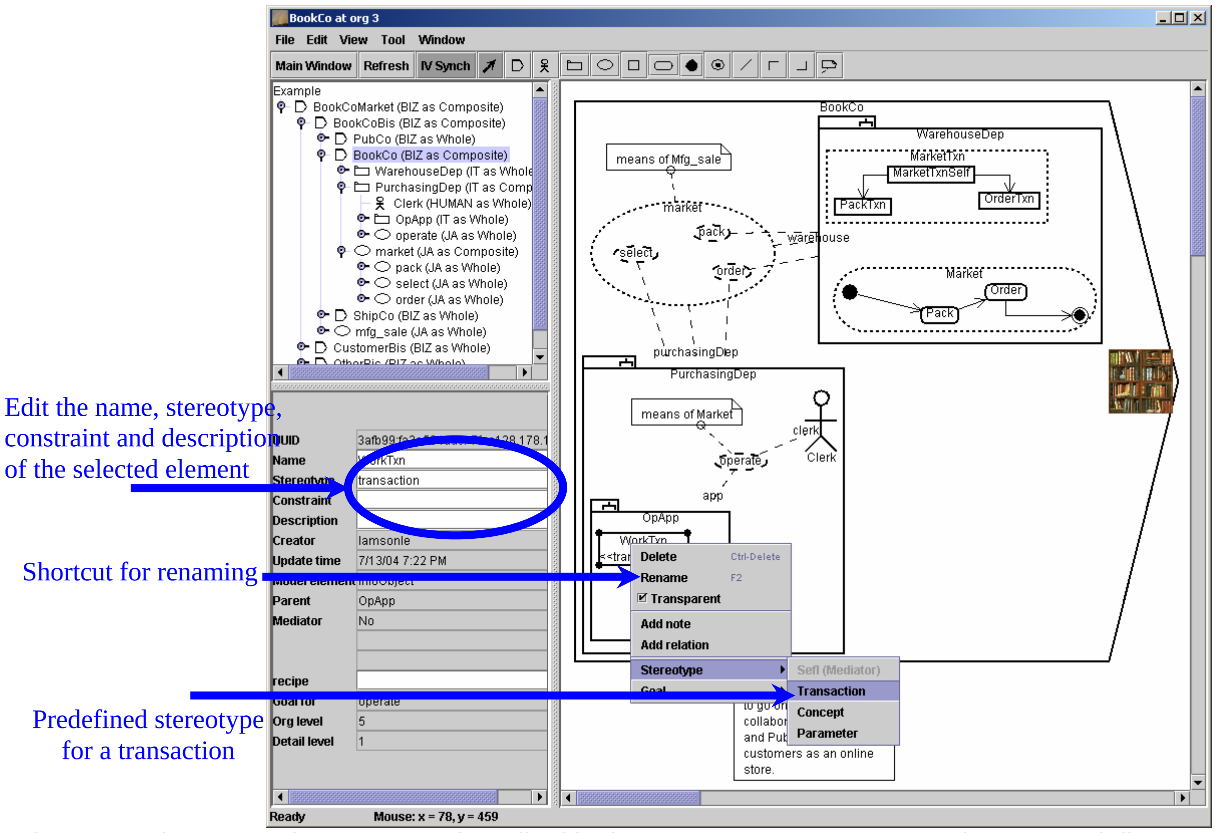
5.7 *Inserting a Note*

Each model element except the relation can be attached some notes. A note has a name (rendered just below the notation) and a text (rendered inside the notation). The following steps should be taken in order to insert a note:

- First, click on the button having a folder icon or menu item “Tool | Insert | Note”.
- Then drop into a model element in the diagram. Note that the potential element is highlighted in blue color.
- The newly created comment is given a default name and a text copied from the description of the targeted element.

5.8 *Modify an Existing Model Element*

In the modeling window, the property panel at the bottom-left corner is used for editing the element selected in the diagram. The name, stereotype, constraint and description of the selected element can be modified. If the selected element is a relation, its roles and cardinalities can be edited in the corresponding text fields of the property panel.



Example
- BookCoMarket (BIZ as Composite)
  - BookCoBis (BIZ as Composite)
    - PubCo (BIZ as Whole)
    - BookCo (BIZ as Composite)
      - WarehouseDep (IT as Whole
      - PurchasingDep (IT as Comp
        - Clerk (HUMAN as Whole)
        - OpApp (IT as Whole)
        - operate (JA as Whole)
      - market (JA as Composite)
        - pack (JA as Whole)
        - select (JA as Whole)
        - order (JA as Whole)
    - ShipCo (BIZ as Whole)
    - mfg_sale (JA as Whole)
  - CustomerBis (BIZ as Whole)

UUID	3afb99:fa... 128.178.1
Name	WorkTxn
Stereotype	transaction
Constraint	
Description	
Creator	lamsonle
Update time	7/13/04 7:22 PM
Model element	InfoObject
Parent	OpApp
Mediator	No
recipe	
Goal for	operate
Org level	5
Detail level	1

Ready Mouse: x = 78, y = 459

Figure 14. The selected element can be edited in the property panel. It can also be renamed directly inside its notation.

In addition, the context popup menu of the model element provides the modeler with shortcuts for quick and easy modifications. Every element can be renamed by using popup menu "Rename" (see Figure 14). The information object and localized action can be manually aligned to a specific joint action by following popup menu "Goal". The relation can be manually set, rerouted and toggled directed/undirected by using popup menu "Relation", "Routing" and (checkbox menu) "Directed" respectively. The modeler can pick a predefined stereotype (<<transaction>>, <<concept>> and <<parameter>>) for an information object by using popup menu "Stereotype". Similarly, she can pick one of two predefined stereotypes <<interaction>> and <<internal>> for a localized action in the same way.

The tool allows the modeler to change the type of an existing holon. Apparently, she can switch between a biz object and an IT object. A human object can be changed to either a biz object or an IT object but not in the opposite way. She can do so by using the popup menu item "Humanize", "to Biz" or "IT systemize" of the holon that she wants to change. Once the type of a holon is changed, the notation of that object is changed accordingly.

5.9 Delete an Existing Model Element

Right-click on the model element to activate its popup menu, then choose menu item Delete. Its component elements and relations will be deleted as well. They are all reported in the Output Window.

5.10 Saving the Model

The newly created and modified model elements need to be updated in the database. This can be done by using menu item "Model | Save <model name>" of the main window.

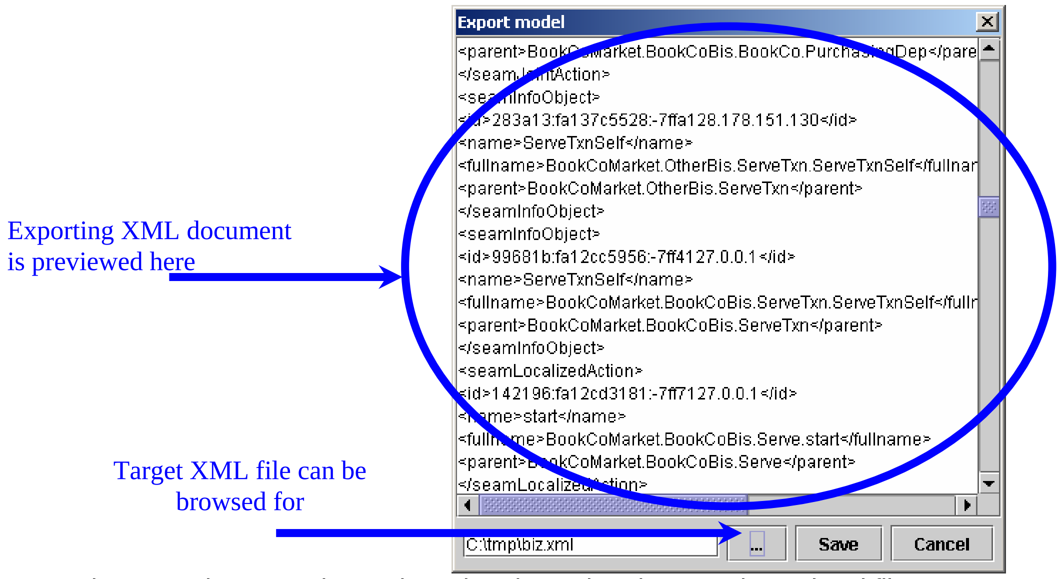
6 Miscellaneous Functionalities

This section presents miscellaneous functionalities such as saving working model, export modeling diagram as a GIF picture, attaching a small image to a holon…

6.1 Export the Working Model to an XML Document

The working model can be exported to an XML document with an XML schema reflecting SEAM modeling language. It is possible to pass this kind of XML document to another tool for simulating the source model…

To export the currently working model, the modeler should follow menu item “Model | Export <model name> to XML” of the main window. A dialog will appear (see Figure 15) and allow her to preview the exporting XML document and then save it as a local file.


Export model
Exporting XML document is previewed here
Target XML file can be browsed for
...
Save
Cancel

```
<parent>BookCoMarket.BookCoBis.BookCo.PurchasingDep</pare
</seamJointAction>
<seamInfoObject>
<id>283a13:fa137c5528:-7ffa128.178.151.130</id>
<name>ServeTxnSelf</name>
<fullname>BookCoMarket.OtherBis.ServeTxn.ServeTxnSelf</fullnar
<parent>BookCoMarket.OtherBis.ServeTxn</parent>
</seamInfoObject>
<seamInfoObject>
<id>99681b:fa12cc5956:-7ff4127.0.0.1</id>
<name>ServeTxnSelf</name>
<fullname>BookCoMarket.BookCoBis.ServeTxn.ServeTxnSelf</fullr
<parent>BookCoMarket.BookCoBis.ServeTxn</parent>
</seamInfoObject>
<seamLocalizedAction>
<id>142196:fa12cd3181:-7ff7127.0.0.1</id>
<name>start</name>
<fullname>BookCoMarket.BookCoBis.Serve.start</fullname>
<parent>BookCoMarket.BookCoBis.Serve</parent>
</seamLocalizedAction>
```

C:\tmp\biz.xml

Figure 15. Exporting XML document is previewed and can then be saved as a local file.

6.2 Export the Modeling Diagram to a GIF Picture

In each modeling window, the diagram on the right can be exported to a GIF picture by using menu item “Model | Export to GIF”. A dialog will appear (see Figure 16) and allow the modeler to locate the target GIF file. The exported picture then can be inserted into other documents or printed to a printer.

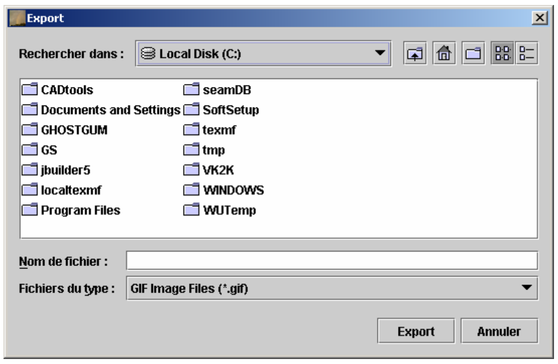


Figure 16. Export dialog allows the modeler to browse for the target GIF file.

6.3 Picture for Holon

Each holon can be attached a small image as an icon as follows. This is useful to make the model more concrete.

- Right-click on a holon and then select menu item “Image Icon”.
- A dialog will appear to help the modeler select an icon from a predefined gallery or browse for her favorite images (see Figure 17).

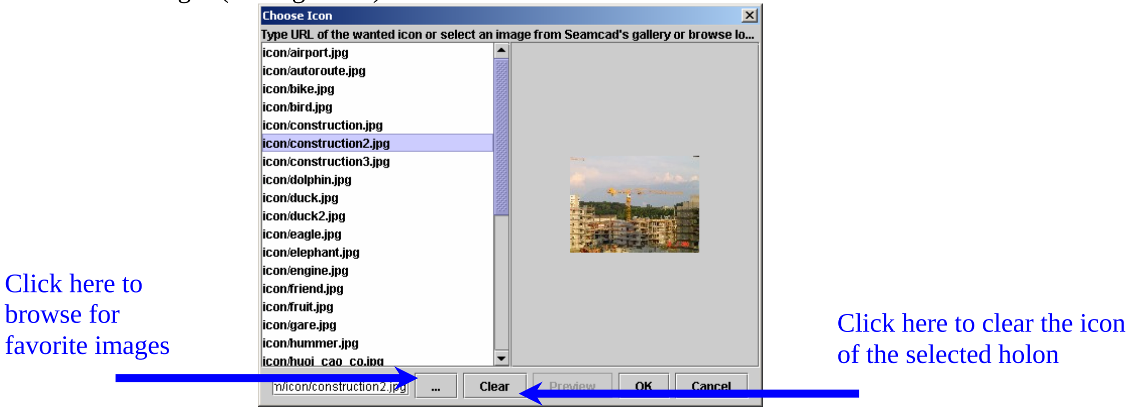


Figure 17. The picture for the selected holon can be chosen from the built-in gallery or from a local file system.

Icons can be painted in 64 x 64, 32 x 32 or not painted at all in modeling diagrams. Menu View | Image icon of the modeling window allows the modeler to switch between these modes.

7 Tool Architecture

The server is a set of Java servlets executed within a web server at our location. These servlets are responsible for storing and loading model elements into a database. The client is a Java application and is available for downloading. The client and the server exchange data in XML format. Typically, the server load elements from the database when the modeler opens a model. The server then produces an XML document form them and send it to the client through a Web connection. The client parses this XML document to reconstruct the model elements and then build an appropriate data structure. When working with the model, the modeler modifies the local copy of the model. When the modeler saves her modified model, the client produces an XML document for newly created and modified elements. The XML document is sent to the server in a Web connection that will update the database.

Appendix A: Web Prototypes

This appendix presents the first two prototypes of SeamCAD which were built as static web pages to illustrate the main functionalities of the tool based on a case-study. In this case-study, the modeler needs to represent the development and the usage of a program called DrawingToolSystem (DTS) that allows the user to draw and manipulate basic 2D shapes (circle, rectangle, group…). Specifically, the user can create a new shape, remove the existing one as well as print all the shapes in a picture. DTS is the system of interest and needs to be modeled as atomic and as composite through several detail levels. In Prototype 1, only DTS is represented within a community consisting of itself, its developer and its user. In Prototype 2, two organizational levels are represented. One level is about the DTS, the user and the developer. The other is about the Java classes that implement DTS.

Prototype 1

Goal:

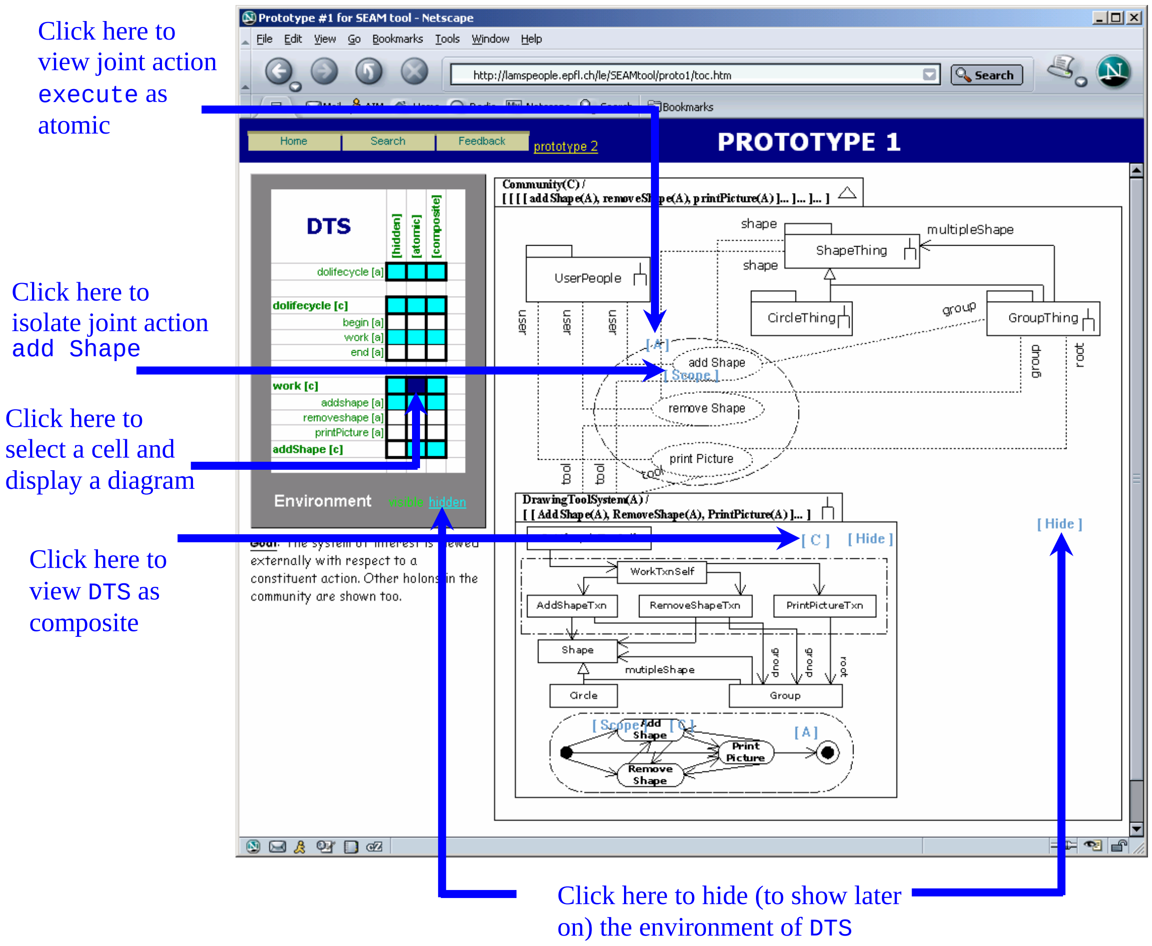
The system of interest needs to be represented with respect to the interaction with its environment. It is represented either as atomic or as composite. Being represented as atomic, the system of interest should have transactions and localized actions regarding the collaboration it takes part in. Being represented as composite, it should have Java classes that implement it.

Description:

The navigation panel on the left allows the modeler to navigate in different diagrams that represent `DTS`, `UserPeople`, `DeveloperPeople` collaborating through some joint actions. There are 3 detail levels that correspond to the decomposition of joint action `doLifecycle` into `install`, `execute`, `uninstall` and into `add Shape`, `remove Shape`, `print Picture`. Each cell of the navigation panel is coordinated by the way to view `DTS` (as unqualified, atomic, or composite on the columns) and by a joint action (on the rows) that `DTS` participates in. In principal, each cell corresponds to one diagram. In fact, not all diagrams are available. The cells whose the corresponding diagram is available are cyan. When the modeler clicks on a cyan cell, it is selected and becomes blue. The diagram of the selected cell is painted on the right. By default, the environment of DTS is shown in the diagram. It is possible to hide (and later on show again) it by clicking on the link labeled "hidden" or "visible" at the bottom of the navigation panel (see Figure 18).

There are also shortcuts inside the pictograms of objects and actions that allow the modeler to toggle between the whole (shortcut [A]) and the composite (shortcut [C]) or even to hide them (shortcut [H]). Clicking on the shortcut [H] of `DTS` - the system of interest will make it as unqualified. In addition, It is possible to isolate a joint action or a localized action from it siblings with shortcut [Scope]. Once the diagram is changed when the modeler follows a shortcut, the corresponding cell is selected in the navigation panel.

Prototype 1 can be reached at http://lamspeople.epfl.ch/lsle/SEAMtool/proto1/toc.htm.


Click here to view joint action `execute` as atomic

Click here to isolate joint action `add Shape`

Click here to select a cell and display a diagram

Click here to view `DTS` as composite

Click here to hide (to show later on) the environment of `DTS`

Goal: The system of interest is viewed externally with respect to a constituent action. Other holons in the community are shown too.

Figure 18. `DTS` as atomic with respect to `add Shape`, `remove Shape` and `print Picture` in Prototype 1.

In summary, prototype 1 introduces the navigation panel, through which the modeler can view the system of interest with respect to different joint actions that more or less denote the detail level.

Findings:

- The only system of interest is viewed either as atomic or as composite
- The system of interest as atomic is always synchronized to the joint actions represented.
- Joint actions are implicitly organized into detail levels, which should be hierarchically organized.
- More than one level with multiple systems of interest need to be represented.

Prototype 2

Goal:

Navigation panel should allow the modeler to select the organizational level she wants to work with. She then can view each object in the chosen level as atomic/composite. The panel should also allow her to navigate in joint actions happening within the chosen level.

Description:

The navigation panel of the left contains

a) a slider to select one of the two organizational levels
b) a table for viewing holons that exist in the selected organizational level
c) a hierarchy of joint actions that happen between viewed objects

First, the modeler selects the organizational level of interest by clicking on a box in the slider. There are two boxes representing level 1 (`DTS` collaborates with people) and level 2 (Java classes collaborate within `DTS`). In the object table at the middle of the navigation panel, each row represents a holon that exists in the selected organizational level. The columns of this table correspond to how these objects are viewed (as unqualified, atomic or composite). Initially, all of them are seen as unqualified.

Then, the modeler chooses the detail level by clicking on the shortcut [+] of a row in the action hierarchy (drawn as a tree structure). The table next to the action hierarchy lists all relevant joint actions at the chosen detail level. Each of them can be isolated (or scoped) by clicking a radio button next to them. There is also a radio button that stands for the parent joint action.

In principal, she can view each object as unqualified, atomic or composite by clicking on the appropriate radio button in the object table. In fact, as the drawings are limited, the modeler gets a warning text if the diagram she wants to see is not available.

There are also shortcuts inside the pictograms of objects and actions that allow the modeler to toggle between the whole (shortcut [A]) and the composite (shortcut [C]) or even to hide them (shortcut [H]). In addition, It is possible to isolate a joint action or a localized action from it siblings with shortcut [Scope]. As the on the right diagram is changed when the modeler follows a shortcut, the appropriate radio button is selected or deselected in the navigation panel (see Figure 19).

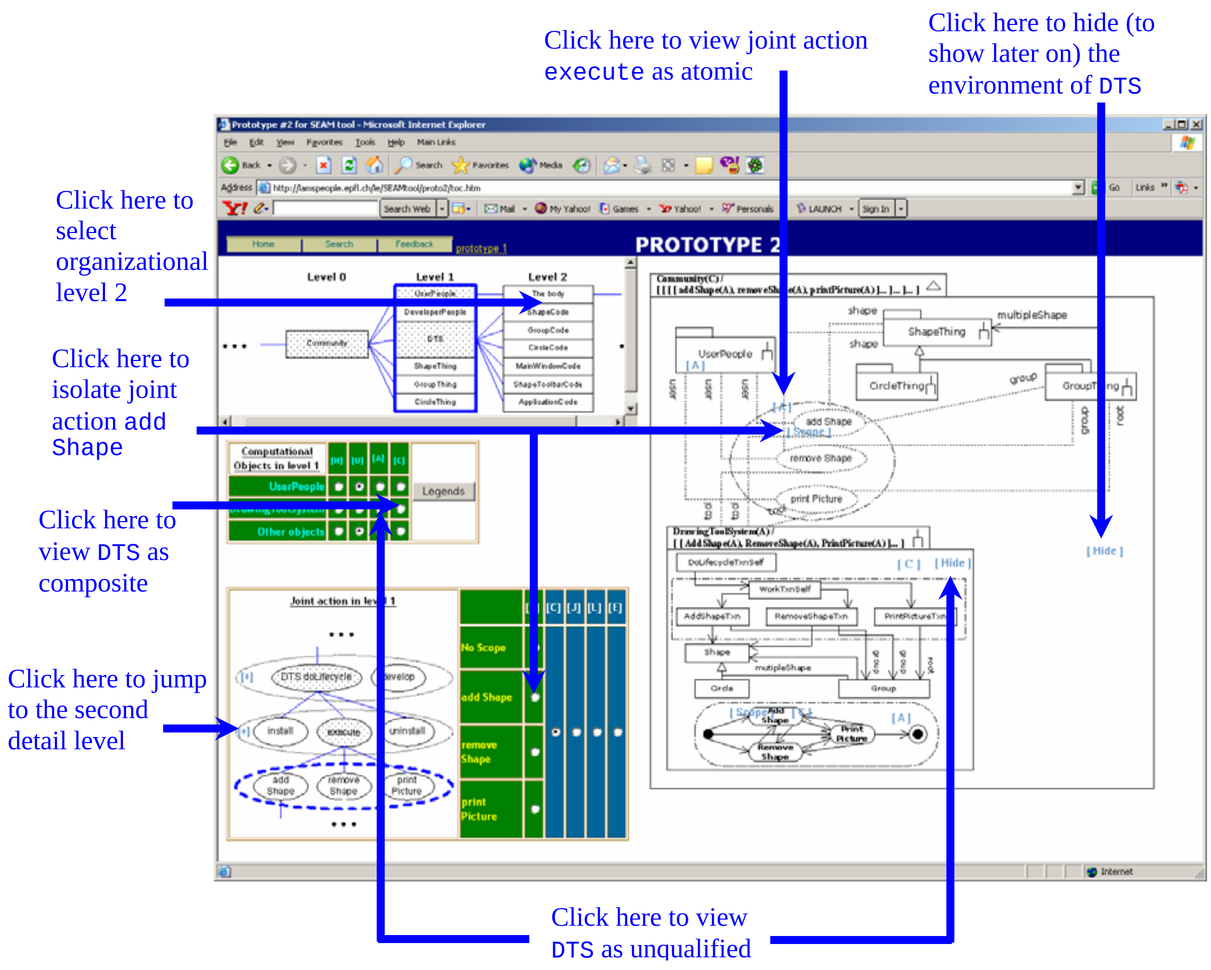

Click here to view joint action execute as atomic
Click here to hide (to show later on) the environment of DTS
Click here to select organizational level 2
Click here to isolate joint action add Shape
Click here to view DTS as composite
Click here to jump to the second detail level
Click here to view DTS as unqualified
Prototype #2 for SEAM tool - Microsoft Internet Explorer
PROTOTYPE 2
Level 0
Level 1
Level 2
Community
DTS
Computational Objects in level 1
UserPeople
DrawingToolSystem
Other objects
Legends
Joint action in level 1
No Scope
add Shape
remove Shape
print Picture
DTS doLifecycle
develop
install
execute
uninstall
add Shape
remove Shape
print Picture
ShapeThing
CircleThing
GroupThing
UserPeople
DrawingToolSystem(A)
[Hide]

Figure 19. DTS as atomic with respect to add Shape, remove Shape and print Picture in Prototype 2.

As a comparison, Prototype 2 provides the modeler more navigation mechanisms than Prototype 1 does. It can be reached at http://lamspeople.epfl.ch/lsle/SEAMtool/proto2/toc.htm.

Our findings:

- The navigational panel allows the modeler navigate in both the organizational level and the detail level.
- The demonstration is good enough to start developing the first functional version of the tool.
- The synchronization between the joint actions and the participating holons seen as whole can be realized in the functional version by aligning each of their transactions and localized actions to a specific joint action.

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