The User Interface Design Process

Design Process

- **Requirements Discovery**
  - Site map
  - Initial prototypes
- **Conceptual Design**
  - Review and refine
- **Logical & Physical Design**
  - UI and visual design
  - Review and refine
- **Design Delivery**
  - Usability Testing
14 Steps for UI Development

• Step 1: Know Your User or Client.
• Step 2: Understand the Business Function
• Step 3: Understand the Principles of Good Screen Design.
• Step 4: Develop System Menus and Navigation Schemes.
• Step 5: Select the Proper Kinds of Windows.
• Step 6: Select the Proper Device-Based Controls.
• Step 7: Choose the Proper Screen-Based Controls.
• Step 8: Write Clear Text and Messages.
• Step 9: Provide Effective Feedback and Guidance and Assistance
• Step 10: Provide Effective Internationalization and Accessibility.
• Step 11: Create Meaningful Graphics, Icons, and Images.
• Step 12: Choose the Proper Colors.
• Step 13: Organize and Layout Windows and Pages.
• Step 14: Test, Test, and Retest.
The User Interface Design Process – Part 2

- Obstacles and Pitfalls in the Development Path
- Designing for People: The Five Commandments
- Usability
  - Common Usability Problems
  - Some Practical Measures of Usability
  - Some Objective Measures of Usability
  - The Design Team
Obstacles and Pitfalls in the Development Path

- Nobody ever gets it right the first time.
• Development is chock-full of surprises.
  • filled to its limit
• Good design requires living in a sea of changes
• Making contracts to ignore change will never eliminate the need for change.
• Even if you have made the best system humanly possible, people will still make mistakes when using it.
• Designers need good tools.
• You must have behavioral design goals like performance design goals.
Common pitfalls

- No early analysis and understanding of the user’s needs and expectations.
- A focus on using design features or components that are “neat” or “glitzy.”
- Little or no creation of design element prototypes.  ○ No usability testing.
- No common design team vision of user interface design goals.
- Poor communication between members of the development team.
Designing for People: The Five Commandments

• Gain a complete understanding of users and their tasks.
  • A wide gap in technical abilities, goals, and attitudes often exists between users and developers
  • A failure to understand the differences will doom a product or system to failure.

• Solicit early and ongoing user involvement.
  • Involving the users in design from the beginning provides a direct conduit to the knowledge they possess about jobs, tasks, and needs.
  • not status or position.
Designing for People: The Five Commandments

• Perform rapid prototyping and testing
• Modify and iterate the design as much as necessary
• Integrate the design of all the system components.
Usability

- Shackel (1991) simply defined usability as “the capability to be used by humans easily and effectively, where, easily = to a specified level of subjective assessment, effectively = to a specified level of human performance.”

**UX vs. Usability**

Usability
- Effectiveness
- Efficiency
- Learnability
- Error prevention
- Memorability

User Experience
- Satisfaction
- Enjoyment
- Pleasure
- Fun
- Value

Where usability is narrow and focused, UX is broad and holistic.
User testing
Do users need my app?

Usability testing
Can users use my app?
Common Usability Problems (GUI)

• Ambiguous menus and icons.
• Languages that permit only single-direction movement through a system.
• Input and direct manipulation limits.
• Highlighting and selection limitations.
• Unclear step sequences.
• More steps to manage the interface than to perform tasks.
• Complex linkage between and within applications
• Inadequate feedback and confirmation.
• Lack of system anticipation and intelligence.
• Inadequate error messages, help, tutorials, and documentation.
Common Usability Problems (WebUI)

• Visual clutter. A lack of “white space,”
• Impaired information readability
• Incomprehensible components
• Annoying distractions
• Confusing navigation
• Inefficient navigation
• Inefficient operations
• Excessive or inefficient page scrolling
• Information overload.
Common Usability Problems (WebUI)

- Design inconsistency
- Outdated information
- Stale design caused by emulation of printed documents and past systems.
Some Objective Measures of Usability

- At better than some required level of performance (for example, in terms of speed and errors)?
- By some required percentage of the specified target range of users?
- Within some required proportion of the range of usage environments?

How learnable is the interface? Can the interface be learned:

- Within some specified time from commissioning and start of user training?
- Based on some specified amount of training and user support?
- Within some specified relearning time each time for intermittent users?

How flexible is the interface? Is it flexible enough to:

- Allow some specified percentage variation in tasks and/or environments beyond those first specified?

What are the attitudes of the users? Are they:

- Within acceptable levels of human cost in terms of tiredness, discomfort, frustration, and personal effort?
- Such that satisfaction causes continued and enhanced usage of the system?
The Design Team

- Development
- Human factors
- Visual design
- Usability assessment
- Documentation
- Training

Roles in UX team
Step 1-Know Your User or Client

• Understand how people interact with computers
• Understand the human characteristics important in design
• Identify the user’s level of knowledge and experience
• Identify the characteristics of the user’s tasks and jobs
• Identify the user’s psychological characteristics
• Identify the user’s physical characteristics
• Employ recommended methods for gaining understanding of users.
“The user is never wrong and the user is never stupid. In information design, only designs are wrong and stupid”

Edward Tufte
The No.1 Cricket App
Important Human Characteristics in Design

- Perception is our awareness and understanding of the elements and objects of our environment through the physical sensation of our various senses.
- Perception is influenced in part by experience.
  - We classify stimuli based on models stored in our memories and in this way achieve understanding.
Important Human Characteristics in Design

• Other Perceptual Characteristics include:
  • Proximity
    • we see objects as belonging together if they are near each other in space.
  • Similarity
    • We see objects as belonging together if they share a common visual property, such as color, size, shape, brightness, or orientation.
Important Human Characteristics in Design

• Other Perceptual...
  • Matching Patterns
    • We respond similarly to the same shape in different sizes (i.e. the letters of the alphabet)
  • Succinctness
    • We see an object as having some perfect or simple shape because perfection or simplicity is easier to remember
Important Human Characteristics in Design

• Other Perceptual...
  • Closure
    • Our perception is synthetic; it establishes meaningful wholes. If something does not close itself; we see it closed anyway.
  • Unity
    • Objects that form closed shapes are perceived as a group
Important Human Characteristics in Design

• Other Perceptual...
  • Continuity
    • Shortened lines may be automatically extended
  • Balance
    • We desire stabilization or equilibrium in our viewing environment. Vertical, Horizontal and right angles are the most visually satisfying and easiest to look at.
Important Human Characteristics in Design

• Other Perceptual...
  • Expectancies
    • Sometimes we perceive no what is there, but what we expect to be there.
  • Signals vs. Noise
    • Stimuli are called *signals*. (important)
    • Those that are not important or unwanted are called *noise*.
Important Human Characteristics in Design

• Memory
  • The short-term memory limit is generally viewed as 7±2 “chunks” of information.
  • Knowledge, experience, and familiarity govern the size and complexity of the chunks that can be recalled.
  • Short-memory last 15 to 30 seconds.
  • Long-term memory is thought to be unlimited.
  • Human active vocabulary (2,000 – 3,000 words)
  • Passive vocabulary (about 100,000)
    • Our power of recognition is much greater than our power of recall.
Important Human Characteristics in Design

• Visual Acuity
  • The capacity of the eye to resolve details is called visual acuity.
  • Visual acuity is halved at a distance of 2.5 degrees from the point of eye fixation.
  • A five degree diameter circle centered around and eye fixation character on a display has been recommended as the area near that character.
Important Human Characteristics in Design

• Visual Acuity
  • Assuming that the average viewing distance of a display screen is 19 inches, the size of the area on the screen of optimum visual acuity is 1.67 inches.
Important Human Characteristics in Design

• Visual Acuity
  • Assuming “average” character sizes and character and line spacing, the number of characters on a screen falling within the visual acuity circle is 88, with 15 characters being contained on the widest line.
Important Human Characteristics in Design

• Foveal and Peripheral Vision
  • Foveal vision is used to focus directly on something
  • Peripheral vision senses anything in the area surrounding where we are looking
    • Provides clues to where the eye should go next
  • Foveal and Peripheral vision have a cooperative and competitive nature.
Important Human Characteristics in Design

• Foveal and Peripheral Vision
  • Mori & Hayashi experimentally evaluated the effect of windows in both foveal and peripheral vision.
    • Performance of a foveal window deteriorates when there are peripheral windows.
    • Performance degradation is even greater if the information in the peripheral is dynamic.
Important Human Characteristics in Design

• Sensory Storage
  • Is a buffer where automatic processing of information collected from our senses takes place.
  • “Cocktail party effect” (someone says your name in a party and you hear it...)
  • Habituation.
Important Human Characteristics in Design

• Information Processing
  • Higher level (slow, sequential)
    • Our first exposure to screens
  • Lower level (work in parallel)
    • Subsequent screens...
    • We look rather than see
    • We perceive rather than see
    • Visual distinctiveness in screen design is very important to process in the lower level
Important Human Characteristics in Design

• Mental Model
  • A mental model is simply an internal representation of a person’s current understanding of something.
  • As a result of our experiences and culture we develop mental models of things and people we interact with.
  • The key to forming mental models is design consistency
Important Human Characteristics in Design

• Learning
  • People prefer to be active, to explore, and to use a trial and error approach
  • People are very sensitive even to minor changes (Shift-Ins; Ctrl-C)
  • The perception of having to learn a lot of information is enough to keep people from using the system.
  • Be consistent in your design
    • Allow skills acquired in one situation to be used in another somewhat like it.
Important Human Characteristics in Design

• Skill
  • The goal of human performance is to perform skillfully.
  • Economy of effort is achieved by establishing a work pace that represents optimum efficiency.
    • It is accomplished by increasing mastery of the system through such things as progressive learning shortcuts, increased speed, and easier access to information or data.
  • Lower-order skills tend to become routine and may drop out of consciousness.
  • Screen design must permit development of increasingly skillful performance.
Important Human Characteristics in Design

• Individual Differences
  • Tailor applications to the specific needs of people with varying and changing learning or skill level.
Important Human Characteristics in Design

• Knowledge/Experience
  • Computer Literacy
  • System Experience
  • App. Experience
  • Task Experience
  • Education
  • Reading Level
  • Typing Skill
  • Native Language
Important Human Characteristics in Design

• Job/Task
  • Type of System Use (Mandatory or Discretionary)
  • Frequency of Use
  • Turnover Rate
  • Task Importance
  • Task Structure (repetitiveness)
  • Primary Training
  • Job Category (Executive, Secretary, Clerk)
Important Human Characteristics in Design

• Psychological Characteristics
  • Attitude (positive, neutral, negative)
  • Motivation (Low-High, Interest or Fear)
  • Cognitive Style (Concrete/Abstract, Analytic or Intuitive)
Important Human Characteristics in Design

• Physical Characteristics
  • Gender
  • Age
  • Handedness
  • Physical Handicaps
Gaining Understanding of Users

• Visit customer locations
• Talk with users/direct contact
• Observe users working (tasks, problems)
• Videotape users working
• Have users think aloud as they work
• Try the job yourself
• Use surveys/questionnaires (bigger sample)
• Establish testable behavioral target goals
• Involve user in the design process (avoid resistance to change)
Gaining Understanding of Users

• Performance vs. Preference
  • Optimize preferences with performance
  • Where optimization is impossible, implement the feature that provides the best performance.
Human interaction speeds

- The speed at which people can perform using various communication methods has been studied by a number of researchers.
- Typical interaction speeds for various tasks are stated as:
  - Reading
  - Listening
  - Speaking
  - Keying
  - Hand printing
<table>
<thead>
<tr>
<th>Action</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading</strong></td>
<td></td>
</tr>
<tr>
<td>Prose text</td>
<td>250–300 words per minute.</td>
</tr>
<tr>
<td>Proofreading text on paper</td>
<td>200 words per minute.</td>
</tr>
<tr>
<td>Proofreading text on a monitor</td>
<td>180 words per minute.</td>
</tr>
<tr>
<td><strong>Listening</strong></td>
<td>150–160 words per minute.</td>
</tr>
<tr>
<td>Speaking to a computer</td>
<td>105 words per minute.</td>
</tr>
<tr>
<td>After recognition corrections</td>
<td>25 words per minute.</td>
</tr>
<tr>
<td><strong>Keying</strong></td>
<td></td>
</tr>
<tr>
<td>Typewriter</td>
<td></td>
</tr>
<tr>
<td>Fast typist</td>
<td>150 words per minute and higher.</td>
</tr>
<tr>
<td>Average typist</td>
<td>60–70 words per minute.</td>
</tr>
<tr>
<td>Computer</td>
<td></td>
</tr>
<tr>
<td>Transcription</td>
<td>33 words per minute.</td>
</tr>
<tr>
<td>Composition</td>
<td>19 words per minute.</td>
</tr>
<tr>
<td>Two finger typists</td>
<td></td>
</tr>
<tr>
<td>Memorized text</td>
<td>37 words per minute.</td>
</tr>
<tr>
<td>Copying text</td>
<td>27 words per minute.</td>
</tr>
<tr>
<td>Hand printing</td>
<td></td>
</tr>
<tr>
<td>Memorized text</td>
<td>31 words per minute.</td>
</tr>
<tr>
<td>Copying text</td>
<td>22 words per minute.</td>
</tr>
</tbody>
</table>
Step 2 - Understand the Business Function
Business Function

- Perform business definition and requirements analysis
- Determine basic business functions
- Describe current activities through task analysis
- Develop a conceptual model of the system
- Establish design standards or style guides
- Establish system usability design goals
- Define training and documentation needs
### Business Definition and Requirements Analysis

<table>
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<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Face-to-Face Interview</td>
<td>A one-on-one visit with the user to obtain information. It may be structured or somewhat open-ended.</td>
</tr>
<tr>
<td>Telephone Interview or Survey</td>
<td>A structured interview conducted via telephone.</td>
</tr>
<tr>
<td>Traditional Focus Group</td>
<td>A small group of users and a moderator brought together to verbally discuss the requirements.</td>
</tr>
<tr>
<td>Facilitated Team Workshop</td>
<td>A facilitated, structured workshop held with users to obtain requirements information. Similar to the Traditional Focus Group.</td>
</tr>
<tr>
<td>Observational Field Study</td>
<td>Users are observed and monitored for an extended time to learn what they do.</td>
</tr>
<tr>
<td>Requirements Prototyping</td>
<td>A demo, or very early prototype, is presented to users for comments concerning functionality.</td>
</tr>
<tr>
<td>User-Interface Prototyping</td>
<td>A demo, or early prototype, is presented to users to uncover user-interface issues and problems.</td>
</tr>
<tr>
<td>Usability Laboratory Testing</td>
<td>Users at work are observed, evaluated, and measured in a specially constructed laboratory.</td>
</tr>
<tr>
<td>Card Sorting for Websites</td>
<td>A technique to establish groupings of information for websites.</td>
</tr>
<tr>
<td>INDIRECT METHODS</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td></td>
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<td>• A company representative defines the user's goals and needs to designers and developers.</td>
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| Paper Survey or Questionnaire |
| • A survey or questionnaire is administered to a sample of users using traditional mail methods to obtain their needs. |

| Electronic Survey or Questionnaire |
| • A survey or questionnaire is administered to a sample of users using e-mail or the Web to obtain their needs. |

| Electronic Focus Group |
| • A small group of users and a moderator discuss the requirements online using workstations. |

| Marketing and Sales |
| • Company representatives who regularly meet customers obtain suggestions or needs, current and potential. |

| Support Line |
| • Information collected by the unit that helps customers with day-to-day problems is analyzed (Customer Support, Technical Support, Help Desk, etc.). |

| E-Mail or Bulletin Board |
| • Problems, questions, and suggestions from users posted to a bulletin board or through e-mail are analyzed. |

| User Group |
| • Improvements are suggested by customer groups who convene periodically to discuss software usage. |

| Competitor Analyses |
| • A review of competitor's products or Web sites is used to gather ideas, uncover design requirements and identify tasks. |

| Trade Show |
| • Customers at a trade show are presented a mock-up or prototype and asked for comments. |

| Other Media Analysis |
| • An analysis of how other media, print or broadcast, present the process, information, or subject matter of interest. |

| System Testing |
| • New requirements and feedback are obtained from ongoing product testing |
Direct Methods - Individual Face-to-Face Interview

- The activities performed in completing a task or achieving a goal or objective.
- The methods used to perform an activity.
- What interactions exist with other people or systems.

It is also very useful to also uncover any:
- Potential measures of system usability
- Unmentioned exceptions to standard policies or procedures.
- Relevant knowledge the user must possess to perform the activity.

If designing a Web site, the following kinds of interview questions are appropriate for asking potential users:
- Present a site outline or proposal and then solicit comments on the thoroughness of content coverage, and suggestions for additional content.
- Ask users to describe situations in which the proposed Web site might be useful.
- Ask users to describe what is liked and disliked about the Web sites of potential competitors.
- Ask users to describe how particular Web site tasks should be accomplished.
Telephone Interview or Survey

• It must have structure and be well planned.
• Arranging the interview in advance allows the user to prepare for it.
• Telephone interviews are less expensive and less invasive than personal interviews.
Traditional Focus Group

- Establish the objectives of the session.
- Select participants representing typical users, or potential users.
- Write a script for the moderator to follow.
- Find a skilled moderator to facilitate discussion, to ensure that the discussion remains focused on relevant topics, and to ensure that everyone participates.
- Allow the moderator flexibility in using the script.
- Take good notes, using the session recording for backup and clarification.
Facilitated Team Workshop

• less formal.

• A common technique used in system requirements determination for many years, it is now being replaced (at least in name) by focus groups.

• Team workshops have had the potential to provide much useful information. Like focus groups, they do require a great deal of time to organize and run.
Observational Field Study

• Observation provides good insight into tasks being performed, the working environment and conditions, the social environment, and working practices. It is more objective, natural, and realistic.
Requirements Prototyping

• A demonstration model, or very early prototype, is presented to users for their comments concerning functionality.
User-Interface Prototyping
Usability Laboratory Testing

Card Sorting for Web Sites
## INDIRECT METHODS

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Requirements Collection Guidelines

• Establish 4 to 6 Different Developer-User Links
• Provide the Most Reliance on Direct Links
Determining Basic Business Functions

- Gain a complete understanding of the user’s mental model based upon:
  - The user’s needs and the user’s profile.
  - A user task analysis.
- Develop a conceptual model of the system based upon the user’s mental model. This includes:
  - Defining objects.
  - Developing metaphors.
Understanding the User’s Mental Model
Understanding the User’s Mental Model

- A goal of task analysis,
- goal of understanding the user,
- A mental model is an internal representation of a person’s current conceptualization and understanding of something.
- Mental models are gradually developed in order to understand
- Mental models enable a person to predict the actions necessary to do things if the actions have been forgotten or have not yet been encountered.
Performing a Task Analysis

- User activities are precisely described in a task analysis.
- Task analysis involves breaking down the user’s activities to the individual task level.
- Interrelationships between people, objects, conceptual frameworks.
- The output of a task analysis is a complete description of all user tasks and interactions.
Developing Conceptual Models

- The output of the task analysis is the creation, by the designer, of a conceptual model for the user interface.
- A conceptual model is based on the user’s mental model.
- Mental models are influenced by a person’s experiences.
- The goal of the designer is to facilitate for the user the development of useful mental model of the system.
Guidelines for Designing Conceptual Models

- Reflect the user’s mental model, not the designer’s.
- Draw physical analogies or present metaphors.
- Comply with expectancies, habits, routines, and stereotypes.
- Provide action-response compatibility.
- Make invisible parts and process of a system visible.
- Provide proper and correct feedback.
- Avoid anything unnecessary or irrelevant.
- Provide design consistency.
- Provide documentation and a help system that will reinforce the conceptual model.
- Promote the development of both novice and expert mental models.
Reflect the user’s mental model, not the designer’s

• A user will have different expectations and levels of knowledge than the designer. So, the mental models of the user and designer will be different.

• The user is concerned with the task to be performed, the business objectives that must be fulfilled.
Draw physical analogies or present metaphors

• Replicate what is familiar and well known.
• The success of graphical systems
• A metaphor, to be effective, must be widely applicable within an interface
• Metaphors that are only partially or occasionally applicable
Comply with expectancies, habits, routines, and stereotypes

• Create a system that builds on knowledge, habits, routines, and expectancies that already exist.

• Use familiar associations, avoiding the new and unfamiliar. With color, for example, accepted meanings for red, yellow, and green are already well established.

• Use words and symbols in their customary ways. Replicate the language of the user, and create icons reflecting already known images.
Provide action-response compatibility

• All system responses should be compatible with the actions that elicit them. Names of commands, for example, should reflect the actions that will occur.

• The organization of keys in documentation or help screens should reflect the ordering that actually exists on the keyboard.
Make invisible parts of the system visible.

• Systems are composed of parts and processes,
• many of which are invisible to the user. In creating a mental model, a person must make a hypothesis about what is invisible and how it relates to what is visible.
• New users of a system often make erroneous or incomplete assumptions about what is invisible and develop a faulty mental model.
• As more experience is gained, their mental models evolve to become more accurate and complete.
Provide Proper and Correct Feedback

• Provide a continuous indication of status
• Provide visible results of actions
• Display actions in progress.
• Present as much context information as possible
• Provide clear, constructive, and correct error messages
Avoid the unnecessary or irrelevant

• Never display irrelevant information on the screen.
• People may try to interpret it and integrate it into their mental models, thereby creating a false one.
• Irrelevant information might be unneeded data fields, screen controls, system status codes, or error message numbers. If potentially misleading information cannot be avoided, point this out to the user.
Provide design consistency

• Design consistency reduces the number of concepts to be learned. Inconsistency requires the mastery of multiple models.
• If an occasional inconsistency cannot be avoided, explain it to the user. For example, if an error is caused by a user action that is inconsistent with other similar actions,
• explain in the error message that this condition exists.
• This will prevent the user from falsely assuming that the model he or she has been operating under is incorrect.
Provide documentation and a help system that will reinforce the conceptual model

• Consistencies and metaphors should be explicitly described in the user documentation.
• This will assist a person in learning the system.
• Do not rely on the people to uncover consistencies and metaphors themselves. The help system should offer advice aimed at improving mental models.
Promote the development of both novice and expert mental models.

- Novices and experts are likely to bring to bear different mental models when using a system.
- It will be easier for novices to form an initial system mental model if they are protected from the full complexity of a system.
- Employ levels of functionality that can be revealed through progressive disclosure.
Defining Objects

- Determine all objects that have to be manipulated to get work done. Describe:
  - The objects used in tasks.
  - Object behavior and characteristics that differentiate each kind of object.
  - The relationship of objects to each other and the people using them.
  - The actions performed.
  - The objects to which actions apply.
  - State information or attributes that each object in the task must preserve, display, or allow to be edited.

- Identify the objects and actions that appear most often in the workflow.

- Make the several most important objects very obvious and easy to manipulate.
Developing Metaphors

- Choose the analogy that works best for each object and its actions.
- Use real-world metaphors.
- Use simple metaphors.
- Use common metaphors.
- Multiple metaphors may coexist.
- Use major metaphors, even if you can’t exactly replicate them visually.
- Test the selected metaphors.
Design Standards or Style Guides
Value of Standards and Guidelines

- Allow faster performance.
- Reduce errors.
- Reduce training time.
- Foster better system utilization.
- Improve satisfaction.
- Improve system acceptance.

They are valuable to system developers because they:

- Increase visibility of the human-computer interface.
- Simplify design.
- Provide more programming and design aids, reducing programming time.
- Reduce redundant effort.
- Reduce training time.
- Provide a benchmark for quality control testing.
Business System Interface Standards and Guidelines

- International Standards Organization (ISO),
An alternative design solution was better than that mandated by the standard.

Available development tools did not allow compliance with the standard.

Compliance with the standard was planned, but time was not yet available to implement it.

The rule that was broken was not known or was overlooked.
Web Guidelines and Style Guides


**Document Design**

- Include checklists to present principles and guidelines.
- Provide a rationale for why the particular guidelines should be used.
- Provide a rationale describing the conditions under which various design alternatives are appropriate.
- Include concrete examples of correct design.
- Design the guideline document following recognized principles for good document design.
- Provide good access mechanisms such as a thorough index, a table of contents, glossaries, and checklists.
Design Support and Implementation

- Use all available reference sources in creating the guidelines.
- Use development and implementation tools that support the guidelines.
- Begin applying the guidelines immediately.
System Training and Documentation Needs

• Training
• Documentation