Product Design

According to the Institute of Electrical and Electronics Engineers (IEEE), design is both "the process of defining the architecture, components, interfaces, and other characteristics of a system or component" and "the result of [that] process". Prelude to system design is analysis which is mainly involved in documenting requirements in a form that can support design and development of the proposed system. This includes business processes as well as the system functionality supporting those processes.

Design activities link requirements analysis to implementation of those requirements. There are a number of recognized strategies to assist with the process of system design. However, functional decomposition and object-oriented design approaches are the most commonly recognized. Regardless of which approach is used it should describe the architecture of the system, how it is decomposed, organized, and any interfaces between components.
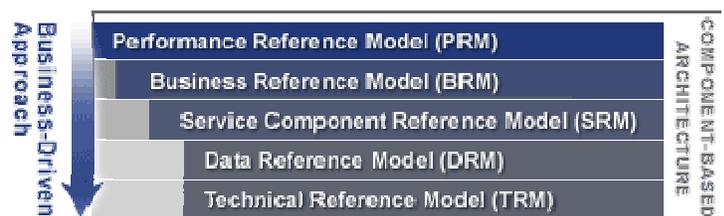
- Function oriented design decomposes requirements using a top-down approach, first identifying major system functions, then elaborating and refining them to a level appropriate for design
- Object oriented design Component-based design methodology that decomposes major system functions into objects rather than procedures
- Data-structure Centered Design - Designs a system starting from the data it manipulates rather than from the function it performs. The structures of the input and output data is first identified and then the control structure of the system is developed based on that data
- Integrated Definition is a modeling technique designed to capture the processes and structure of information in an organization through the use of sixteen methods each designed to capture a particular information through modeling processes

System design approaches may vary from organization to organization. However, regardless of which design approach is used a best practice approach to design is comprised of activities resulting in analysis of requirements to produce a description of the structure, organization, and operability of the system being developed. Design efforts decompose and describe system components to a level that allows for their construction. Any successful design approach must have documented guidelines designed to support at least three basic components:

1. Identification of classes and objects
2. Description and diagramming of relationships between classes and objects (logical blueprints)
3. Definition and diagramming of object behaviors by describing functionality of each class

All federal systems must demonstrate traceability to the Federal Enterprise Architecture (FEA). The FEA is an initiative led by Office of Management and Budget to identify opportunities to simplify processes and unify work across agencies. The FEA is designed using a collection of interrelated reference models to facilitate cross-agency analysis and the identification of duplicative investments, gaps, and opportunities. Its foundation is the Business Reference Model, which is made up of the following five reference models:

- Performance Reference Model - is a standardized framework to measure the performance of major IT investments and their contributions to program performance. This model helps produce enhanced performance information to improve strategic and daily decision-making; improves the alignment and better articulates the contribution of inputs to outputs and outcomes; and identifies performance improvement opportunities that span traditional

organizational structures and boundaries.

- Business Reference Model - is a function driven framework that describes the Lines of Business and Internal Functions performed by the Federal Government independent of the agencies that perform them. All IT investments (including non-major) are mapped to the BRM to identify collaboration opportunities.
- Service Component Reference Model - provides a common framework and vocabulary for characterizing the IT and business components that collectively comprise an IT investment. The SRM will help agencies rapidly assemble IT solutions through the sharing and reuse of business and IT components. A component is a self contained process, service, or IT capability with predetermined functionality that may be exposed through a business or technology interface.
- Data Reference Model - describes, at an aggregate level, the data, and information that supports government program and business line operations. This model enables agencies to describe the types of interaction and exchanges that occur between the Federal Government and citizens.
- Technical Reference Model - provides a framework to describe the standards, specifications, and

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technologies supporting the delivery, exchange, and construction of business (or service) components and eGov solutions. The Federal TRM unifies existing Department TRMs and electronic Government guidance by providing a foundation to advance the reuse of technology and component services from a government wide perspective.

Regardless of the method used, system design consists of at least three main activities that fit between the requirements phase and development/testing phase of a project's life cycle.

1. Architectural Design - Describes the top-level structure and organization of the system and how the system is decomposed and organized into its various components. It defines the internal structure of a system, the way it is constructed, its subsystems, components, and the relationships between them
   a. System Architecture - Is concerned with how the application interacts with other applications, not necessarily how the application itself works but, that the appropriate data is passed between applications correctly
   b. Application Architecture - Is concerned with how individual components of the system work together, security, best designs interfaces, etc
2. System Design - Produces a blueprint of the system to be developed by describing specific behaviors of each system component sufficiently to allow for their development
3. Documenting Design - Design documents that record how design elements will be decomposed, organized, and packaged

For more information and tools related to Product Design or the CDC Unified Process, please visit the CDC UP website at http://www.cdc.gov/cdcup/. ▐

Contact the CDC Unified Process Team

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