

Object Oriented Analysis and Design



Traditional Systems Analysis and Design?

The [Systems Development Life Cycle \(SDLC\)](#) or the Structured Systems Analysis & Design (SSAD) is a framework of activities and tasks that need to be accomplished to develop an information system. This approach is also known as top-down design, modular programming, and stepwise refinement. In this approach, every problem is divided into smaller sub-problems. Each sub-problem is then analyzed and a solution is obtained to solve that sub-problem. The Solutions of overall sub-problems are then combined to solve the overall problem. The process of implementing a structured design is called Structured Programming.

What is Object Oriented Analysis and Design?

Object-oriented analysis and design (OOAD) is a technological approach to analyze, design a software system or business by using Object Oriented (OO) concept. [Object Oriented Analysis \(OOA\)](#) is the investigation of objects. Object Oriented Design (OOD) is the relationships of identified objects.

The most important purpose of OO analysis is to identify the objects of a system that have to be implemented. This analysis can also perform for an existing system. An efficient analysis is only possible when we think in a way where objects can be identified. After identifying the objects the relationships between them are identified and finally the design is produced.

Purpose of OO Analysis and Design

We can summarize the purpose of OO analysis and design in the following way:

- Identifying the objects of a system
- Identify their relationships
- Generate a design which can be converted into applications using OO languages

In software development life cycle we can apply and implement OO concepts by following three steps. The steps can be labeled as:

OO Analysis --> OO Design --> OO implementation by using OO languages

Let's describes the above three points in details:

The first phase is OO analysis. In OO analysis the most important purpose is to identify objects and describes them in a proper way. If the objects are identified efficiently then the next task of design will be easy. The objects should be identified with their responsibilities. The responsibilities are the functions or jobs performed by the object. We know every object have to perform some responsibilities. When these responsibilities are collaborates accurately the purpose of the system is fulfilled.

The second phase is OO design. This phase highlights on the requirements and their fulfillment or completion. In this phase all the objects are collaborated according to their projected relationships. After the completion of relationships the design is completed.

The third phase is OO implementation. In this phase the above design is implemented using OO languages like C#, Java, C++ etc.

In the system analysis or object-oriented analysis phase of software development, the system requirements are determined, the classes are identified and the relationships among classes are identified.

The three analysis techniques that are used in conjunction with each other for object-oriented analysis are object modelling, dynamic modelling, and functional modelling.

Object Modelling

Object modelling develops the static structure of the software system in terms of objects. It identifies the objects, the classes into which the objects can be grouped into and the relationships between the objects. It also identifies the main attributes and operations that characterize each class. The process of object modelling can be visualized in the following steps –

- Identify objects and group into classes
- Identify the relationships among classes
- Create user object model diagram
- Define user object attributes
- Define the operations that should be performed on the classes
- Review glossary

Dynamic Modelling

After the static behavior of the system is analyzed, its behavior with respect to time and external changes needs to be examined. This is the purpose of dynamic modelling.

Dynamic Modelling can be defined as “a way of describing how an individual object responds to events, either internal events triggered by other objects, or external events triggered by the outside world”.

The process of dynamic modelling can be visualized in the following steps –

- Identify states of each object
- Identify events and analyze the applicability of actions
- Construct dynamic model diagram, comprising of state transition diagrams
- Express each state in terms of object attributes
- Validate the state–transition diagrams drawn

Functional Modelling

Functional Modelling is the final component of object-oriented analysis. The functional model shows the processes that are performed within an object and how the data changes as it moves between methods. It specifies the meaning of the operations of object modelling and the actions of dynamic modelling. The functional model corresponds to the data flow diagram of traditional structured analysis.

The process of functional modelling can be visualized in the following steps –

- Identify all the inputs and outputs
- Construct data flow diagrams showing functional dependencies
- State the purpose of each function
- Identify constraints
- Specify optimization criteria

Structured Analysis vs. Object Oriented Analysis

The Structured Analysis/Structured Design (SASD) approach is the traditional approach of software development based upon the waterfall model. The phases of development of a system using SASD are –

- Feasibility Study
- Requirement Analysis and Specification
- System Design
- Implementation
- Post-implementation Review

Advantages/Disadvantages of Object Oriented Analysis

Advantages	Disadvantages
Focuses on data rather than the procedures as in Structured Analysis.	Functionality is restricted within objects. This may pose a problem for systems which are intrinsically procedural or computational in nature.
The principles of encapsulation and data hiding help the developer to develop systems that cannot be tampered by other parts of the system.	It cannot identify which objects would generate an optimal system design.
The principles of encapsulation and data hiding help the developer to develop systems that cannot be tampered by other parts of the system.	The object-oriented models do not easily show the communications between the objects in the system.
It allows effective management of software complexity by the virtue of modularity.	All the interfaces between the objects cannot be represented in a single diagram.
It can be upgraded from small to large systems at a greater ease than in systems following structured analysis.	

Advantages/Disadvantages of Structured Analysis

Advantages	Disadvantages
As it follows a top-down approach in contrast to bottom-up approach of object-oriented analysis, it can be more easily comprehended than OOA.	In traditional structured analysis models, one phase should be completed before the next phase. This poses a problem in design, particularly if errors crop up or requirements change.
It is based upon functionality. The overall purpose is identified and then functional decomposition is done for developing the software. The emphasis not only gives a better understanding of the system but also generates more complete systems.	The initial cost of constructing the system is high, since the whole system needs to be designed at once leaving very little option to add functionality later.
The specifications in it are written in simple English language, and hence can be more easily analyzed by non-technical personnel.	It does not support reusability of code. So, the time and cost of development is inherently high.

Advantages of Object-Oriented Analysis and Design

Benefits of Object Oriented Analysis and Design are given bellow:

- It is easy to understand.
- It is easy to maintain. Due to its maintainability OOAD is becoming more popular day by day
- It provides re-usability
- It reduce the development time & cost
- It improves the quality of the system due to program reuse

Disadvantages of Object-Oriented Analysis and Design

Drawbacks of Object Oriented Analysis and Design are given bellow:

- In OOAD, all time it is not easy to determine all the necessary classes and objects required for a system
- Most of our project development teams are familiar with traditional analysis & design. The OOAD offers a new kind of project management. That's why it may be difficult to complete a solution within estimated time and budget
- Without an explicit reuse procedure this methodology do not lead to successful reuse on a large scale

Difference between Structured and Object-Oriented Analysis and Design

A comparison between traditional structured analysis & design and object-oriented analysis and design is given bellow:

Object-Oriented

- It is data oriented
- Its main focus is data
- There is no separation of the systems data and processes. Data and processes are encapsulated into objects
- Its risk is low
- It breaks down the system data through the use of Use Cases.

Structured

- It is process oriented
- Its main focus is process
- There is a separation of the systems data and processes
- Its risk is high
- It breaks down the system data through the use of Data Flow Diagram (DFD)