Chapter 7: Collaboration Diagram

The Collaboration Diagram

What is a Collaboration Diagram

- Cross between an symbol diagram and a sequence diagram

- Describes a specific scenario

- Numbered arrows show the movement of messages during the course of a scenario
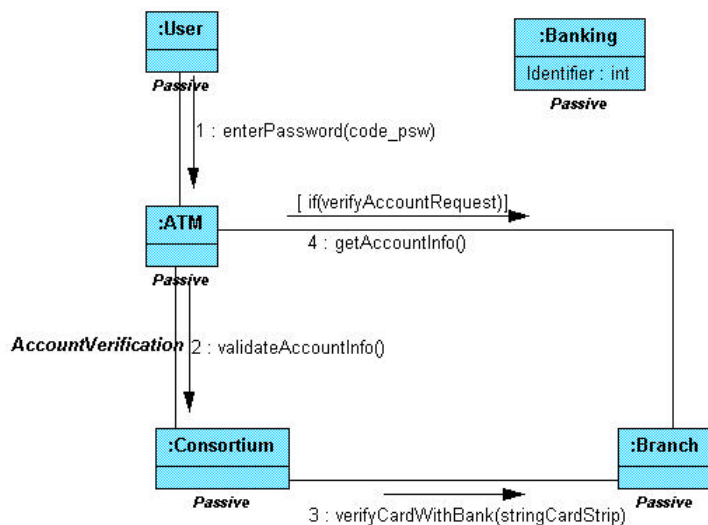
When to use a Collaboration Diagram

- When you prefer to show a spatial organization of symbols and interaction rather than concentrating on the sequence of the interaction

Creating a Collaboration Diagram

A collaboration diagram shows an interaction organized around the objects in the interaction and their links to each other. Unlike a sequence diagram, a collaboration diagram shows the relationships among the objects. On the other hand, a collaboration diagram does not show time as a separate dimension, so sequence numbers determine the sequence of messages and the concurrent threads.

When you have completed your Collaboration Diagram portion of the tutorial your model should be similar to the following example.

Note: The diagram shown above is for reference only. Use the instructions beginning in the next topic to draw your collaboration diagram.
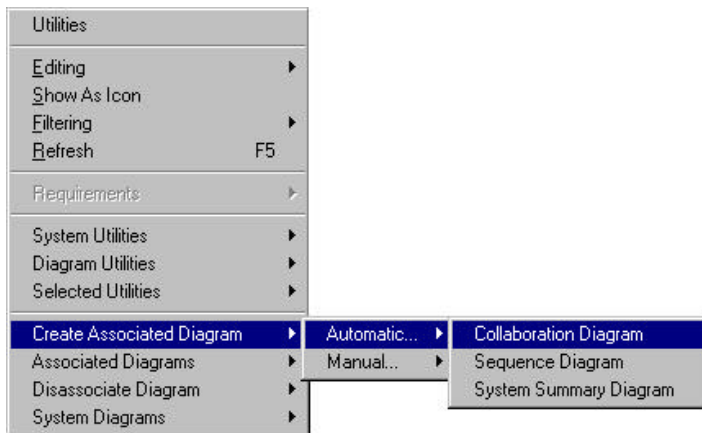
To Draw a Collaboration Diagram Automatically

1. Open the previously created class diagram called CLD_1_Members Institution if it is not presently the current diagram.

2. We do not want all the classes in this diagram to appear in the collaboration diagram so select only the following classes in the CLD_1_Members Institution diagram:
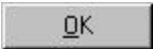   ATM
    Consortium
    Branch

Note: You can select multiple classes by holding down the Shift key and clicking on each class you want included.

3. Right-click anywhere on the background of the diagram. The Utilities background menu opens.


4. Choose CREATE ASSOCIATED DIAGRAM->AUTOMATIC->COLLABORATION DIAGRAM. The Collaboration Diagram Name dialog box opens. The default name includes the class diagram name (Member Institutions), the number of the diagram (1), and the type of diagram (COD). You can edit this name but for purposes of the tutorial we will leave the default name. You can also add a description for the diagram.
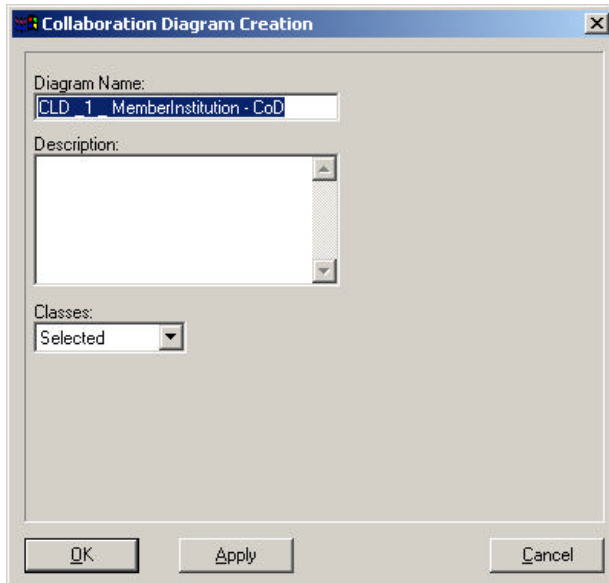
5.   Choose "Selected" from the Classes drop down menu. Only the classes you selected earlier will be used in the creation of the collaboration diagram.

6.   Click [OK   ]. The dialog box closes and Diagram Window opens. The Diagram Window opens with the selected classes and is labeled CLD_1_Member Institutions - CoD.
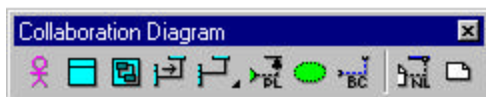
Note: The diagram you just created is now the active design model. When the Collaboration model is created, the Diagram Window displays a palette with icon symbols used to create collaboration diagrams.
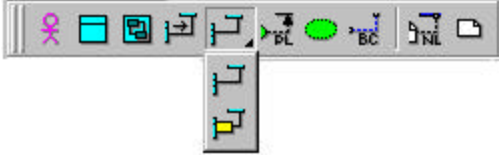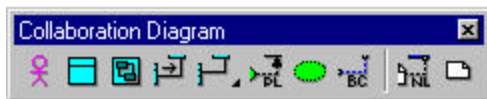

Note: When the Collaboration Diagram is created, the use case and class diagrams remain open as well.

The Collaboration Diagram Palette

Each icon on this palette represents a notation used to create a package diagram.

Icon	**Notation**	**Definition**
	Actor	◆　Actors represents roles of entities outside of a system that interact directly with the system. ◆　Actors can be anything - humans, devices, other systems ◆　One physical object can play several roles and so can be modeled by several actors.
	Object	An object represents a particular instance of a class. You name the object, the name of the class of the object, and if applicable, the name of the package in which the object element can reside. If the class of the object is scoped, the scope name of the class is required, an example of this would be, Package1_ClassA. You can define object attributes and assign initial values.
	Composite Object	Objects made of sub-objects can be represented using a composite object. Using the composite object can reduce the diagram's complexity. Composite objects are represented like normal objects except that attributes are replaced by objects. Composite objects are instances of composite classes. All properties are the same as an Object and represents an object composed of tightly bound parts.
	Message	In a collaboration diagram objects collaborate by exchanging messages. These messages are placed parallel to the links that connect the objects. The arrows point toward the recipient of the message. The message implementation can take various forms: a procedure call; the sending of a signal between active threads; the explicit raising of events, and so on. Since time is not represented explicitly in a collaboration diagram the messages are numbered to indicate the sending order.
	Object Link	In a collaboration diagram objects are connected by links. These links are instances of associations between the classes of the objects being considered. Messages are placed parallel to the links that connect the objects.

	Link Adornment	◆ An adornment is used as a link qualifier to indicate various kinds of implementations of the link.
		◆ These are predefined types to declare how the link is used - global variable, local variable, parameter, etc.
	Pattern Member Link	Used to show the member classes or objects participating in a pattern.
	Design Pattern	Patterns describe small, recurring entities, reusable on a day to day basis in order to resolve specific problems. These patterns do not express the general form of an application.
		This symbol is available in the following diagrams: Use Case, Class, Collaboration, Deployment, and Component.
	Binary Constraint	The binary constraint notation is available on all diagram palettes. A constraint is a semantic relationship among model elements that specifies conditions and propositions that must be maintained as true. Otherwise the system described by the model is invalid. Certain kinds of constraints (such as association "or" constraint) are predefined in UML, others can be user defined. A constraint represents semantic information attached to a model element, not just a view of it.
		A binary constraint allows a constraint to be defined between any symbols on the diagram. The binary constraint allows the constraint to be defined on the link rather than in a note symbol. If there is a need for a single constraint or three or more way constraint, then a note symbol is used to explain the constraint and the note symbol is linked to the constrained symbols using a note link.

|	Note Link	The note link notation is available on all diagram palettes. The note pad can be used to record information for an object or link in a diagram. This information is not included in generated code but is for information only. Each note pad can contain unlimited text, can be numbered, a stereotype defined, and a noted element entered.
	Note Pad	The note pad notation is available on all diagram palettes. The note pad can be used to record information for an object or link in a diagram. This information is not included in generated code but is for information only. Each note pad can contain unlimited text, and be numbered. You can also define a stereotype, and enter a noted element.

Rearranging and Placing Objects

The automatically created diagram appears with the three selected classes:
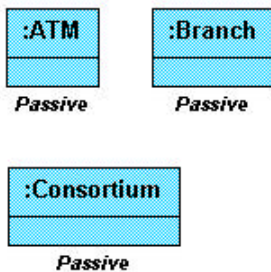

1.   Rearrange the object symbols, leaving a space at the top of the diagram, so they resemble the following example:
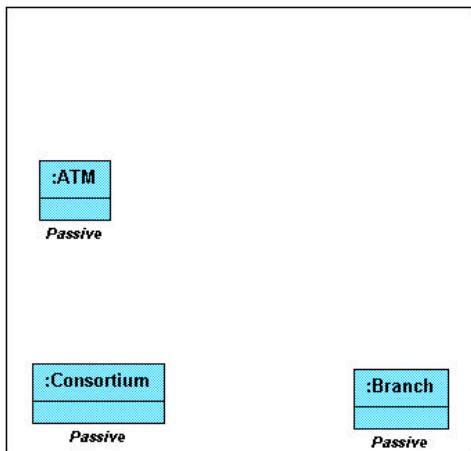

2.   We need to add two more objects to the collaboration diagram but will use two different methods. With the first method, we can drag a class symbol from the System Hierarchy Window and it is automatically translated to an object symbol when placed in the collaboration diagram.

To add the first object, select the class symbol "User" in the System Hierarchy Window.
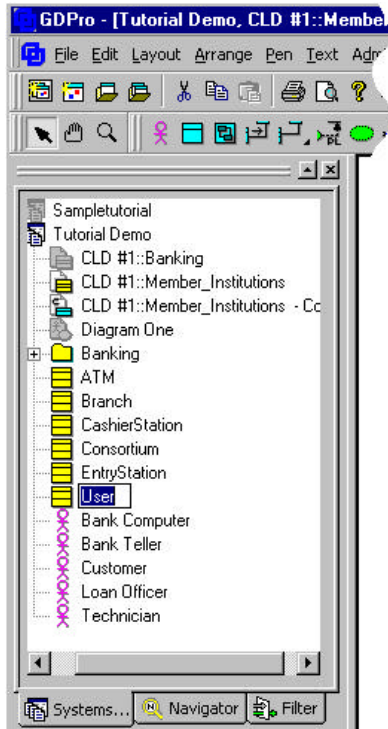
3. Drag and place the "User" class symbol so it is placed above the ATM object as shown in the following illustration. Once you release the cursor, the class symbol becomes an object symbol with the class name of "User"
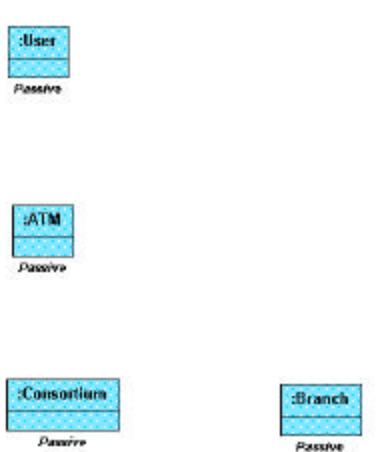

4. To add the second object click the object icon and then click in the upper right corner of the diagram to place the object.

:User

Passive

:<un-named>

Passive

:ATM

Passive

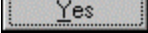:Consortium

Passive

:Branch

Passive
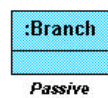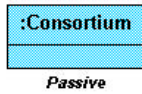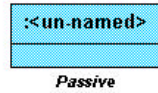
Labeling the Object

1. Select the unnamed object you just added to the diagram.

2. Click in the upper portion of the selected object and the Object Identifier pop-up editor opens.
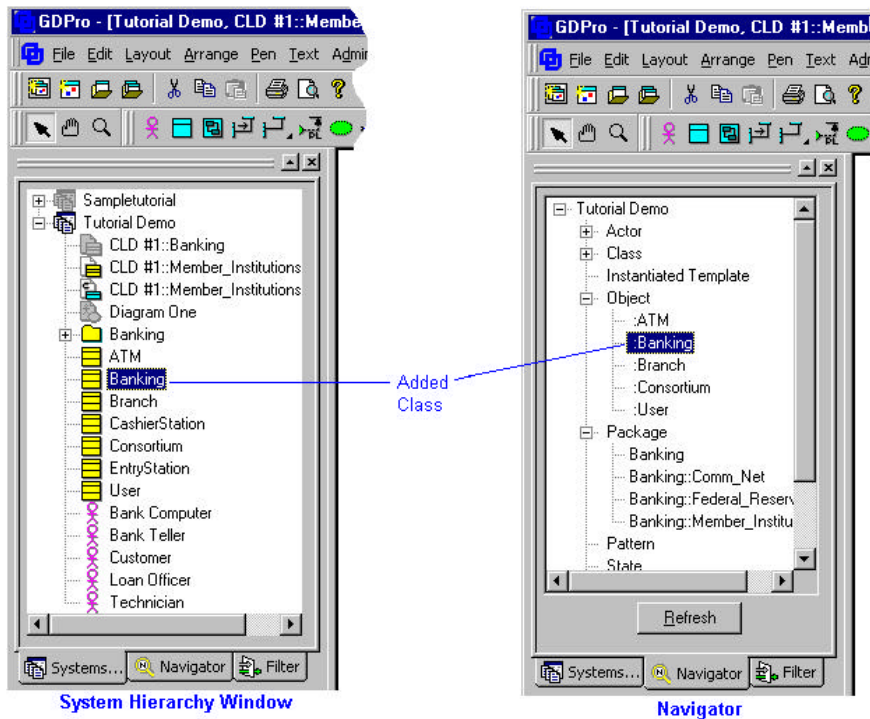
    ObjectIdentifier

ObjectName	ClassName	PackageName
	<un-named> ▼	▼
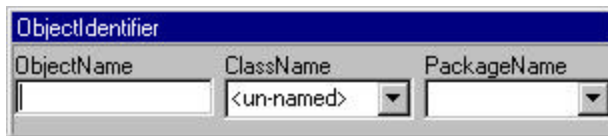
3. Tab to the ClassName text box and replace <unnamed> with "Banking" and click outside the pop-up editor. You will get the following message:

    GDPro   ☒

    ⚠ Banking does not exist. Would you like to add it?
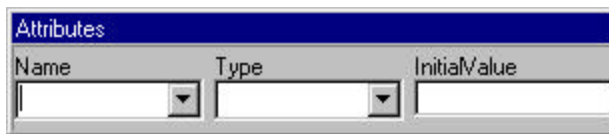
    [Yes]   [No]
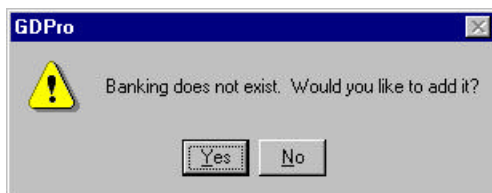
4. Click [Yes]. The object is labeled and the Class "Banking" is added to the list of Classes in the Navigator. The class is also added to the System Hierarchy Window

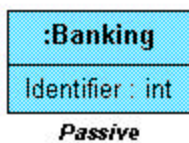**System Hierarchy Window**   **Navigator**

5. Select the object labeled "Banking". Click once in the lower portion of the object and an Attributes pop-up editor opens.


6. Enter "Identifier" in the Name text box and "int" in the Type text box.

7. Click outside the popup window and the attribute is added to the object.

Drawing Object Links

Each object in the Collaboration diagram is connected by object links. These links can be identified and message flows added.

1. Click the Object Link symbol icon in the Collaboration Diagram Palette **.**

2. Click once on the bottom center of the object labeled User. Drag the cursor down to the top center of the ATM object and click again. An object link is drawn between the two objects.

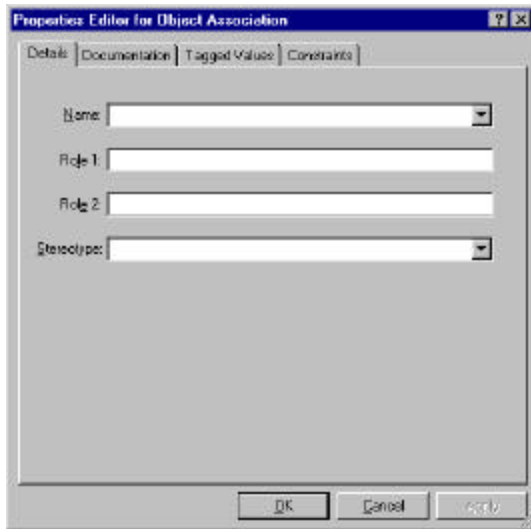3.   Using the same procedure outlined above, draw the following links

ATM	to	Consortium
Consortium	to	Branch
ATM	to	Branch

Note: When you draw the ATM to Branch link, it is automatically squared.
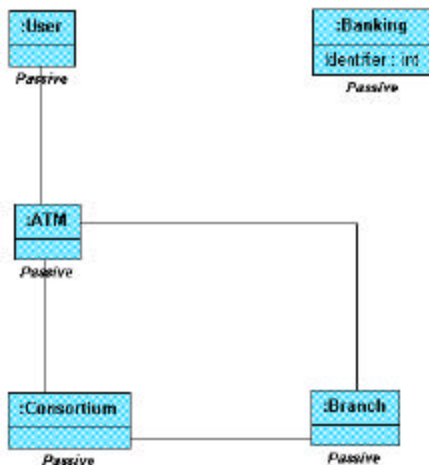

Identifying Object Links

1.   Double-click the object link between ATM and Consortium. The Properties Editor for Object
Association dialog box opens.

2.   Click the drop-down arrow located to the right of the Name text box and a drop-down menu opens.

3.   Select "AccountVerification" from the list and click [OK   ]. The dialog box closes and the label
appears next to the object link.
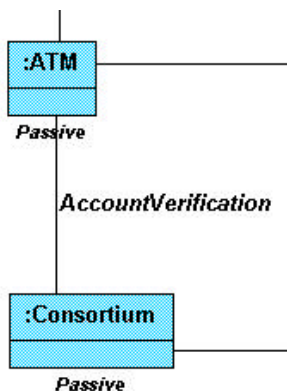
4.   Since we are going to put a message on the right side of the object link we need to reposition the
label. Place the cursor on the label "AccountVerification" and while holding down the mouse button,
move the label to the left side of the link. Release the mouse button once the label is in place.

Note: You can place the label anywhere you want, but the association to the link does not change.

Message Flows

A message flow is shown as a labeled arrow placed parallel to a link. This link is used to transport or
implement the delivery of the message to the target symbol.

1.   Click the Message symbol icon in the Collaboration Diagram palette .

2.   Place the cursor to the left of the User to ATM link. Click, **and while holding down the mouse button**, drag the cursor parallel to the object link. Release the mouse and the message arrow snaps in place next to the object link.
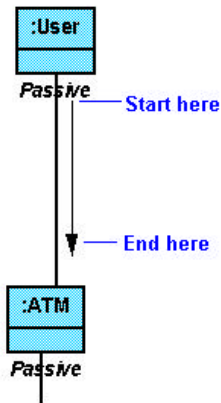
3.   Using the technique outlined in step 2, draw the following message arrows:

ATM   to   Consortium
ATM   to   Branch
Consortium   to   Branch
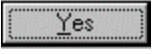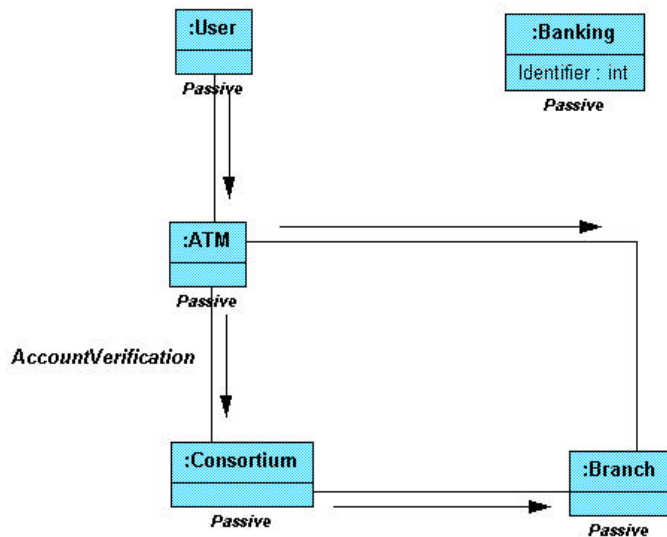
Message Identifiers

The label indicates the message sent, its arguments and return values, and the sequencing of the message.

1.   Double-click the message arrow between the User and ATM symbols. The Properties Editor for Message dialog box opens.
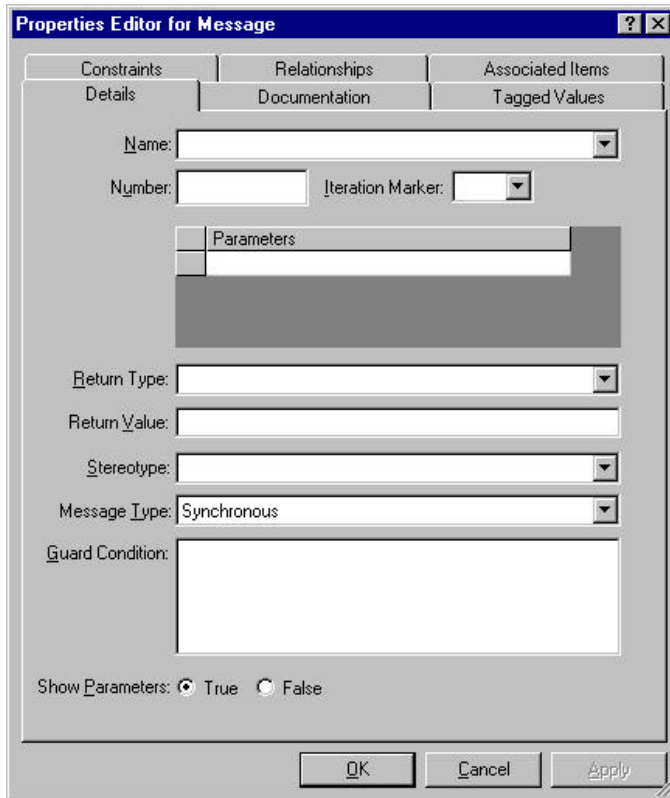
2.   Enter the text "enterPassword".in the Name text box.

3.   Enter "1" in the Number text box.

4.   Right-click in the Parameters list box and select Insert from the menu.. An insert box opens in the list box..

5.   Enter the text "code_psw".

6.   Click [OK   ] in the Properties Editor dialog box to close it. A prompt box opens asking if you want to add this operation to the associated class diagram.
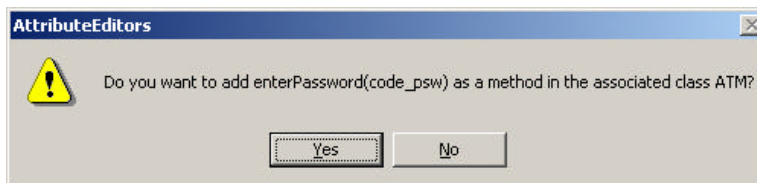
7.   Click [Yes   ] and the prompt box closes and the label appears to the right of the message arrow.
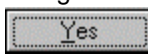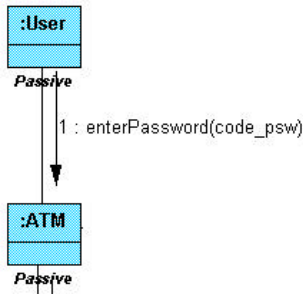
Key: The operation is added to the ATM class symbol in the class diagram as illustrated in the following graphic.
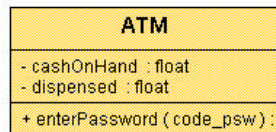
8.   Using the steps 1-8 label two of the message arrows as follows:

Consortium to Branch   3: verifyCardWithBank(stringCardStrip)
ATM to Branch   4: getAccountInfo

Note: You will also get a prompt box for each of these messages asking if you want to add these operation to the associated class diagram. Select [Yes] each time you are prompted.

Labeling the Last Message Identifier

1.   To label the last message we will use an operation already existing in the class diagram so we will use the pick list from the pop-up editor. Click once on the message flow from "ATM" to "Consortium" to select it.

2.   Click once again and the MessageIdentifier pop-up editor opens.

3.   Enter the number "2" in the MessageNumber text box and tab to the MessageName text box.

4.   Click the drop-down arrow in the MessageName text box and a drop-down menu opens listing all the available operations for this link. In this case there is only one operation available (validateAccountInfo) so click on it. The selected operation appears in the MessageName text box.

5.   Click anywhere outside the pop-up editor. The window closes and the message flow is labeled.

Entering Guard Conditions

The message arrow between the ATM and Branch symbols has a guard condition.

1.   Double-click the message arrow between the ATM and Branch symbols. The Properties Editor for Message dialog box opens. Notice that the properties editor is now labeled with the message name.


2.   Enter the text "if (verifyAccountRequest)" in the Guard Condition text box and click <u>OK</u>. The Message dialog box closes and the guard condition appears by the message arrow. Due to layout restraints, the text may appear on top of the message identifier.

3.   If so, place the cursor on the guard condition text and while holding down the mouse button, move the label above the message label.
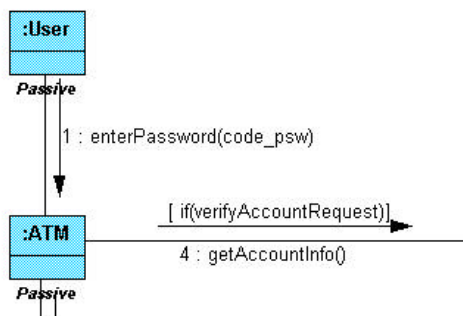
The Finished Collaboration Diagram

Your completed collaboration diagram should resemble the following graphic:
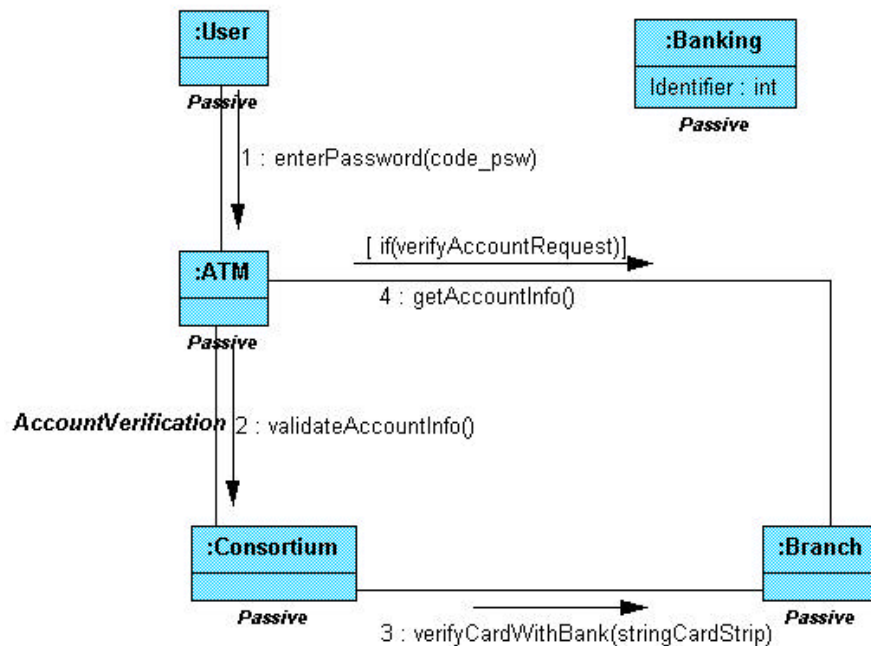
Adding Banking to the Class Diagram

Once the collaboration diagram is completed you can add the new "Banking" class to the class diagram. Also, notice that the three new messages you added to the Collaboration diagram now appear in the appropriate classes in the Class Diagram.

1.   Open the class diagram named CLD_1_MemberInstitutions.

2.   Click the class label "Banking" in the System Hierarchy Window and while holding down the mouse button, drag the label from the tree to the class diagram. Release the mouse button to place the class in the diagram.
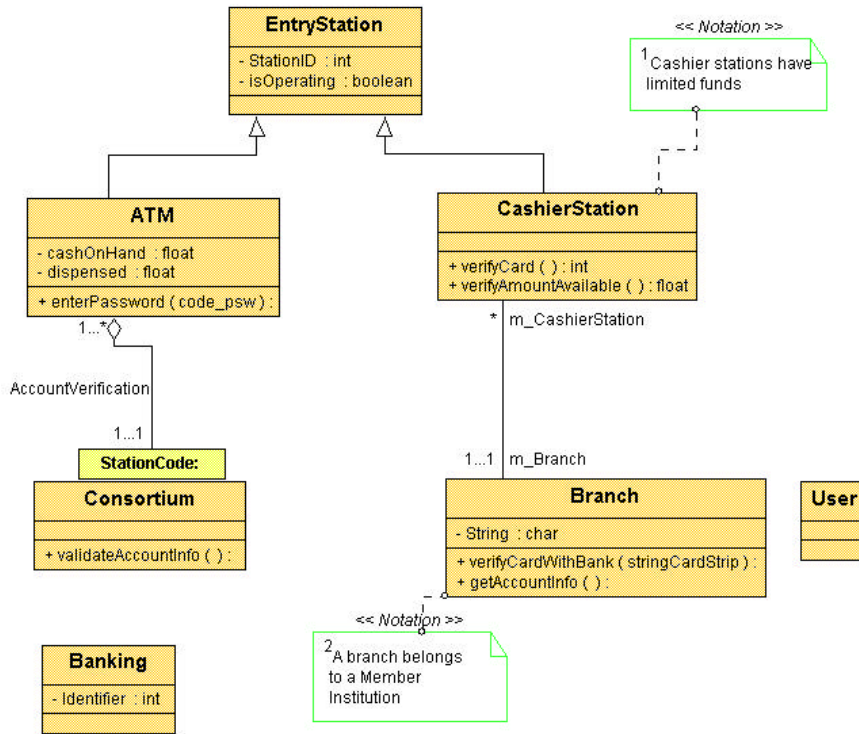
Note: Notice that the attribute that you added to the Banking symbol in the Collaboration diagram also appears with the class symbol.