Interaction Diagram

- As its name might suggest, an interaction diagram is a type of UML diagram that's used to capture the interactive behaviour of a system
- Interaction diagrams are models that describe how a group of objects collaborate in some behaviour - typically in a single use-case.
- The diagrams show a number of example objects and the messages that are passed between these objects within the use-case.
- Interaction diagrams should be used when you want to look at the behaviour of several objects within a single use case.
- They are good at showing the collaborations between the objects, they are not so good at precise definition of the behaviour.

The purpose of interaction diagram is −

- To capture the dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe the structural organization of the objects.
- To describe the interaction among objects.

Types of Interaction Diagram

- **Sequence Diagram** ***(Already Discussed. Note is with You)***
- **Communication Diagram or Collaboration Diagram**

Communication Diagram or Collaboration Diagram:

- A collaboration diagram, also known as a communication diagram, which represents the relationships and interactions among software objects in the Unified Modelling Language (UML).

- These diagrams can be used to portray the dynamic behaviour of a particular use case and define the role of each object.

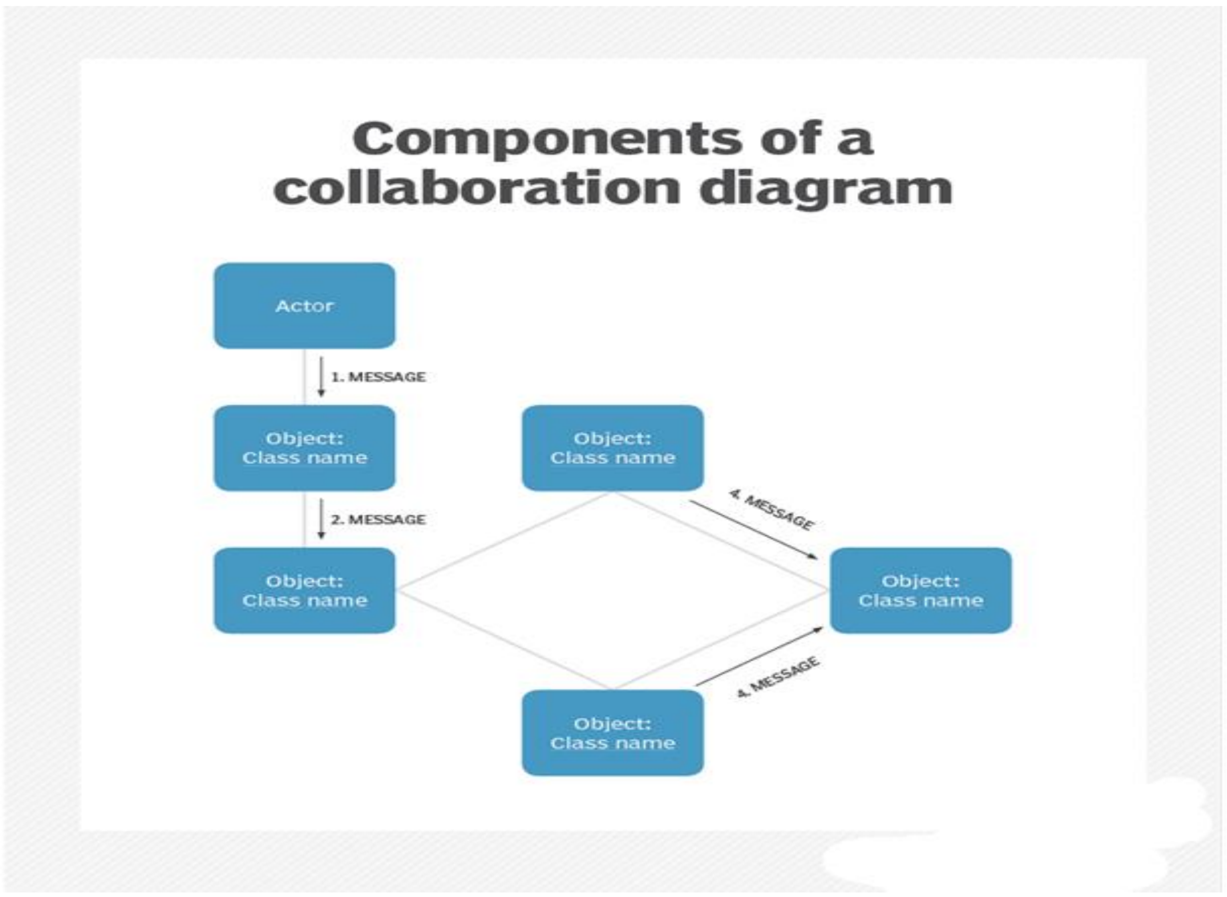
- These diagrams are used to show how objects interact to perform the behaviour of a particular use case, or a part of a use case.
- Along with sequence diagrams, collaboration are used by designers to define and clarify the roles of the objects that perform a particular flow of events of a use case.
- They are the primary source of information used to determining class responsibilities and interfaces.

Notations of a collaboration diagram

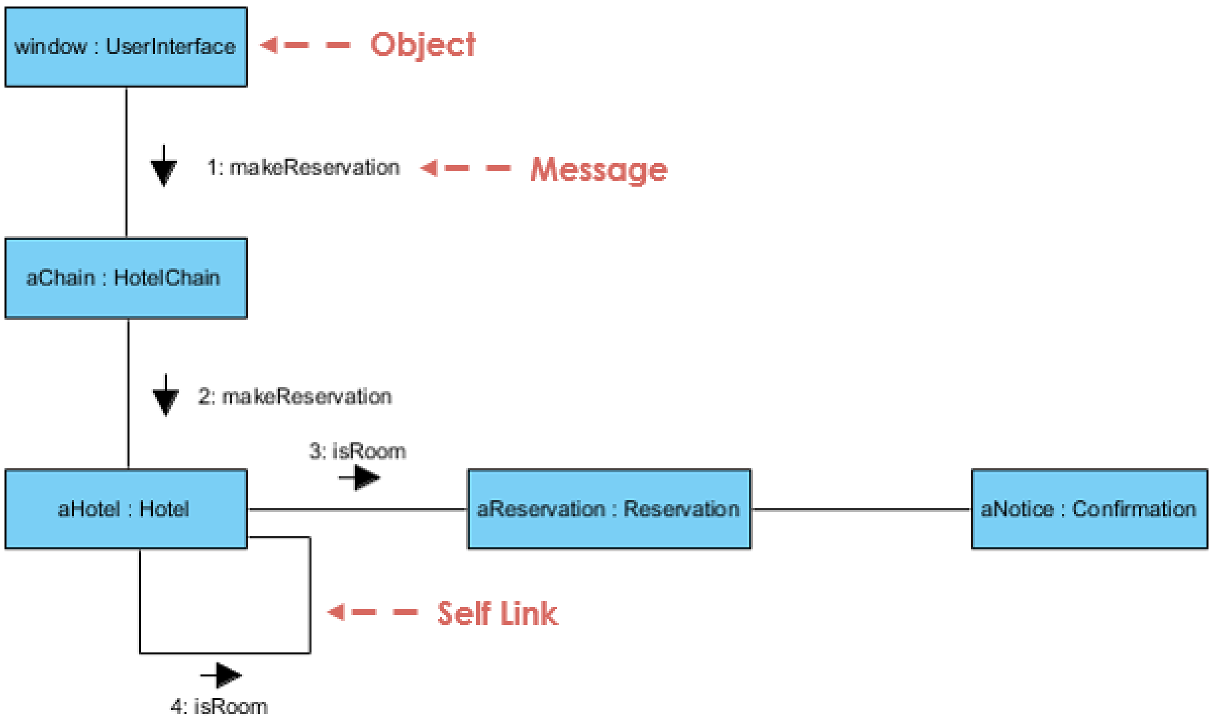
A collaboration diagram shows the roles, functionality and behaviour of individual objects as well as the overall operation of the system in real time.

The four major components of a collaboration diagram are:

1. Objects- Objects are shown as rectangles with naming labels inside. The naming label follows the convention of object name: class name. If an object has a property or state that specifically influences the collaboration, this should also be noted.
2. Actors- Actors are instances that invoke the interaction in the diagram. Each actor has a name and a role, with one actor initiating the entire use case.
3. Links- Links connect objects with actors and are depicted using a solid line between two elements. Each link is an instance where messages can be sent.
4. messages- Messages between objects are shown as a labelled arrow placed near a link. These messages are communications between objects that convey information about the activity and can include the sequence number.

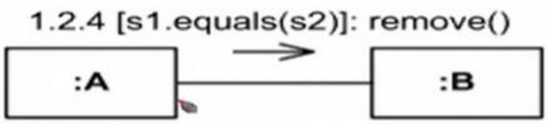


Collaboration Diagram Example is given below:



Messages in Communication (or Collaboration) Diagram

- Message in Communication Diagram is shown as a line with sequence expression and **arrow** above the line
- The arrow indicates direction of the communication

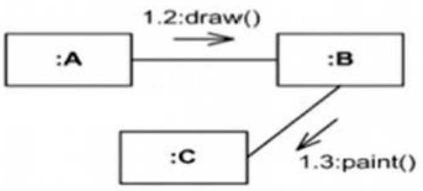


Instance of class A sends remove() message to instance of B if s1 is equal to s2

- The sequence expression is a dot separated list of sequence terms followed by a colon (":") and message name after that:
  sequence-expression ::= sequence-term '.' . . . ':' message-name
- Example: **3b.2.2:m5** : Sequence expression **3b.2.2** and message name **m5**
- Each Sequence term
  sequence-term ::= [integer [name]] [recurrence]
- The **integer** represents the **sequential order** of the message within the next higher level of procedural calling

Sequential order messages

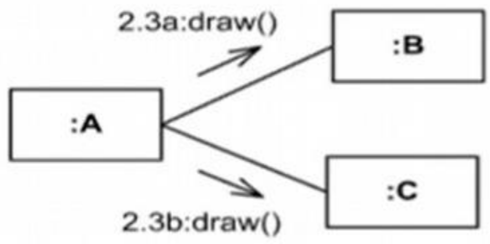
- **Example**:
  - message with sequence 2 follows message with sequence 1
  - 2.1 follows 2
  - 5.3 follows 5.2 within activation 5
  - 1.2.4 follows message 1.2.3 within activation 1.2.



Instance of A sends draw() message to instance of B, and after that B sends paint() to C

Concurrent Messages

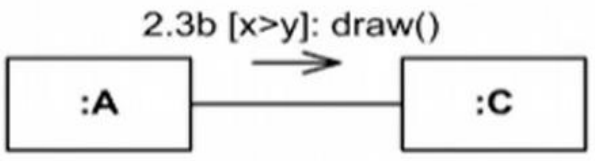
- The **name** represents a **concurrent thread** of control
- **Example**:
  - messages 2.3a and 2.3b are concurrent within activation 2.3
  - 1.1 follows 1a and 1b
  - 3a.2.1 and 3b.2.1 follow 3.2



Instance of A sends draw() messages concurrently to instance of B and to instance of C

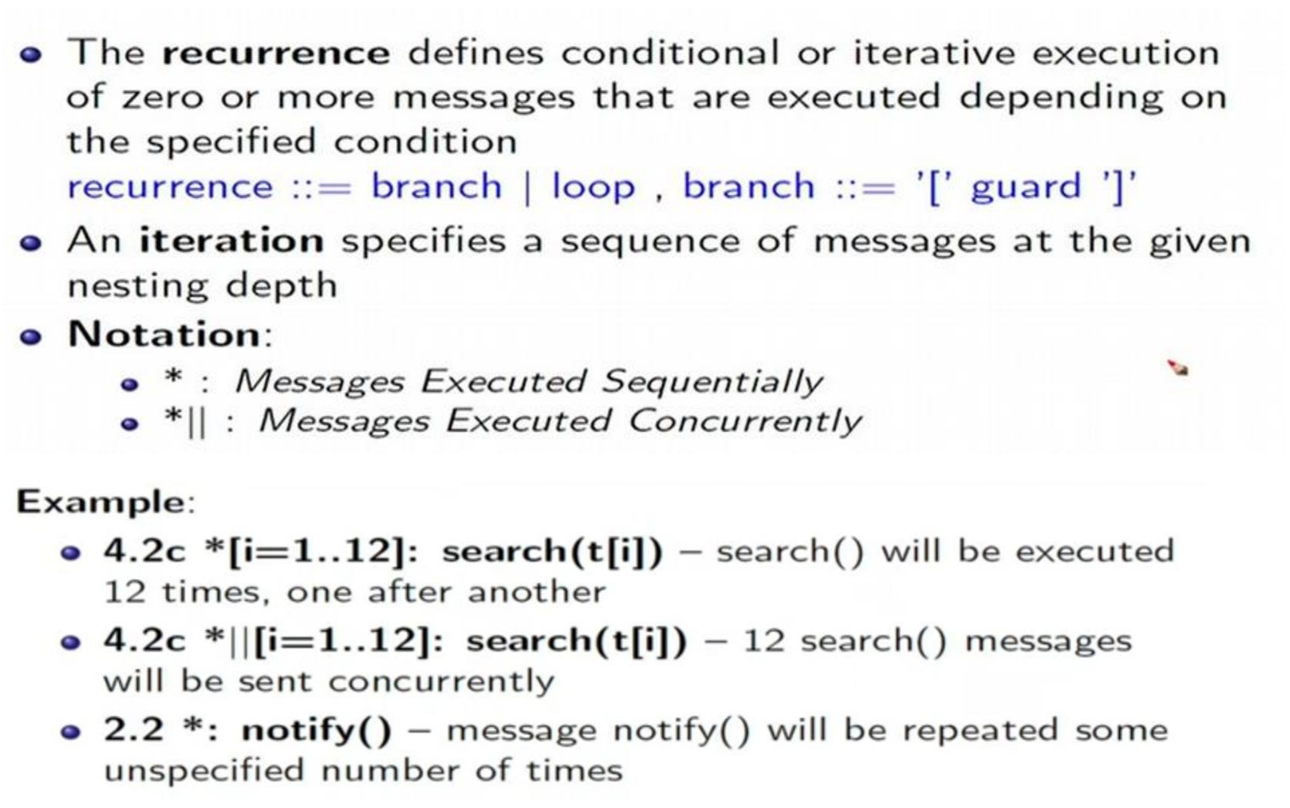
Guard :

- A **guard** specifies condition for the message to be sent (executed) at the given nesting depth
- **Example**:
  - **2.3b [x>y]: draw()**: message draw() will be executed if x is greater than y
  - **1.1.1 [s1.equals(s2)]: remove()** – message remove() will be executed if s1 equals s2



Instance of class A will send message draw() to the instance of C, if $x > y$

Recurrence and Iteration

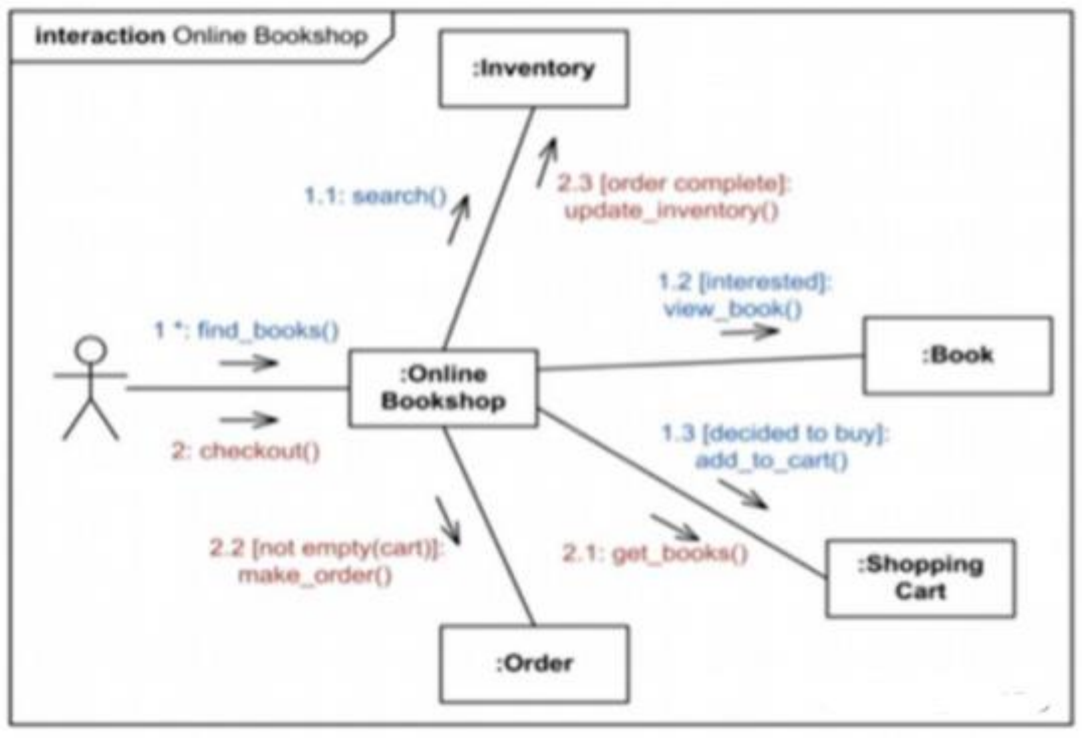


- The **recurrence** defines conditional or iterative execution of zero or more messages that are executed depending on the specified condition
  recurrence ::= branch | loop , branch ::= '[' guard ']'
- An **iteration** specifies a sequence of messages at the given nesting depth
- **Notation**:
  - * : *Messages Executed Sequentially*
  - *|| : *Messages Executed Concurrently*

Example:

- **4.2c *[i=1..12]: search(t[i])** – search() will be executed 12 times, one after another
- **4.2c *||[i=1..12]: search(t[i])** – 12 search() messages will be sent concurrently
- **2.2 *: notify()** – message notify() will be repeated some unspecified number of times

e.g. Online Book Shop Component diagram


interaction Online Bookshop
:Inventory
1.1: search()
2.3 [order complete]: update_inventory()
1.2 [interested]: view_book()
:Book
1 *: find_books()
:Online Bookshop
2: checkout()
1.3 [decided to buy]: add_to_cart()
2.2 [not empty(cart)]: make_order()
2.1: get_books()
:Shopping Cart
:Order

✓ **(*IMP*) Difference between Sequence Diagram and Communication Diagram**

Sequence Diagram	**Communication Diagram or Collaboration Diagram**
• Sequence diagram is the diagram in which main representation is of the sequence of messages flowing from one object to another; also main emphasis is on representing that how the messages/events are exchanged between objects and in what time-order.	• On other hand, Collaboration diagram is a diagram in which main representation is of how one object is connected to another implementing the logic behind these objects with the use of conditional structures, loops, concurrency, etc.
• Sequence diagram mainly focuses to represent interaction between different objects by pictorial representation of the message flow from one object to another object. It is time ordered that means exact interactions between objects is represented step by step.	• On other hand Collaboration diagram focus to represent the structural organization of the system and the messages that are sent and received.
• As Sequence diagram models the sequential logic, ordering of messages with respect to time so it is categorised as Dynamic modelling diagram.	• On other hand Collaboration diagram mainly represent organization of system so it is not classified as Dynamic modelling diagram.
• Sequence diagram as already mentioned is used to describe the behaviour of several objects in a particular single use case with implementation of all possible logical conditions and flows.	• However on other hand Collaboration diagrams is used to describe the general organization of system for several objects in several use cases.