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What is structured analysis

Structured analysis emerged as a crucial tool in software engineering in the 1960s and 1970s. It involves breaking down complex systems into manageable components to develop specifications for computer programs and hardware configurations. The method became widely used in the 1980s and remains relevant today, despite its limitations. To tackle complexity, data flow diagrams are employed to represent system concepts as data and control terminology. Bubbles in these diagrams can become overwhelming; a solution is to define events from the outside world that require system responses, then assign bubbles accordingly. Data dictionaries and process specifications are also necessary for describing data and command flows. The structured analysis and design (SA/SD) approach was part of a broader collection of techniques developed in response to the challenges faced by the software industry during this period. Other notable developments include structured programming, stepwise design, Nassi-Shneiderman diagrams, Warnier/Orr diagrams, HIPO, and structured design methodologies like PRIDE and SDM/70. These innovations aimed to provide standard techniques for documenting requirements and designs in a rapidly growing and increasingly complex software landscape dominated by languages such as Cobol, Fortran, C, and BASIC. Jackson's structured programming emerged around 1975, while Michael A. Jackson developed Structured Analysis circa 1978 in collaboration with Tom DeMarco and Edward Yourdon. Others who made significant contributions include Gane & Sarson, McMenamin & Palmer, and Douglas T. Ross through his SADT (Structured Analysis and Design Technique). The Structured Method was developed by Edward Yourdon, while Tom DeMarco published "Structured Analysis and System Specification" in 1978. SSADM (Structured Systems Analysis and Design Method) was first presented by the UK Office of Government Commerce in 1983. Essential Systems Analysis was proposed by McMenamin and Palmer, and IDEF0 was developed by Douglas T. Ross based on SADT around 1985. The Hatley-Pirbhai modeling approach was defined by Derek J. Hatley and Imtiaz A. Pirbhai in "Strategies for Real-Time System Specification" (1988). Modern Structured Analysis was developed by Edward Yourdon, who also published his work in 1989. Information technology engineering emerged around 1990 with Finkelstein and James Martin's contributions. According to Hay (1999), structured techniques from the 1970s led to structured design, which further evolved into structured systems analysis. Structured analysis uses diagrams like structure charts for design and data flow diagrams for analysis to aid communication between users and developers, and improve analyst and designer discipline. During the 1980s, tools began to appear that automated diagram drawing and tracked elements in a data dictionary, eventually becoming known as CASE (Computer-Aided Software Engineering). Structured analysis creates a hierarchy using a single abstraction mechanism, employing IDEF (as seen in the figure), and starts with a purpose and viewpoint. It identifies overall functions and iteratively divides them into smaller functions while preserving necessary inputs, outputs, controls, and mechanisms to optimize processes. This method focuses on cohesion within functions and coupling between functions, leading to structured data. The functional decomposition approach of the structured method describes processes without system behavior, dictating structure in the form of required functions. It identifies inputs and outputs related to activities, making it an intuitive tool for communicating high-level processes and concepts at single system or enterprise levels. However, its applicability to object-oriented development is unclear, especially when discovering how objects might support commercially prevalent functions. In contrast to IDEF, UML has different characteristics. interface design with multiple abstraction mechanisms useful in describing service-oriented architectures (SOAs). Structured analysis views a system from the perspective of data flowing through it. The function of the system is described by processes that transform data flows. Structured analysis uses information hiding through successive decomposition, allowing focus on pertinent details and avoiding irrelevant confusion. The system design involves context understanding, with system context diagrams aiding in software engineering comprehension. A data dictionary is essential for database table design, extracting metadata, and entity relationship diagrams. It contains basic organization details, file lists, record counts, and field names. Database management systems often hide data dictionaries to prevent user errors. Without a data dictionary, accessing database data becomes inaccessible. An authoritative document catalogs database structure, tables, fields, and encoding details. A well-designed data dictionary promotes consistency across complex databases or federated collections. Data flow diagrams represent data flow through information systems, contrasting with system flowcharts. They show data processing, system division, and data exchange between parts. Compared to the new system's data flow diagrams, we can draw comparisons to implement a more efficient system. These diagrams provide users with a visual representation of how their input affects the overall structure of the system. By examining these charts, developers can determine how any system is developed. Structure charts are used in structured programming to organize program modules into a tree-like structure. Each module is represented by a box containing its name, and the relationships between modules are visualized through this chart. This design tool helps programmers divide and conquer large software problems by breaking them down into smaller parts that can be understood by humans. Structured design focuses on developing modules and synthesizing these modules in a hierarchical framework. Two key principles guide optimal module structure and interfaces: cohesion, which groups functionally related processes into modules; and coupling, which refers to the flow of information between modules. By minimizing interfaces and complexity, software development becomes more efficient. Larry Constantine developed structured design in the late 1960s and refined it with collaborators in the 1970s. Another approach was proposed by Page-Jones (1980), which involves three main objects: structure charts, module specifications, and data dictionaries. This stage of the software development lifecycle enables automatic generation of data type declarations and procedure templates. #### With Data Flow Diagrams, the Following Aspects Are Included: - Choosing Bubbles Appropriately - Partitioning Bubbles in a Meaningful and Mutually Agreed Upon Manner - Documentation Size Needed to Understand the Data Flows - Data flow diagrams are strongly functional in nature and thus subject to frequent change. - Although "data" flow is emphasized, "data" modeling is not, resulting in little understanding of the system's subject matter. - Customers often struggle to follow how the concept is mapped into data flows and bubbles. - Designers must shift the DFD organization into an implementable format. - Event partitioning - Flow-based programming - HIPO (Hierarchical Integrated Programming Output) - Jackson structured programming - Prosa Structured Analysis Tool - Soft systems methodology - Tricia Gilbert's evaluation criteria for technology assessment - FAA System Safety Handbook's criteria for assessing technology - Edward Yourdon's strategies for managing structured techniques in software development - Dave Levitt's introduction to structured analysis and design Structured Analysis and Design (SA/SD) is a method used to understand and develop complex systems, especially computer programs. It was widely used from the 1970s to the 1990s. The goal of SA/SD is to create robust and maintainable systems by breaking them down into smaller components. This approach focuses on three main aspects: solidity, pliability, and maintainability. SA/SD involves two phases: Structured Analysis and Structured Design. In the first phase, the problem is analyzed, and requirements are gathered. Then, in the second phase, the system is designed to meet those requirements. The method emphasizes structured programming, which means breaking down a complex system into smaller, more manageable pieces. SA/SD involves several techniques for designing and developing software systems in a systematic way. One key concept is Functional Decomposition, where the system is divided into smaller functions or components that work together seamlessly. To break down a complex system into smaller, more manageable parts, System Analysis and Design (SA/SD) uses several techniques. First, it identifies the main functions of the system and breaks them down into smaller, independent functions. Data Flow Diagrams (DFDs) help model how data moves through the system, while a data dictionary provides clear definitions for all data elements. Structured design is used to develop the system's architecture and components, and modular programming helps break down code into manageable modules. Some benefits of SA/SD include its emphasis on structured design and documentation, which can improve clarity and maintainability. However, it also has limitations, such as being rigid and inflexible, making it difficult to adapt to changing requirements or technological trends. Additionally, SA/SD may not be well-suited for complex, dynamic systems that require more agile development methodologies. The SA/SD process involves several steps: gathering requirements from stakeholders, analyzing those requirements to identify major components and data flows, creating a data model to represent the system's data, modeling processes using flowcharts and DFDs, designing inputs and outputs, including user interfaces and reports, and finally, implementing and testing the system. SA/SD Development Method Overview The SA/SD method focuses on breaking down complex systems into smaller components, simplifying understanding and management. Based on Data Flow Diagrams, it emphasizes a well-defined system boundary, contrasting with JSD's complexity without graphical representation. SA/SD Combines SAD: Focusing on 3 key points: System Process Technology **Analysis Phase:** - Utilizes Data Flow Diagram, Data Dictionary, State Transition diagram, and ER diagram. - Incorporates Boolean operators for multiple data flows & or inputs. Example: Data flow diagram describes how data flows through the system, using operators like AND for input/output processes. Data Dictionary: Defines content not described in DFD, including data store meanings and descriptions of data elements flowing between processes. State Transition Diagram: Specifies function execution time, data access triggered by events, object states, event conditions, and activities during object life. ER Diagram: Describes relationships between data stores, used in database design. **Design Phase:** - Involves Structure Chart and Pseudo Code. - Created from Data Flow Diagrams. Structured Analysis (SA) is a time- and cost-independent tool with no error-checking technique. Its modules are arranged arbitrarily, allowing analysts to choose any process from a Data Flow Diagram as the central transform based on their perception. The structured chart is challenging to amend, verify, maintain, and check for completeness and consistency. SA/SD (Structured Analysis and Structured Design) has several advantages. It emphasizes breaking down complex systems into smaller components, making it easier to understand and manage. This approach also provides a common language and framework for communication, improving stakeholder collaboration and ensuring that the system meets their needs. Additionally, SA/SD offers improved maintainability, better testability, and clarity. However, SA/SD has some disadvantages. It can be time-consuming, especially for large systems, as it requires significant documentation and analysis. The process is also inflexible, making it challenging to make changes once the design is completed. Furthermore, SA/SD is not well-suited for iterative development, as it is designed to be completed in a single pass. Structured Analysis is an essential resource for Software Development exam preparation. These study notes provide experts' curated content on essential topics and concepts, enhancing learning efficiency and effectiveness. The guide provides a detailed understanding of the concept, helping students plan their preparation effectively. With this indispensable resource, you'll achieve your desired results and master the topic with ease. This comprehensive document covers all aspects related to Structured Analysis, including exam syllabus, recommended books, and study materials. It also includes practice papers and question papers to assess your progress and provides valuable tips for tackling the exam strategically. Access to Toppers' notes gives you an edge in understanding complex concepts. Whether you're a beginner or aiming for advanced proficiency, this guide is your ultimate resource for success.

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