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Chapter 10:
The Traditional Approach to Design

Systems Analysis and Design in a Changing World, 3rd Edition

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Learning Objectives

- Develop a system flowchart
- Develop a structure chart using transaction analysis and transform analysis
- Write pseudocode for structured modules

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Overview

- Traditional approach to designing software
  - Overview of structured models, model development process, related terminology
  - How data flow diagrams are annotated with automation boundary information
  - How analysis phase models are transformed into design models using system flowcharts, structure charts, and module pseudocode
  - Integration into other design phase activities
  - Applying approach to a three-layer architecture

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The Structured Approach to Designing the Application Architecture

- Application software programs
  - Designed in conjunction with database and user interface
  - Hierarchy of modules
- Design internal logic of individual modules
- Top-down approach
  - DFDs with automation boundaries
  - System flowcharts, structure charts, pseudocode

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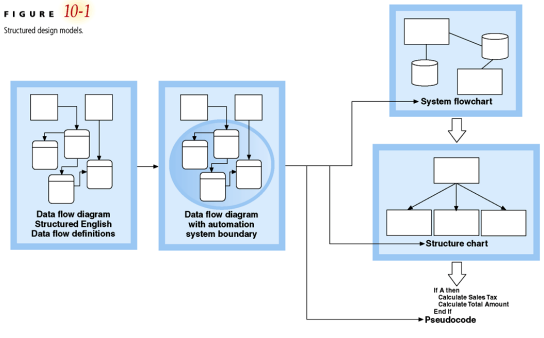
Structured Design Models

FIGURE 10-1
Structured design models.



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The Automation System Boundary

- Partitions data flow diagram processes into manual processes and automated systems
- Processes can be inside or outside boundary
- Data flows can be inside and outside of boundary
  - Data flows that cross system boundary represent inputs and outputs of system
  - Data flows that cross boundaries between programs represent program-to-program communication

DFD with Automation System Boundary

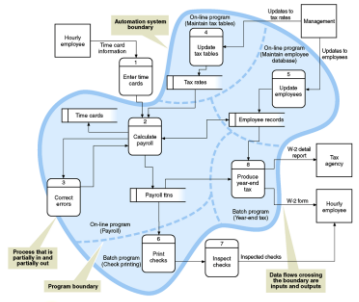


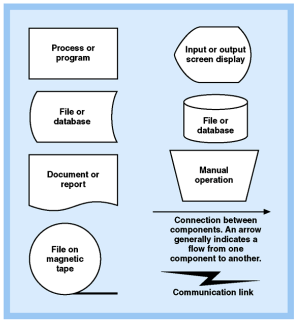
FIGURE 10-2
The data flow diagram with an automation system boundary.

The System Flowchart

- Representation of various computer programs, files, databases, and associated manual processes that make up complete system
- Frequently constructed during analysis activities
- Graphically describes organization of subsystems into automated and manual components
- Can show type of transaction processing system
  - Batch
  - Real time

Common System Flowchart Symbols

FIGURE 10-3
Common system flowchart symbols.



Sample System Flowchart for Payroll System

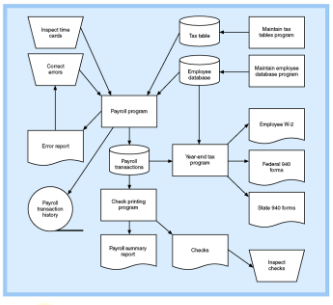


FIGURE 10-4
A sample system flowchart for a payroll system.

System Flowchart for RMO

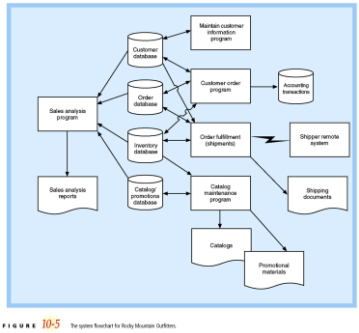


FIGURE 10-5
The system flowchart for Rocky Mountain Outfitters.

The Structure Chart

- Describes functions and subfunctions of each part of system
- Shows relationships between modules of a computer program
- Simple and direct organization
  - Each module performs a specific function
  - Each layer in a program performs specific activities
- Chart is tree-like with root module and branches

A Simple Structure Chart for the Calculate Pay Amounts Module

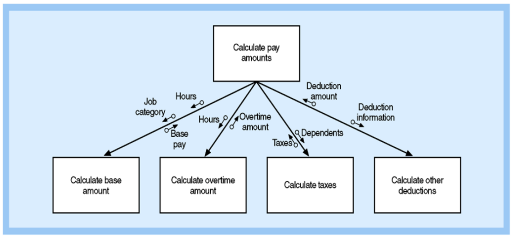
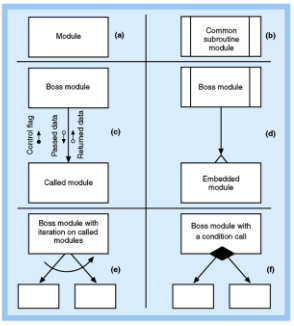


FIGURE 10-6
A simple structure chart for the *Calculate pay amounts* module.

Structure Chart Symbols

FIGURE 10-7
Structure chart symbols.



Structure Chart for Entire Payroll Program

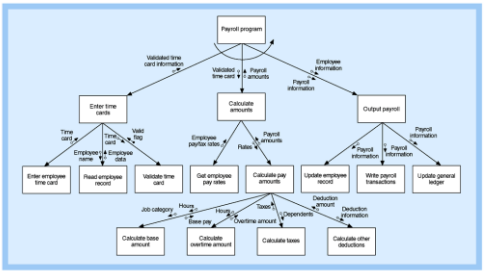


FIGURE 10-8
A structure chart for the entire Payroll program.

Developing a Structure Chart

- Transaction Analysis
  - Uses system flow chart and event table inputs
  - Upper-level modules developed first
  - Identifies each transaction supported by program
- Transform Analysis
  - Uses DFD fragments for inputs
  - Computer program 'transforms' inputs into outputs
  - Charts have input, calculate, and output subtrees

Event-partitioned DFD for the Order-Entry Subsystem

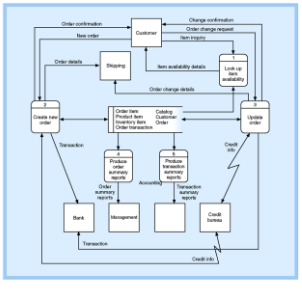


FIGURE 10-9

High-level Structure Chart for the Customer Order Program

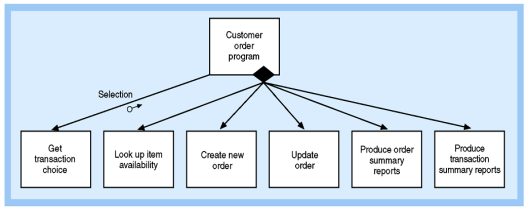


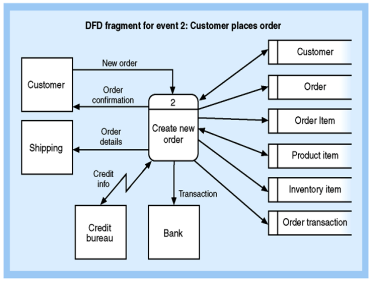
FIGURE 10-10
High-level structure chart for the Customer order program.

Steps to Create a Structure Chart from a DFD Fragment

- Determine primary information flow
  - Main stream of data transformed from some input form to output form
- Find process that represents most fundamental change from input to output
- Redraw DFD with inputs to left and outputs to right – central transform process goes in middle
- Generate first draft structure chart based on redrawn data flow

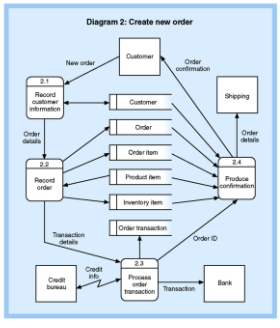
The *Create New Order* DFD Fragment

FIGURE 10-11
The Create new order DFD fragment.



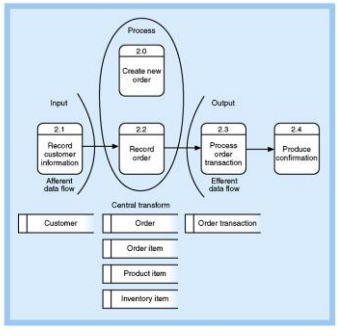
Exploded View of Create New Order DFD

FIGURE 10-12
Exploded view of the Create new order DFD.



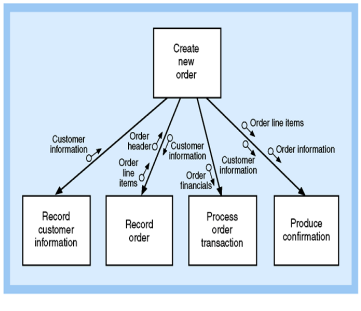
Rearranged Create New Order DFD

FIGURE 10-13
Rearranged view of the Create new order DFD.



First Draft of the Structure Chart

FIGURE 10-14
First draft of the structure chart.

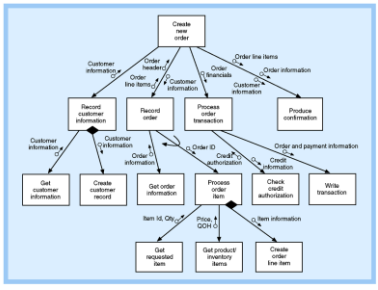


Steps to Create a Structure Chart from a DFD Fragment (continued)

- Add other modules
  - Get input data via user-interface screens
  - Read from and write to data storage
  - Write output data or reports
- Add logic from structured English or decision tables
- Make final refinements to structure chart based on quality control concepts

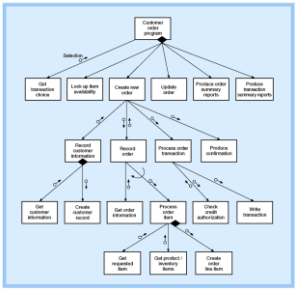
The Structure Chart for the *Create New Order* Program

FIGURE 10-15



Combination of Structure Charts

FIGURE 10-16

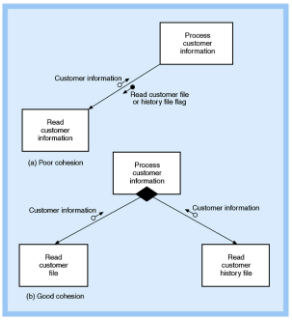


Evaluating the Quality of a Structure Chart

- Module coupling
  - Measure of how module is connected to other modules in program
  - Goal is to be loosely coupled
- Module cohesion
  - Measure of internal strength of module
  - Module performs one defined task
  - Goal is to be highly cohesive

Examples of Module Cohesion

FIGURE 10-17



Module Algorithm Design: Pseudocode

- Describes internal logic of software modules
- Variation of structured English that is closer to programming code
- Syntax should mirror development language
- Three types of control statements used in structured programming:
  - Sequence: sequence of executable statements
  - Decision: if-then-else logic
  - Iteration: do-until or do-while

Integrating Structured Application Design with Other Design Tasks

- Structure chart must be modified or enhanced to integrate design of user interface and database
  - Are additional modules needed?
  - Does pseudocode in modules need modification?
  - Are additional data couples needed to pass data?
- Structure charts and system flowcharts must correspond to planned network architecture
  - Required protocols, capacity, and security

Three-Layer Design

- Three-layer architecture:
  - View layer, business logic layer, and data layer
- Structure charts and system flowcharts describe design decisions and software structuring
- Employs multiple programs for user interface, business logic, and data access modules
- Modules in different layers communicate over real-time links using well-defined protocols

System Flowchart Showing Three-Layer Architecture for Customer Order

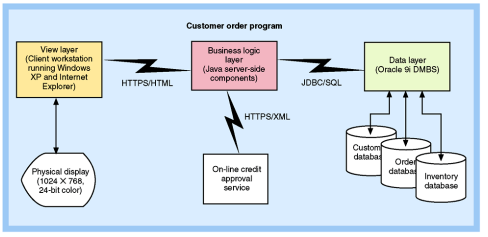


FIGURE 10-19

A system flowchart showing three-layer architecture for the *Customer order* program.

Structure Chart Showing Three-Layer Architecture for Create New Order

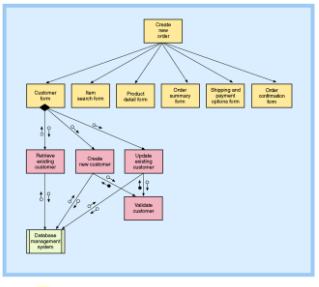


FIGURE 10-20

Summary

- For traditional structured approach to systems design, primary input is data flow diagram
  - DFD is enhanced by adding system boundary
  - Designer describes processes within each DFD boundary using one or more structure charts
- Structure charts developed using:
  - Transaction analysis – multiple transaction types
  - Transform analysis – single transaction from input to output

Summary (continued)

- Structure charts may be based on three-layer architecture
  - Modules will be clearly identified by layer
  - Structure chart may be decomposed if layers execute on multiple systems
- Structured design may also include:
  - System flowcharts to show data movement
  - Module pseudocode to describe internal logic of structure chart module