

Systems Development Life Cycle & Prototyping



Groups Involved in Systems Development



- * **Organizational Groups**
 - * Senior management
 - * Professional experts
 - * Middle management
 - * Supervisory management
 - * Factory/clerical workers
 - * **Information Systems Groups**
 - * Senior management
 - * Project management
 - * Senior analysts
 - * Systems analysts
 - * Programmers
- | |
|--|
| Funding and support |
| Legal, procurement, and organizational expertise |
| Entry and support |
| Entry & critical support |
| Information, job & task details |
| Coordinates system development and planning |
| Manages a specific project |
| Coordinates systems analysts, designers, & procurement personnel |
| Determine new system requirements, concepts and procedures |
| Technical realization of new system |

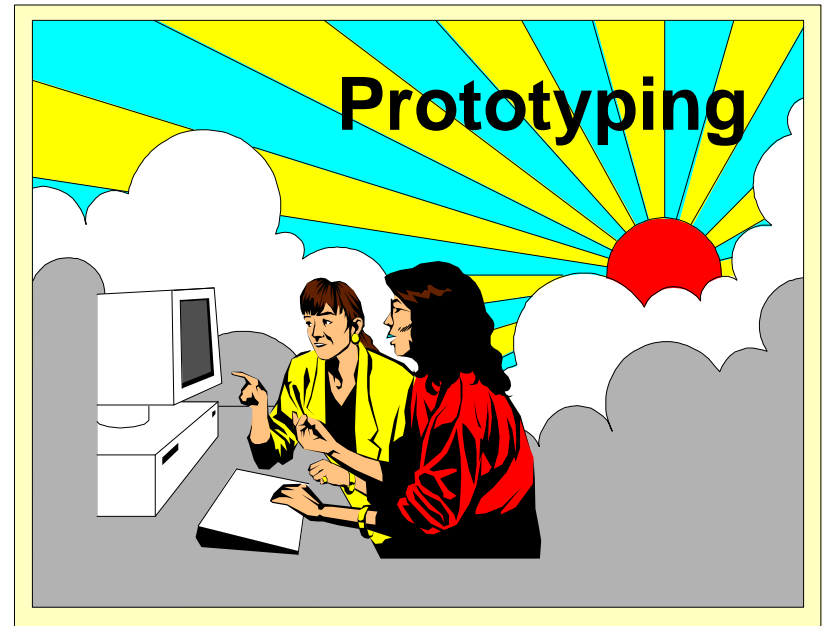
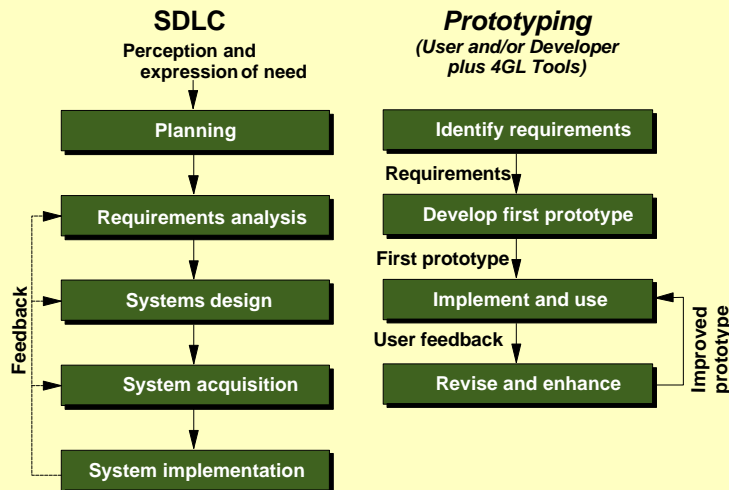
Approaches to Systems Development (Methodologies)

- * **Traditional Systems Development Life Cycle (SDLC)**
 - System under study is developed in stages
 - Extensive use of professional development personnel
- * **Prototyping**
 - Building small models of some elements and gradually expanding them from user experience
 - Extensive use of professional DP and 4GL tools
 - Used especially for decision support systems
- * **Alternate Systems Development Life Cycle (SDLC)**
 - Front end is prototyped; back end traditional process
- * **End-User Computing**
 - End user takes primary initiative in development process

Traditional Systems Development Life Cycle (SDLC) Process

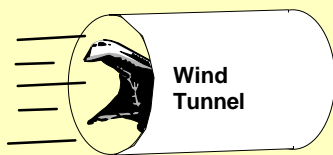
- **Planning**
- **Requirements Analysis**
 - Understand & document the existing system
 - Determine requirements for new system
- **Systems Design**
 - Develop overall plan for new system
- **System Acquisition**
 - Acquire necessary hardware & software
- **System Implementation**
 - Build & put new system into use

Traditional SDLC vs. Prototyping

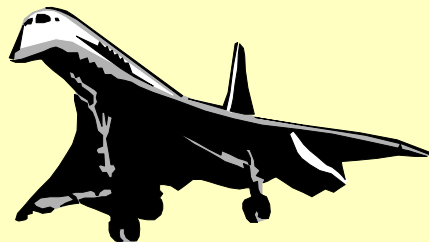


What is Prototyping?

Creating the system in little, a version with certain functions in essential operating condition in order to experiment with the requirements and design of the final product






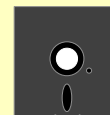
Prototype



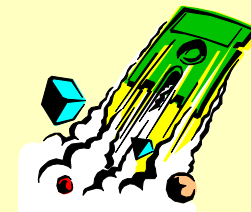
Real World System

What is Prototyping?

-  Building small models of certain critical elements and gradually expanding on these basic elements based on experience
-  Extensive use of professional IS, CASE, DBMS, and 4GL tools
-  Used especially for EUC and decision support systems







Prototype



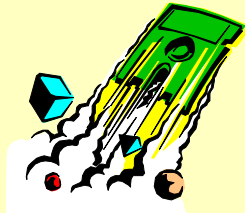
Real World System

What is Prototyping?

-  A live working system (not just an idea on paper)
-  A system that can itself become the production system
-  An experimental system built by trial and error
-  A system built quickly and inexpensively

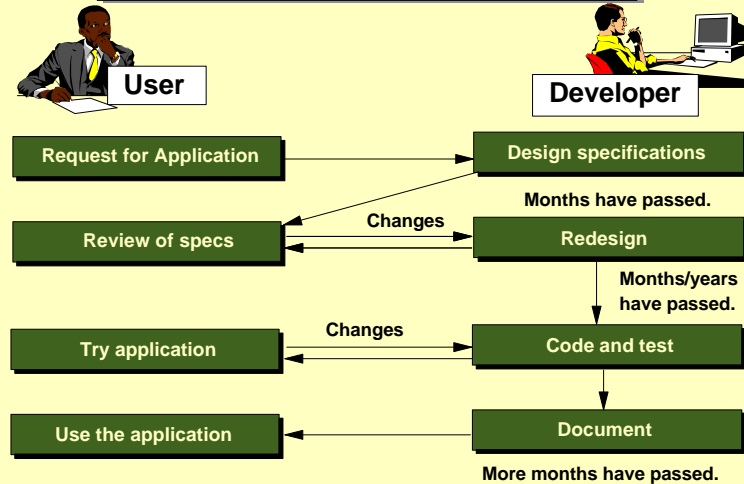


Prototype

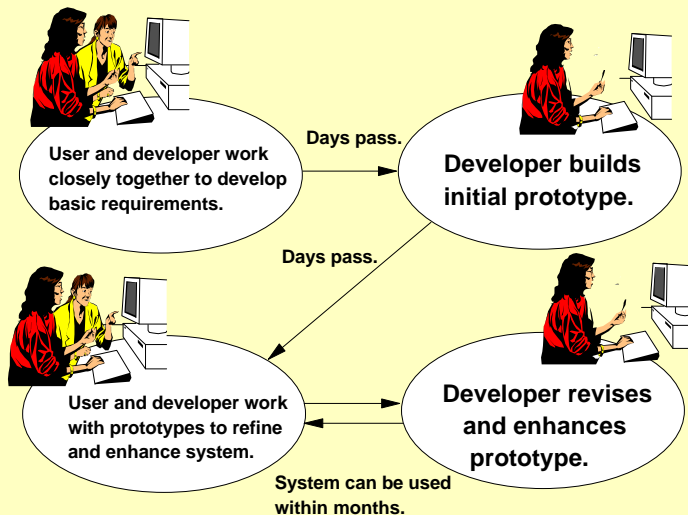


Real World System






Traditional SDLC vs. Prototyping



Prototyping vs. Traditional SDLC



SDLC vs Prototyping Circumstances favoring SDLC

-  There is significant experience with the type of system to be built
-  Important system features can be easily identified
-  Data requirements can be identified in advance
-  Management requires a comprehensive "picture" of the new system before giving approval
-  The development staff is not experienced with 4GL's or prototyping

SDLC vs Prototyping Circumstances favoring Prototyping

- ➡ Users do not have a feel for the information or systems capabilities required
- ➡ Rapidly changing user needs
- ➡ Little experience in delivering the type of system requested
- ➡ High risk of delivering the wrong system
- ➡ High level of user involvement is required for success
- ➡ Numerous alternative design strategies must be tested
- ➡ System must be developed quickly and/or at the lowest possible cost

Traditional SDLC



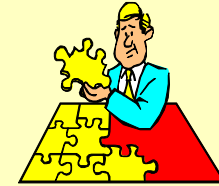
Planning

Requirements Analysis

Systems Design

Systems Acquisition

Systems Implementation



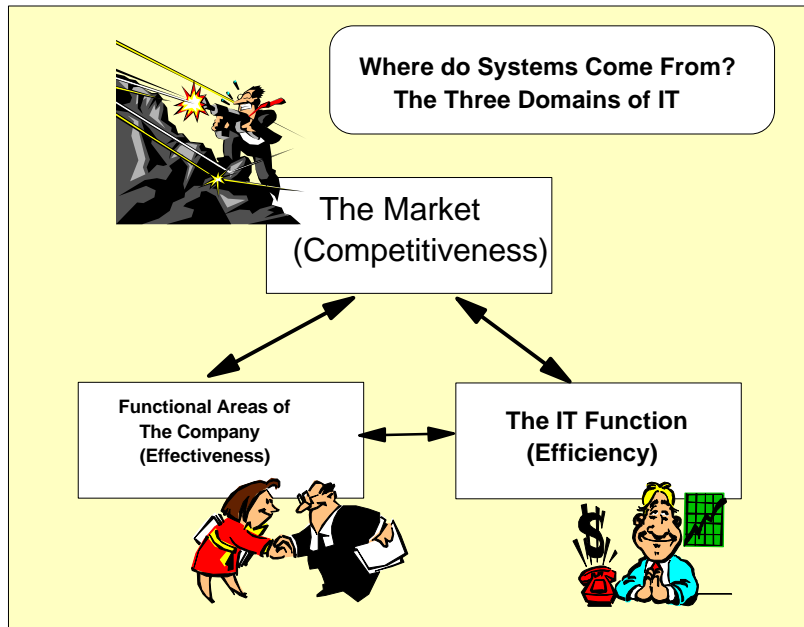
Traditional SDLC Planning

- * Objectives
 - * Determine project priority by defining problem or opportunity
- * Steps to Take
 - * Determine nature of problem and scope of project
 - * Determine possible solutions
 - * Assess project feasibility
 - operational
 - economic
 - technical
 - * Report to management
 - Cost/benefit data, prelim. organizational data, system documentation
 - * Mgmt prioritizes projects; decides to proceed or terminate

Ideas for New Systems: Determining Nature of Problem

- ✓ User Demands
 - Problems with existing systems suggest new systems; ideas for productivity gains
- ✓ IS/IT Function (Emerging Technologies Group/Scanning Group)
 - New technologies offering potential
 - ▶ Technological Push
- ✓ Senior Management
 - Strategic Planning
 - Threat of competitors
 - ▶ Strategic or Demand Pull





Who is particularly competent to identify areas for greater **Efficiency**?

- To reduce unit production and sales costs as much as constraints allow (e.g., quality)
- To improve capacity planning
- To optimize distribution systems
- To reduce turnaround and cycle times
- To improve scheduling
- To improve inventory control and manufacturing resource planning

The IS/IT Function!



Who is particularly competent to identify areas for greater**Effectiveness**?

- To ensure that all tasks are accomplished thoroughly
- To maximize coverage of markets for sales and service
- To respond to all relevant inquiries

Users from Functional Areas
of the Company!



Who is particularly competent to identify areas for greater**Competitiveness**?

- To scan the competitive environment outside the firm
- To identify and track threats and opportunities to do things differently (e.g., differentiate products and services)
- To do different things (e.g., new line of business)
- To anticipate the consequences of change

Senior
Management!



Planning for different Types of IT/IS

- Large scale, company wide systems for transaction processing typically use the planning process called the Systems Development Life Cycle (SDLC)
 - this includes systems that are strategic in nature as well as those that enhance efficiency and effectiveness
- Smaller impact systems affecting an individual's work or a department's are developed in a different fashion
 - these are typically called End User Computing (EUC)



Traditional Systems Development Life Cycle (SDLC) Planning Process

- **Planning**
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Advantages of using Planned System Approach to Systems Development

- * **Improved understanding and tracking of projects**
- * **Ease of collection of performance data to aid in future project planning and estimating**
- * **Users would have a better idea of what has to be done to accomplish a systems project**

Planning in the SDLC

- **Who does it?**
 - Steering committees with representation from functional areas are common
 - An IS/IT Staff Planning function is also common
- **Tasks of Planning Group**
 - Selection of projects is made, usually on the basis of cost-benefit or value analyses
 - Prioritization of projects is critical
 - Scheduling/budgeting of projects is final responsibility

Planning in the SDLC

- Project Planning
 - Choosing project leader
 - Choosing team members
 - Scheduling timelines, budgets, tasks
 - Planning for training
 - Planning for conversion cutover
 - Post implementation evaluation

Traditional SDLC

Planning



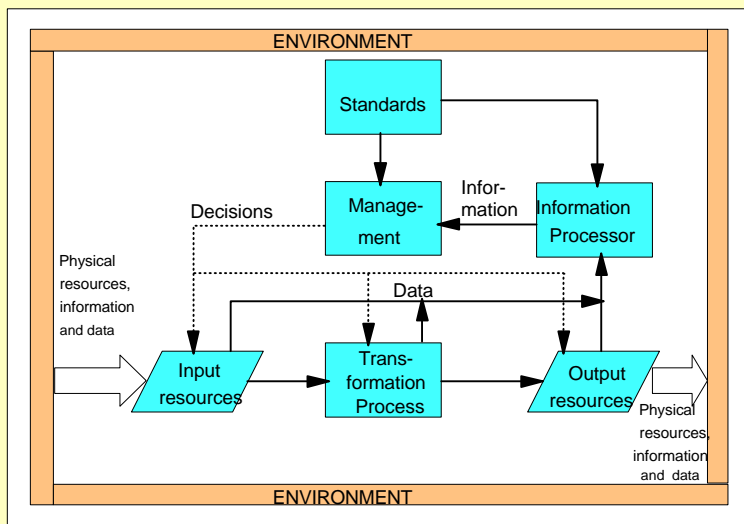
**Requirements Analysis
(Systems Analysis or Information
Requirements Determination, "ISD")**

Systems Design

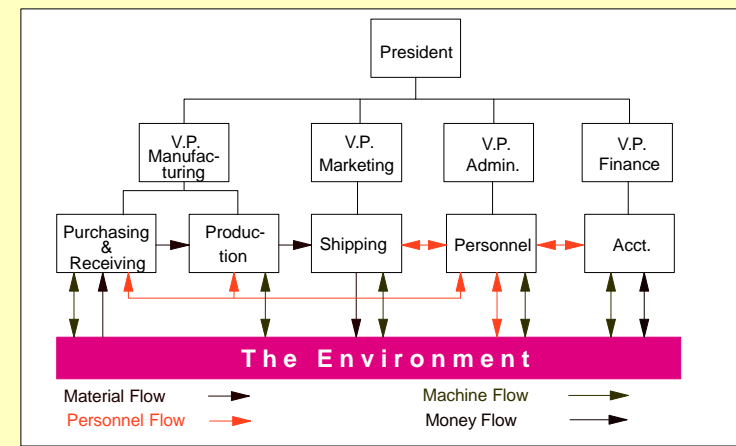
Systems Acquisition

Systems Implementation

General Systems Model of Firm



Information System as Symbolic Representation of Physical Resource Flows: *Information as 5th Resource of the Firm*



Systems Development Concepts

* Systems Analysis

Taking things apart to fully understand them

- * Define overall objectives of system
- * Identify the operation and problems of existing system
- * Identify the requirements and objectives of the new system
- * Identify areas of required organizational change

* Systems Design

Establishing a plan to put things back together in a more satisfactory manner (Synthesis)

- * Devise detailed system solutions
- * Deliver the functions required by the analyst and, ultimately, by the user
- * Manage the technical realization of systems

System Developer Skills

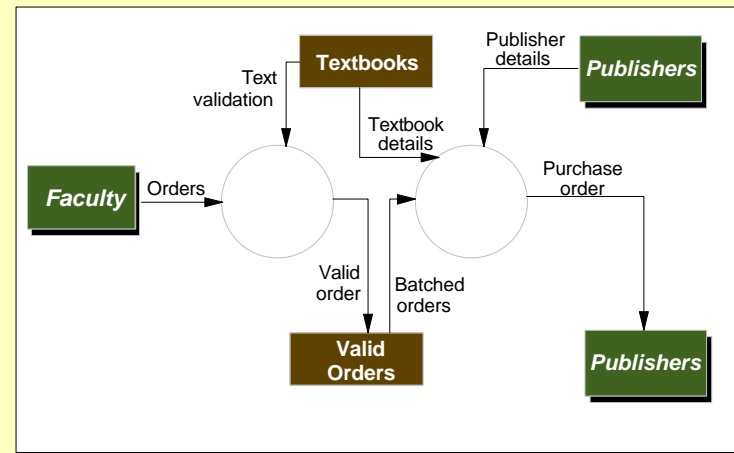
- * Technological Skills
- * Problem definition skills
- * Communication skills
- * Organizational skills
- * Ability to work with people in the organization
- * Understanding of organization

System Developer Tools

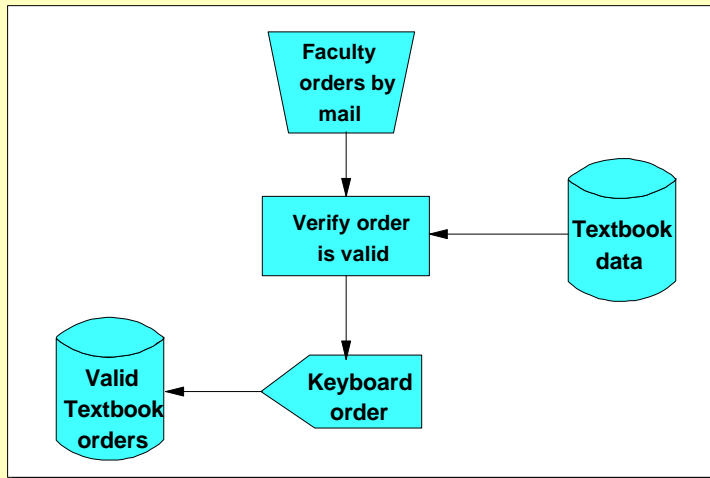
* Diagrams

- * Data flow diagrams (DFD's) & Object-oriented diagrams
- * System Flowcharts
- * Structured analysis & design technique (SADT)
- * Systematic Activity Modeling Method (SAMM)
- * Logical Data Structure Models (LDS's)
- * Data Dictionary
- * Computer-Aided Software Engineering (CASE)

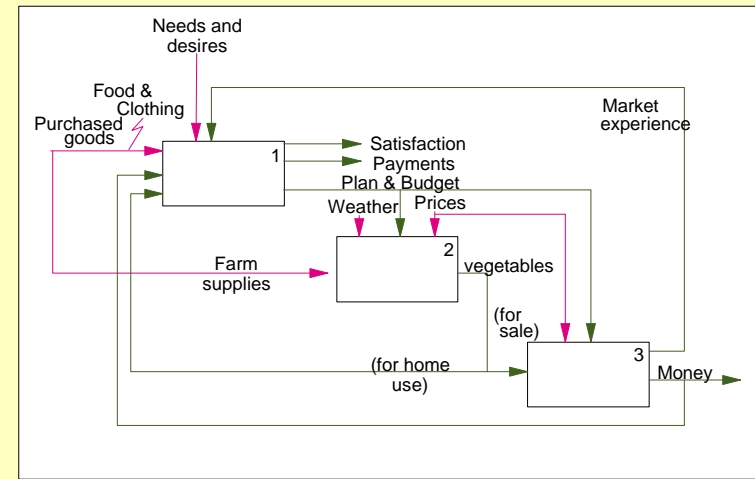
Data Flow Diagram (DFD)



System Flow Chart

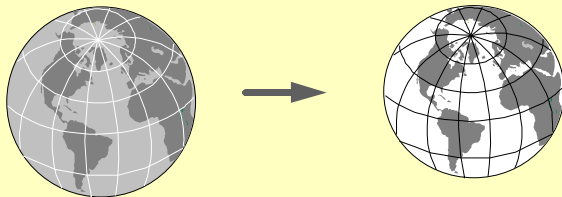


SADT Activity-flow Diagram



Object-Oriented Paradigm

- ✓ Objects are????
 - representations of real world objects, transactions, states-of-being, activities, people, etc. in computer systems/applications/programs



Objects & Classes ...

OBJECT STATE

- u Attribute values
- u Service/capability/behavior/methods

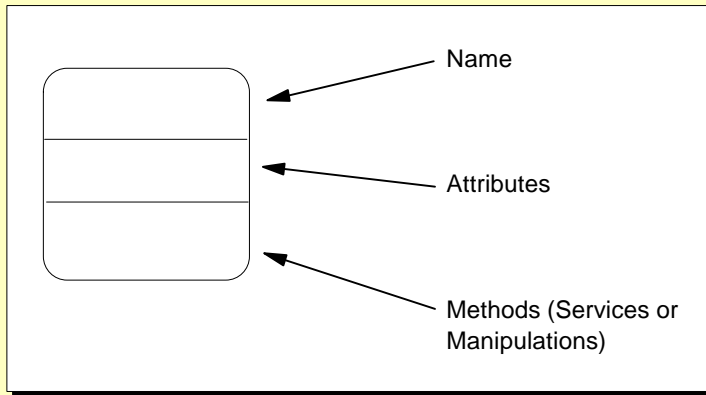


King, Jr. (name)
 7/4/42 (birth date)
 3 Main St. (address)
Dragon Restaurant (employer)
 Sichuan dishes (specialty)
 Can cook
 Manage kitchen staffs
 Request supplies

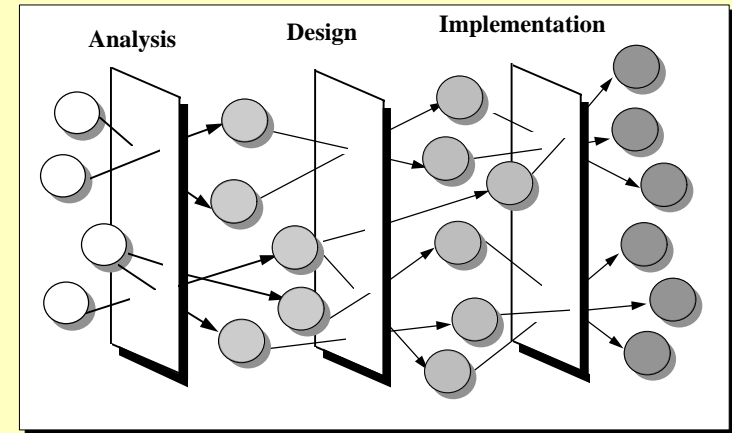


Smith (name)
 3/8/60 (birth date)
 21 Peachtree (address)
Account Manager (title)
Global Bank (employer)
 Special in account management
 Approve loan application
 Supervise staffs

Class...Class-&-Object Models



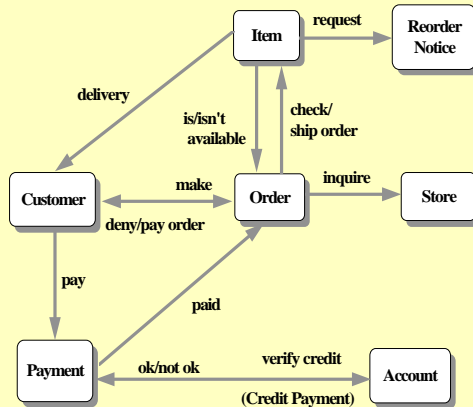
Uniform Representation



OOA/OOD

© Hong & Wei

MM Store – Methods



Item
SKUNumb
Qty-On-Hand
ReorderPt
YTD Sold
Supplier
Price
Add-item
Remove-item
Check-local-stock
Check-remote-stock
Calculate-YTD-total
Ship-item
Reduce-stock
Request-reorder
Receive-new-stock

SDLC - Requirements Analysis

- * **Objective**
 - * Understand & document the existing system
 - * Determine requirements of the new system
- * **Activities**
 - * Collect data concerning existing system
 - Study existing documents
 - Questionnaires
 - Interviews
 - Personal observation
 - * Analyze and determine information system requirements
 - * Report to management
 - Set of user reviewed/accepted models of the system
 - Organizational needs that will be served by new system
 - More refined cost/benefit data

Documentation

Written Instructions associated with using, operating, or developing a computer system

- * Prepared at ALL phases of development
- * Flowcharts, DFD's, OODs, user manuals, system manuals, sample input/output forms
 - * Project Documentation
 - * System Documentation (DFDs, ERs, etc.)
 - * Program Documentation
 - User documentation
 - Programmer documentation
 - Operator documentation

Traditional SDLC

Planning

Requirements Analysis



Systems Design

Systems Acquisition

Systems Implementation

SDLC - Systems Design

Objective

- * Develop overall plan or model for the system

Activities

- * Review requirements
- * Design logical (conceptual) system
- * Design physical system
- * Report to management
 - * Refined cost/benefit
 - * Design recommendations
 - * Plan for remaining development activities

Factors Shaping Design

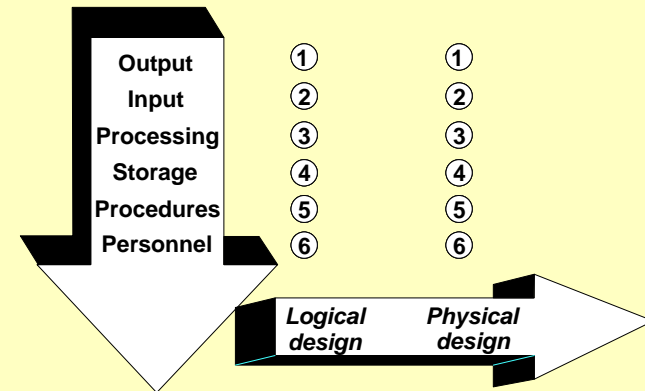
What makes one design superior to others

- * Ease and efficiency with which it fulfills user requirements within a specified set of technical, organizational, financial, and time constraints
- * Each design is balance between:
 - * User information requirements
 - * System requirements
 - * Information processing technology
 - * Systems development methodologies
 - * Organizational characteristics

System Design Components

- * Output ①
- * Input ②
- * Processing ③
- * Storage ④
- * Procedures ⑤
- * Personnel ⑥

Steps in Design



Output Specification

- * Content
- * Output Volume
- * Timeliness
- * Media
- * Format

Input Specification

- * Content
- * Timeliness
- * Media
- * Format
- * Input volume

Processing Specifications

Design of the automated or manual procedures or activities through which data are transformed from input to output

- * **Basic functions and capabilities** applications software must possess
- * **Degree of processing** the system will need to handle
- * **Systems software and Computing Hardware**
 - * *Computational environment, User volume, Throughput*
- * **Create software in-house or acquire from vendor**
 - * *Make-or-buy decision*

Storage Specifications

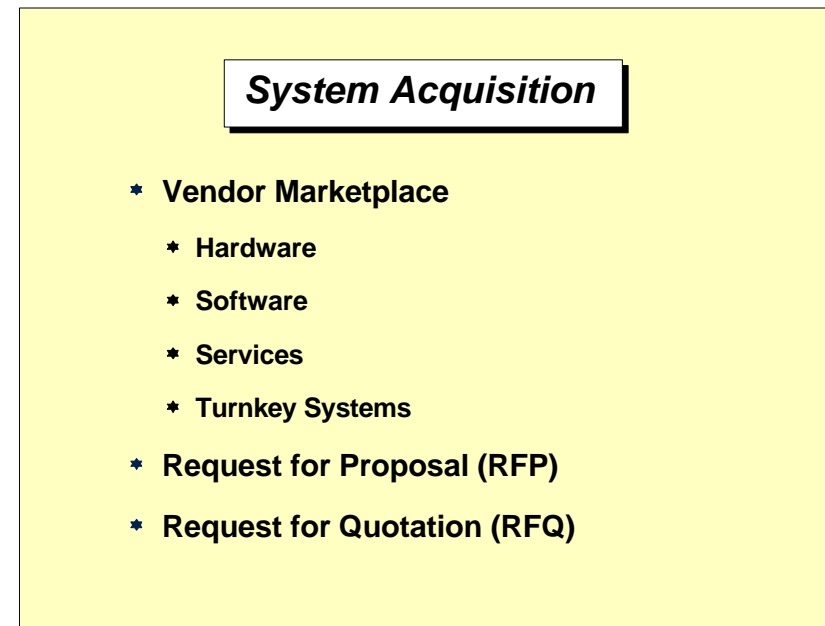
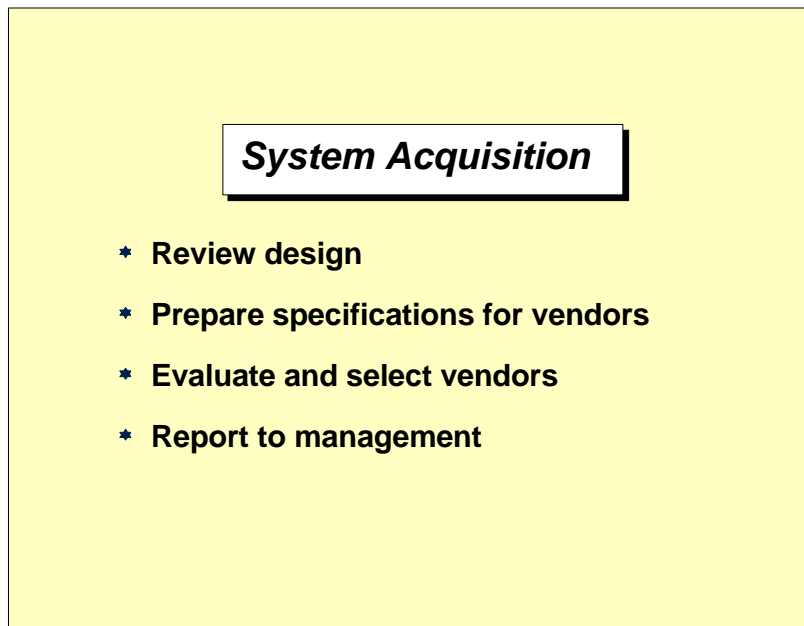
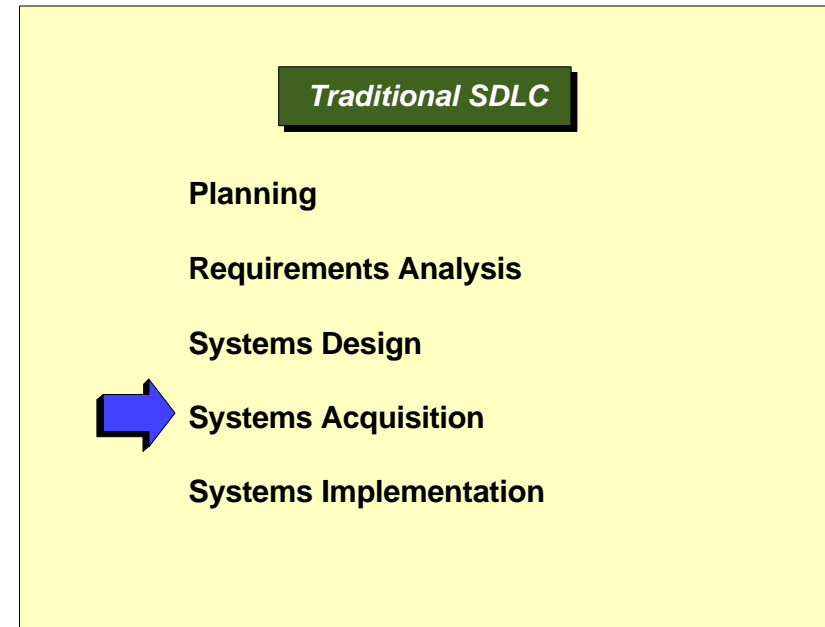
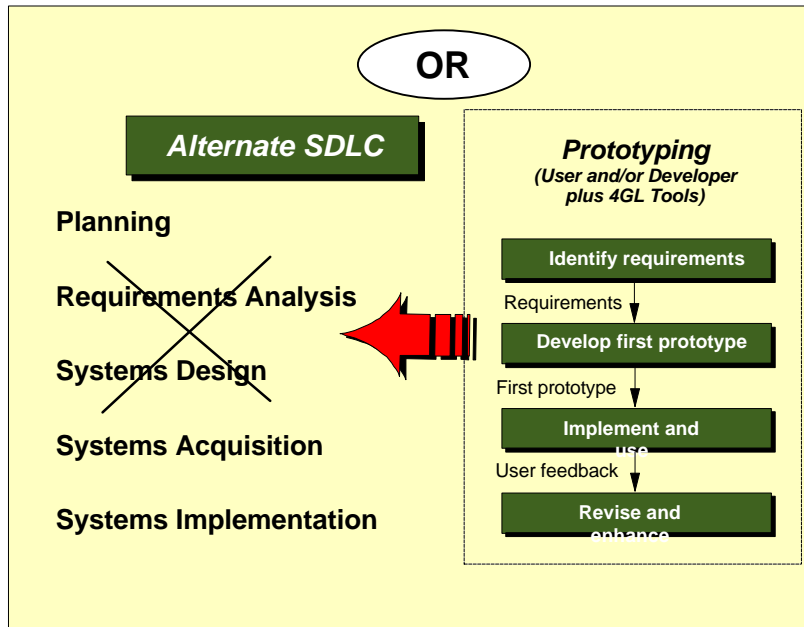
- * **Access and Organization of data**
- * **Storage volume**
- * **Media**

Procedures Specification

- * **Work Procedures**
- * **Control Procedures**
 - * Security controls
 - * Accuracy controls
 - * Privacy controls

Personnel Specifications

- * **Work Description**
- * **Skills/Qualifications**
- * **Training**



Using Vendor Applications Packages

Advantages

- * Better quality software and documentation
- * Overall cost is lower & is known
- * Product enhancements by vendor
- * In-house development risks are avoided
- * Quicker development
- * Lower training and support costs
- * Less need for analyst / programmer support

Disadvantages

- * There may be no appropriate package available
- * Less control over applications development
- * Less flexibility in meeting system needs
- * Package may not interface with existing applications

Traditional SDLC

Planning

Requirements Analysis

Systems Design

Systems Acquisition

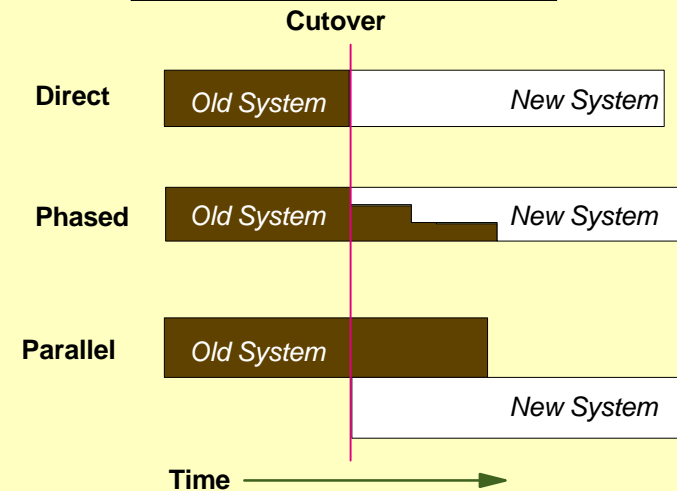


Systems Implementation

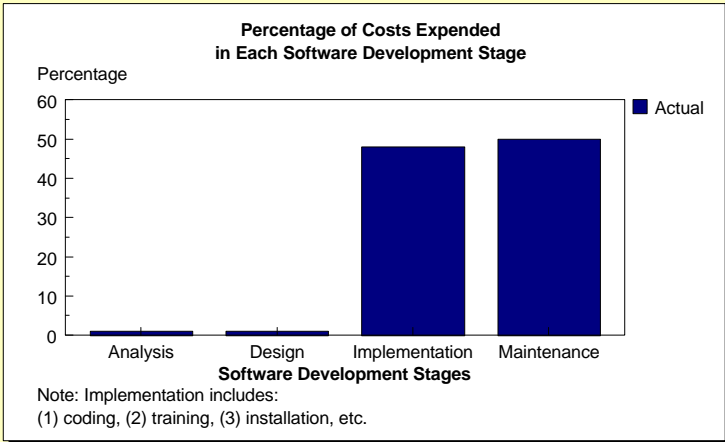
Systems Implementation

- * Schedule implementation tasks
 - * CPM, PERT, Gantt Charts
- * Code, debug and test programs
- * Train personnel
- * Convert to a new system
 - * direct, phased, parallel
- * Post-implementation review
 - * formal impact study, regular audit, performance monitoring
- * On-going system maintenance

Conversion Approaches



Actual Allocation of Effort in Software Development



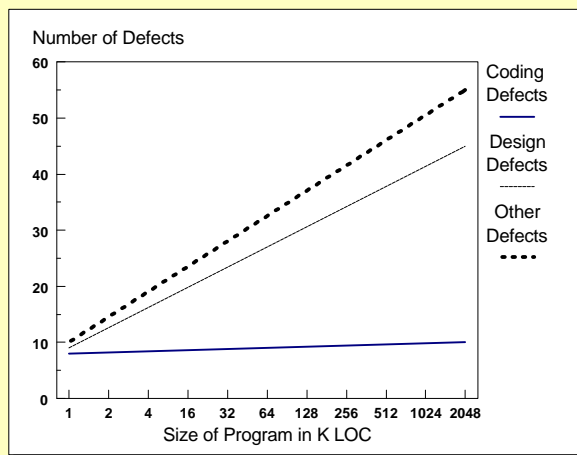
Origins of Software Defects

Looking at just design and coding errors...

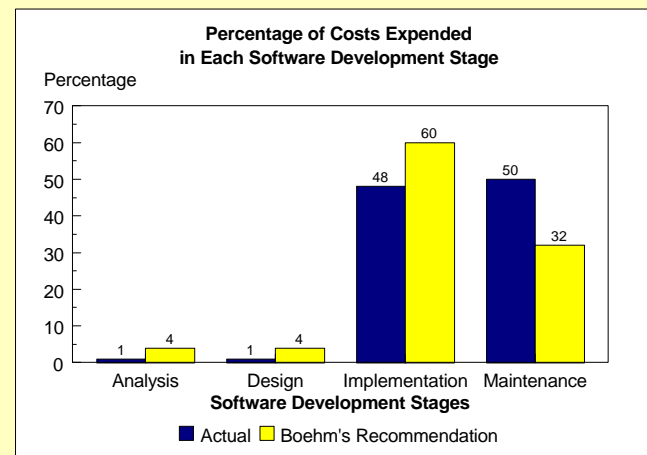
	Design Errors	Coding Errors
IBM	65%	35%
TRW	60%	40%
Mitre	64%	36%
Nippon Electric	60%	40%

-based on Knight

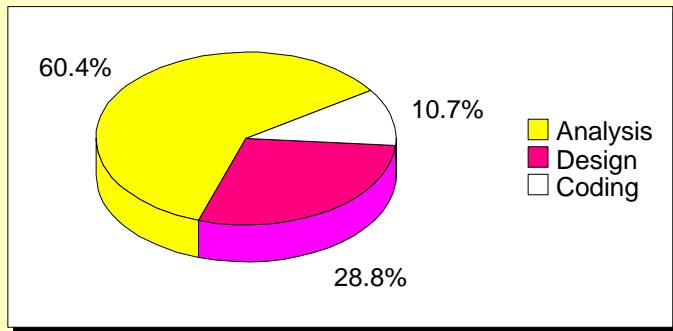
General Defect Trends



Actual and Suggested Allocation of Effort in Software Development



Origins of Software Defects



-based on DeMarco

Actual and Suggested Allocation of Effort in Software Development

