INTRODUCTION TO SYSTEMS ANALYSIS AND DESIGN:

AN AGILE, ITERATIVE APPROACH

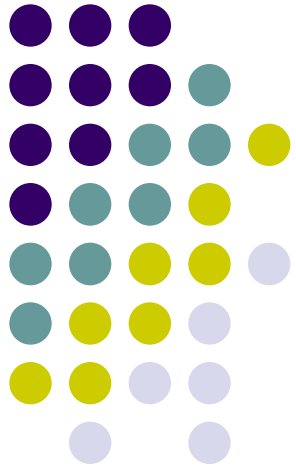
SATZINGER | JACKSON | BURD

CHAPTER 7

Designing the User and System Interfaces

Chapter 7

Introduction to Systems Analysis and Design:
An Agile, Iteractive Approach
6th Ed
Satzinger, Jackson & Burd



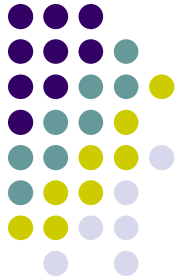
Chapter 7 Outline

- User and System Interfaces
- Understanding the User Interface
- User-Interface Design Concepts
- The Transition from Analysis to User-Interface Design
- User-Interface Design
- Identifying System Interfaces
- Designing System Inputs
- Designing System Outputs

Learning Objectives

- Describe the difference between user interfaces and system interfaces
- Describe the historical development of the field of human-computer interaction (HCI)
- Discuss how visibility and affordance affect usability
- Describe user-interface guidelines that apply to all types of user-interface types and additional guidelines specific to Web pages and mobile applications

Learning Objectives (continued)

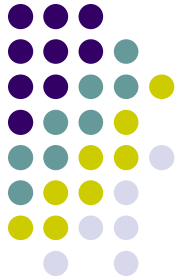


- Create storyboards to show the sequence of forms used in a dialog
- Discuss examples of system interfaces found in information systems
- Define system inputs and outputs based on the requirements of the application program
- Design printed and on-screen reports appropriate for recipients

Overview

- Information systems interact with people and other systems
- Poorly designed user interface can make the information system unusable
- Poorly designed system interfaces are a source of errors and inefficiency
- User and system interfaces involve both inputs and outputs and involve a large number of stakeholders

User Interfaces and System Interfaces



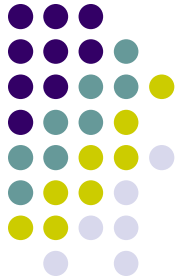
- User Interface – inputs and outputs that directly involve a human user/actor
  - A dialog goes on between actor and system
- System Interface – the inputs and outputs that require minimal human intervention
  - Inputs captured automatically
  - Outputs direct to other systems
  - Printed and distributed outputs (statements, reports)

User Centered Design

- Design techniques that embody the view that the user interface is the system to the user
- Dates back to the 1980s (more for Mac)
- Principles of User Centered Design
  - Focus early on users and their work
  - Evaluate designs to ensure usability
  - Use iterative development
- Note that contemporary A&D finally incorporates these principles

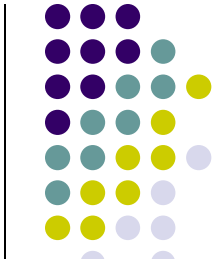
Three Components of the User Interface

Metaphors of Human Computer Interaction



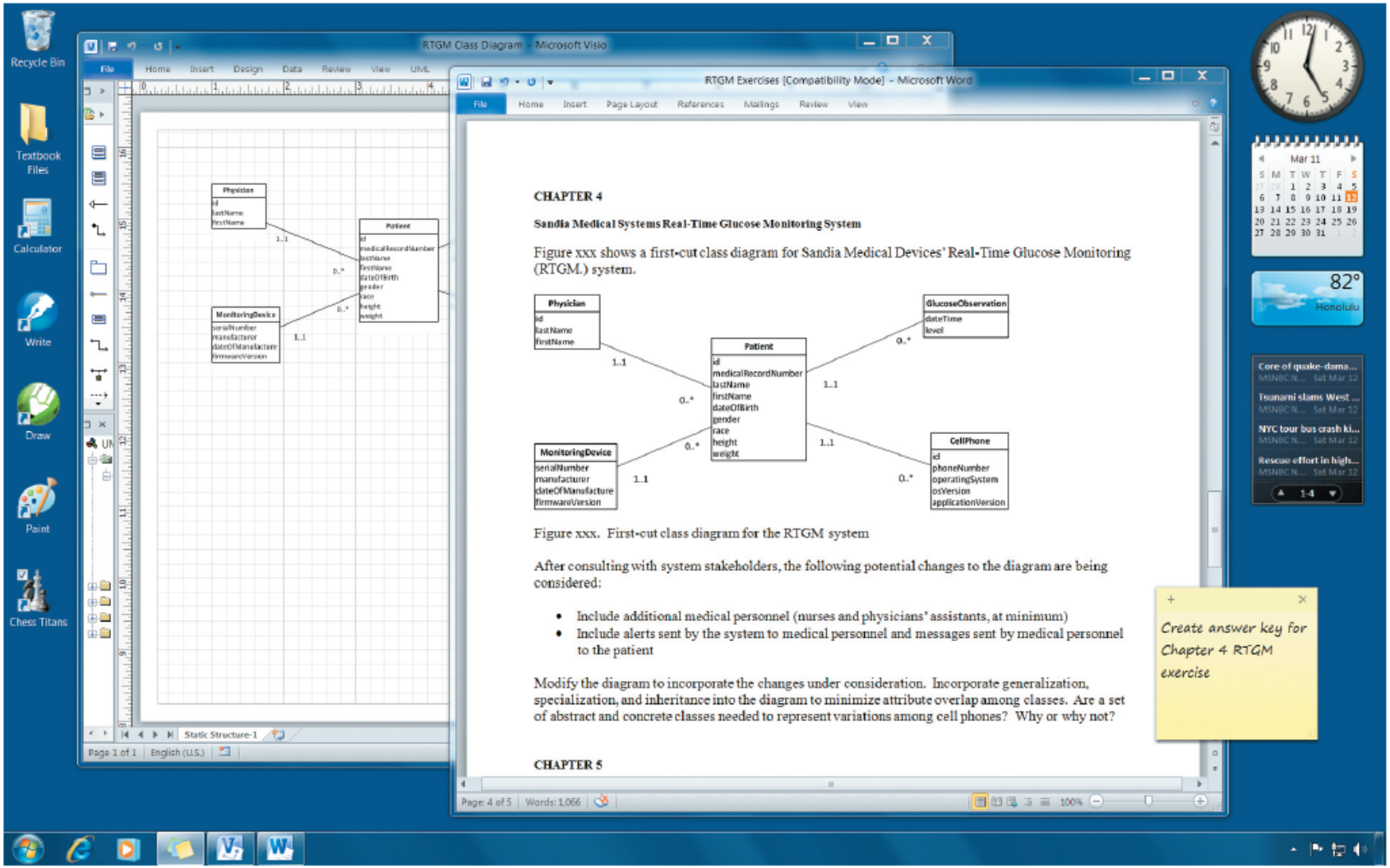
- Direct manipulation metaphor
  - metaphor in which objects on a display are manipulated to look like physical objects (pictures) or graphic symbols that represent them (icons)
- Desktop metaphor
  - metaphor in which the visual display is organized into distinct regions, with a large empty workspace in the middle and a collection of tool icons around the perimeter
- Document metaphor
  - metaphor in which data is visually represented as paper pages or forms
- Dialog metaphor
  - metaphor in which user and computer accomplish a task by engaging in a conversation or dialog via text, voice, or tools such as labeled buttons

Metaphor Details

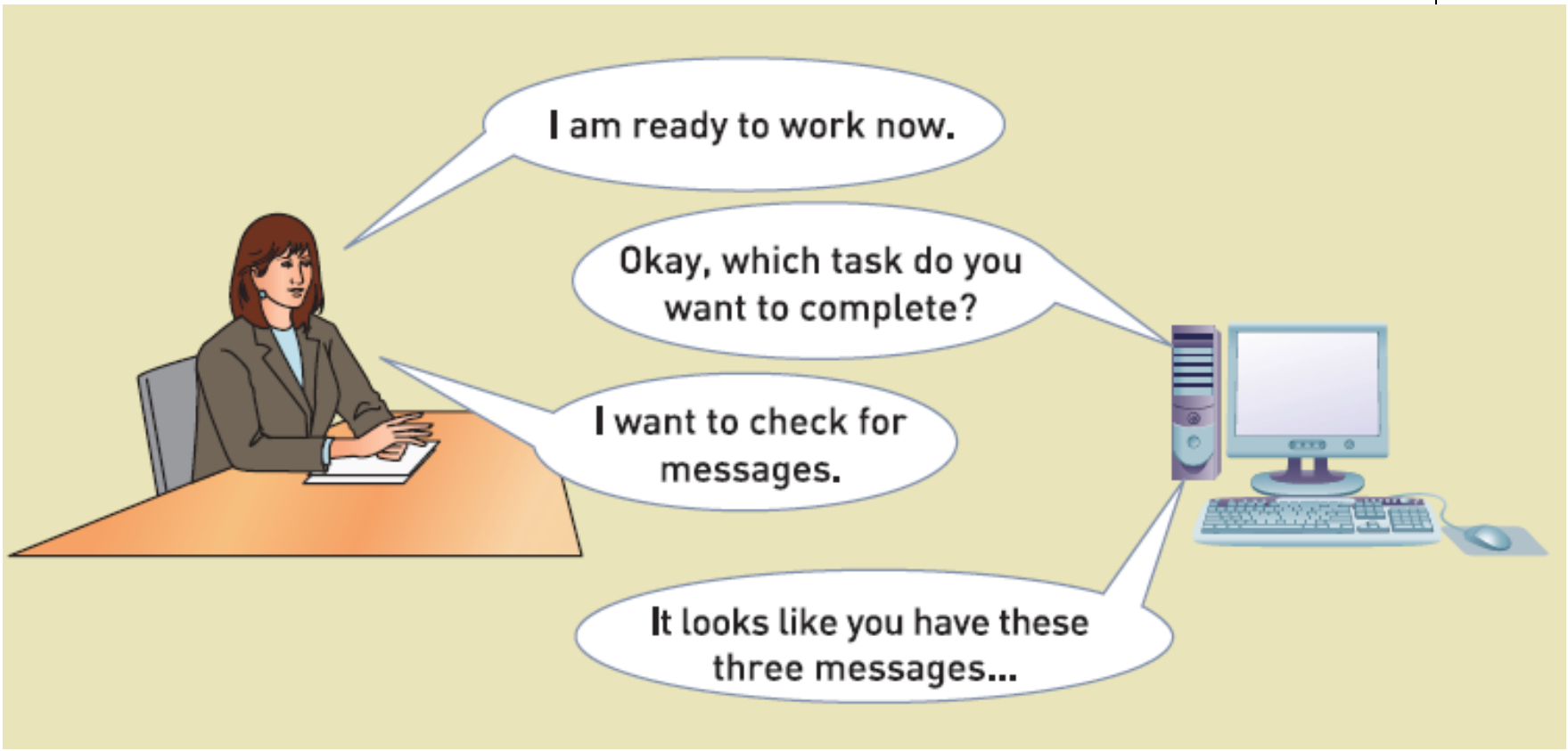


Metaphor	Description	Example
Direct manipulation	Manipulating objects on a display that look like physical objects (pictures) or that represent them (icons)	The user drags a folder icon to an image of a recycle bin or trash can to delete a collection of files.
Desktop	Organizing visual display into distinct regions, with a large empty workspace in the middle and a collection of tool icons around the perimeter	At computer startup, a Windows user sees a desktop, with icons for a clock, calendar, notepad, inbox and sticky notes (the computer interface version of a physical Post-It note).
Document	Visually representing the data in files as paper pages or forms. These pages can be linked together by references (hyperlinks)	The user fills in a form field for a product he or she owns, and the manufacturer's Web site finds and displays the product's manual as an Adobe Acrobat file, which contains a hyperlinked table of contents and embedded links to related documents.
Dialog	The user and computer accomplishing a task by engaging in a conversation or dialog by using text, voice, or tools, such as labeled buttons	The user clicks a button labeled "troubleshoot" because the printer isn't working. The computer prints questions on the display, and the user responds by typing answers or selecting responses from a printed list.

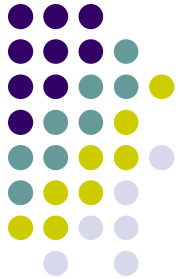
Direct Manipulation, Desktop, and Document Metaphors On One Screen



Dialog Metaphor

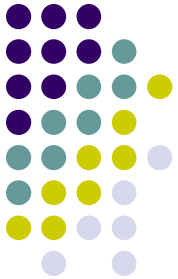


User Interface Design Concepts



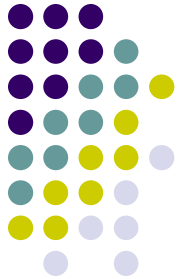
- Human-Computer Interaction (HCI)
  - A field of study concerned with the efficiency and effectiveness of user interaction with computer systems, human-oriented input and output technology, and psychological aspects of user interfaces
- Visibility and Affordance
  - To be usable, a control must be visible to the user and its appearance should suggest its functionality
    - Media player controls, buttons, scroll bars

User Interface Design Guidelines



- Design for Consistency
- Provide Shortcuts
- Provide Feedback
- Dialogs Should Yield Closure
- Error Handling that Provides Guidance
- Easy Reversal of Actions
- Reduce Short Term Memory Load

Use Cases and the Menu Hierarchy

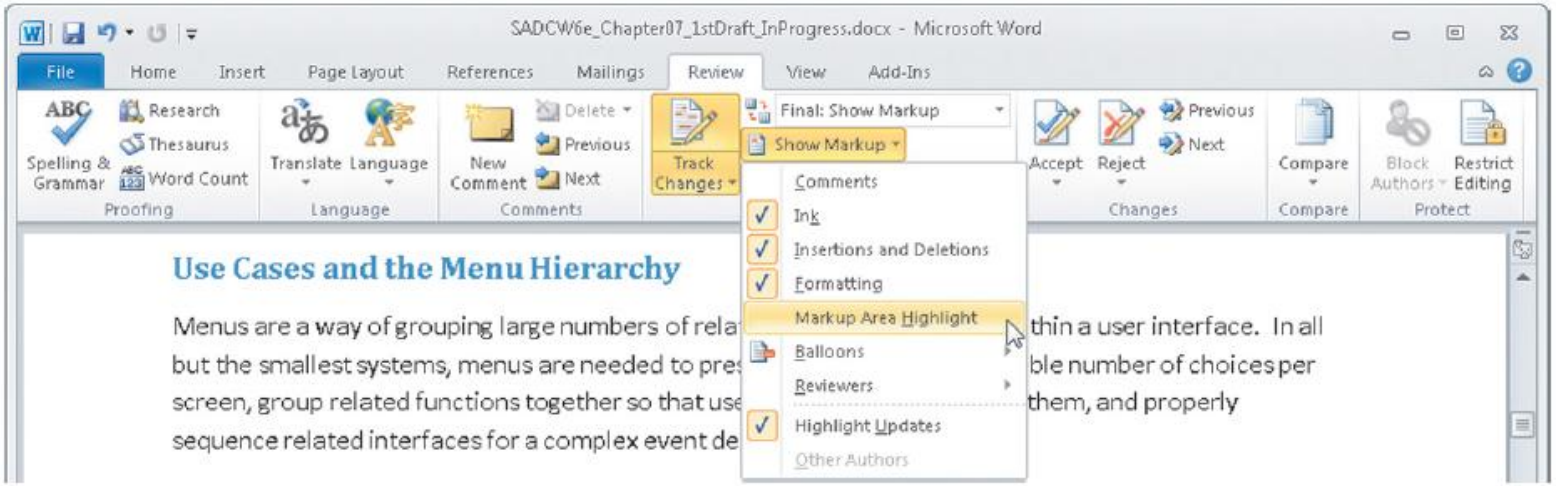


- We design use case by use case
- Menus are a typical way to organize access to use case functionality
- Different types of users might have different menus
- Useful to design an overall menu hierarchy and then subsets for different users
- Once the hierarchy is established, menus can be implemented in a variety of ways

Two Different Menu Styles

(a)

(b)



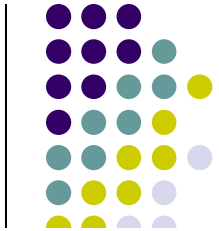
Some RMO Use Cases

Grouped by Actor and Subsystem

Subsystem	Use Case	Users/Actors
Sales	Search for item	Customer, customer service representative, store sales representative
Sales	View product comments and ratings	Customer, customer service representative, store sales representative
Sales	View accessory combinations	Customer, customer service representative, store sales representative
Sales	Fill shopping cart	Customer
Sales	Empty shopping cart	Customer
Sales	Check out shopping cart	Customer
Sales	Fill reserve cart	Customer
Sales	Empty reserve cart	Customer
Sales	Convert reserve cart	Customer
Sales	Create phone sale	Customer service representative
Sales	Create store sale	Store sales representative
Order fulfillment	Ship items	Shipping
Order fulfillment	Manage shippers	Shipping
Order fulfillment	Create backorder	Shipping
Order fulfillment	Create item return	Shipping, customer
Order fulfillment	Look up order status	Shipping, customer, management
Order fulfillment	Track shipment	Shipping, customer, marketing
Order fulfillment	Rate and comment on product	Customer
Order fulfillment	Provide suggestion	Customer

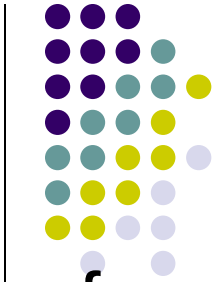
RMO Use Cases

Grouped into First Cut Menu Hierarchy



Menu Description	Menu Choices (Use Cases)	Intended User(s)
Shopping cart functions (primary or reserve)	■ Search for item ■ View product comments and ratings ■ View accessory combinations ■ Switch carts (primary to reserve or vice versa) ■ Fill shopping cart ■ Empty shopping cart ■ Check out shopping cart	Customer
Sale creation	■ Search for item ■ View product comments and ratings ■ View accessory combinations ■ Create sale	Customer service and store sales representatives
Order shipment	■ Ship items ■ Manage shippers ■ Create backorder ■ Create item return ■ Look up order status ■ Track shipment	Customer service and store sales representatives
Customer order control	■ Look up order status ■ Track shipment ■ Create item return ■ Rate and comment on product ■ Provide suggestion	Customer

Dialog Design



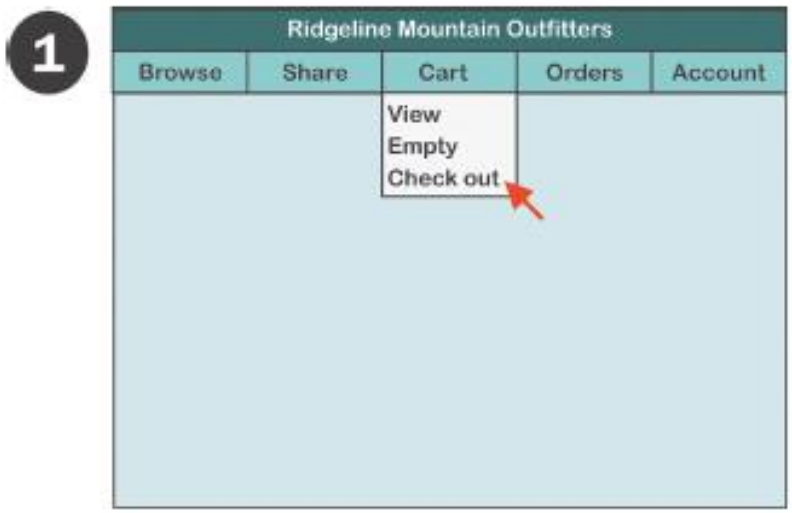
- For each use case, think of the natural flow of a dialog between user and computer
  - Based on the flow of activities in use case description and/or the system sequence diagram
  - Use natural language to emphasize feedback to user
  - Create a storyboard of the dialog, showing the sequence of sketches of the screen each step of the dialog. (storyboarding)
  - Review the storyboard with users

From Dialog to Storyboard (part 1)

Use case *Check out shopping cart*

SYSTEM:	What would you like to do?
USER:	I'd like to check out.
SYSTEM:	Okay. What is your e-mail address or account number?
USER:	My e-mail address is nwells22@gmail.com.
SYSTEM:	Fine. You are Nancy Wells at 1122 Silicon Avenue. Correct?
USER:	Yes.
SYSTEM:	All items in your cart are in stock and can be shipped today. Because your order subtotal is over $100, you qualify for free UPS ground shipping (3–5 days). Other shipping options include next day ($35.00), two day ($20.00), and USPS parcel post ($11.70, 5–7 days). How would you like your items to be shipped?

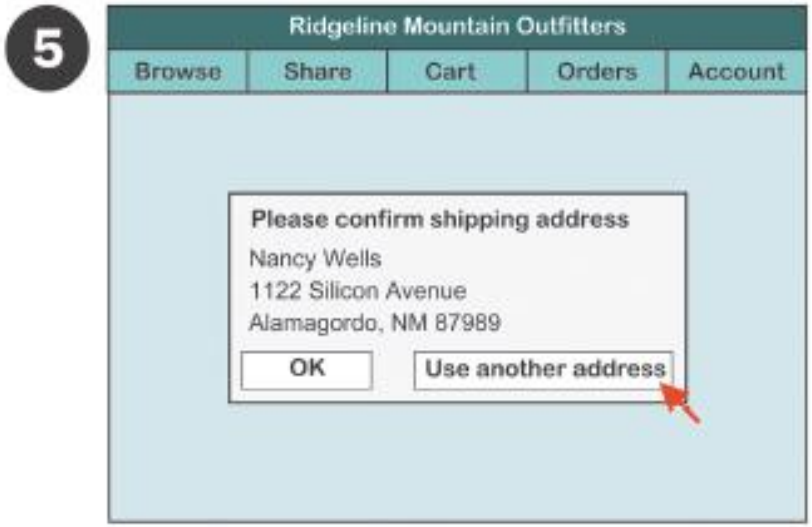
From Dialog to Storyboard (part 1)

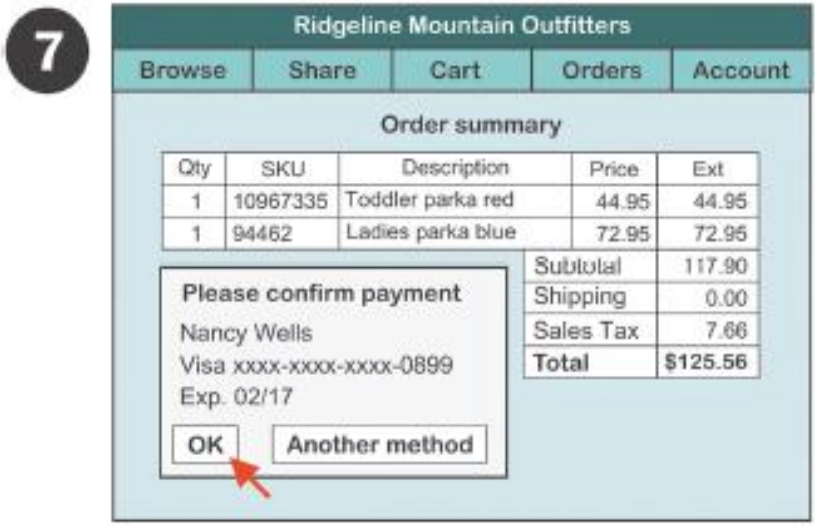


From Dialog to Storyboard (part 2)

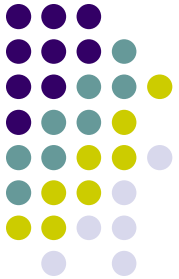
USER:	Free UPS ground shipping.
SYSTEM:	We have a shipping address on file for you (1122 Silicon Avenue). Do you want your order shipped to that address?
USER:	No.
SYSTEM:	To what address would you like the order shipped?
USER:	John Wells, 1612 Jefferson Street NE, Albuquerque, NM 87123.
SYSTEM:	Okay, the total charge is $125.56 ($117.90 item subtotal plus $7.66 sales tax). Shall I charge that amount to your credit card on file (a Visa with an account number ending in 0899)?
USER:	Yes.
SYSTEM:	Your payment has been approved, and your order is being prepared for shipment. A confirmation e-mail has been sent to you, and another will be sent with a shipment tracking number when the order is shipped later today. Can I help you with anything else?
USER:	No.

From Dialog to Storyboard (part 2)



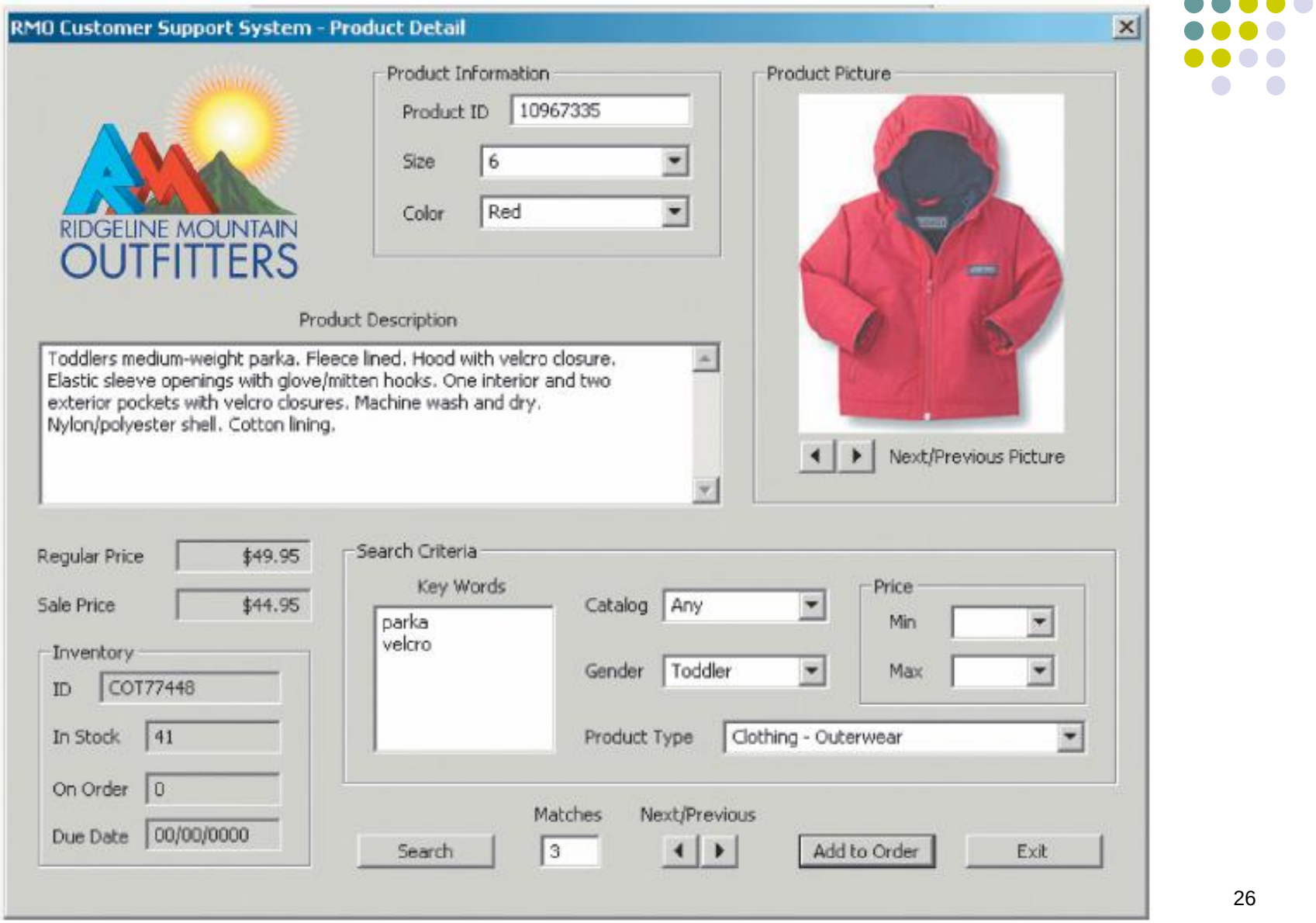


Guidelines for Windows and Forms

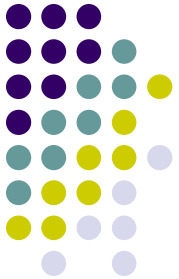


- Interface Layout and Formatting
  - Consistency, labels and headings, distribution and order, fonts and colors
- Data Entry
  - Text box, list box, combo box, radio buttons, check boxes
- Navigation and Support Controls
  - Minimize, maximize, close, scroll bars, resize

RMO Windows Form

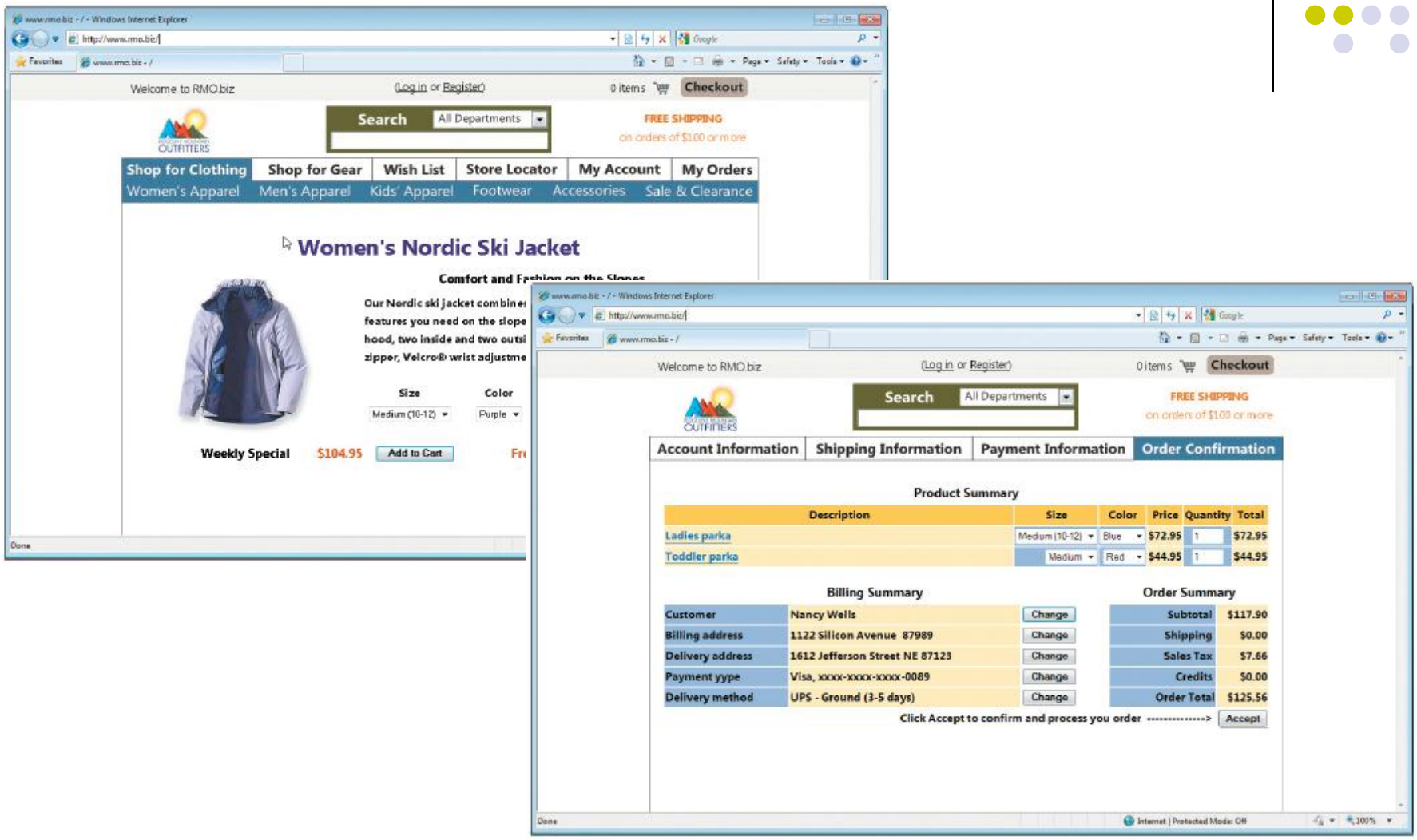


Guidelines for Web Browser User Interfaces



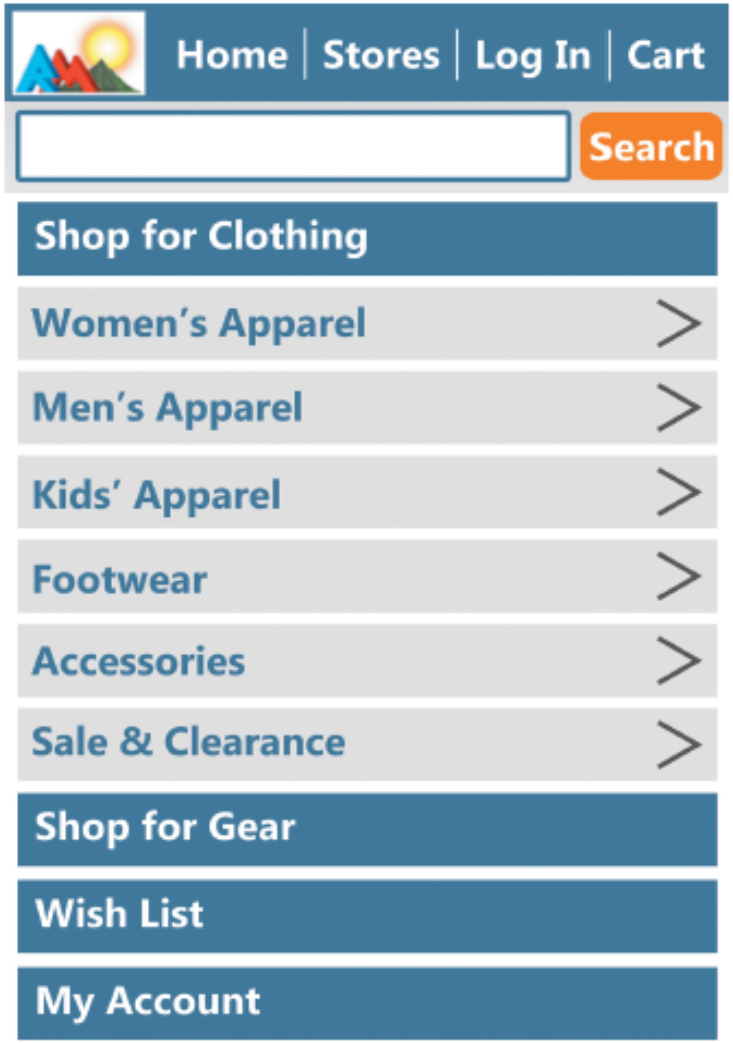
- Consistency
  - Cascading Style Sheets (CSS) – Web page encoding standard that enables a Web site designer to specify parts of a page that will always look the same and parts that will vary by task or audience
- Performance Considerations
  - Sensitive to network connection, amount of information transmitted, type of information transmitted
- Pictures, Video, and Sound
  - Powerful, but compatibility issues arise
- Users with Disabilities
  - Assistive technologies -- software (such as text-to-speech and voice-recognition utilities) that adapts user interfaces to the special needs of persons with disabilities

RMO Example
Using CSS for Consistency

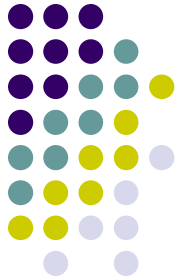


Guidelines for Handheld Devices

- Challenges
  - Small screen size, small keyboards and touch screens, limited network capacity, app design guidelines and toolkits

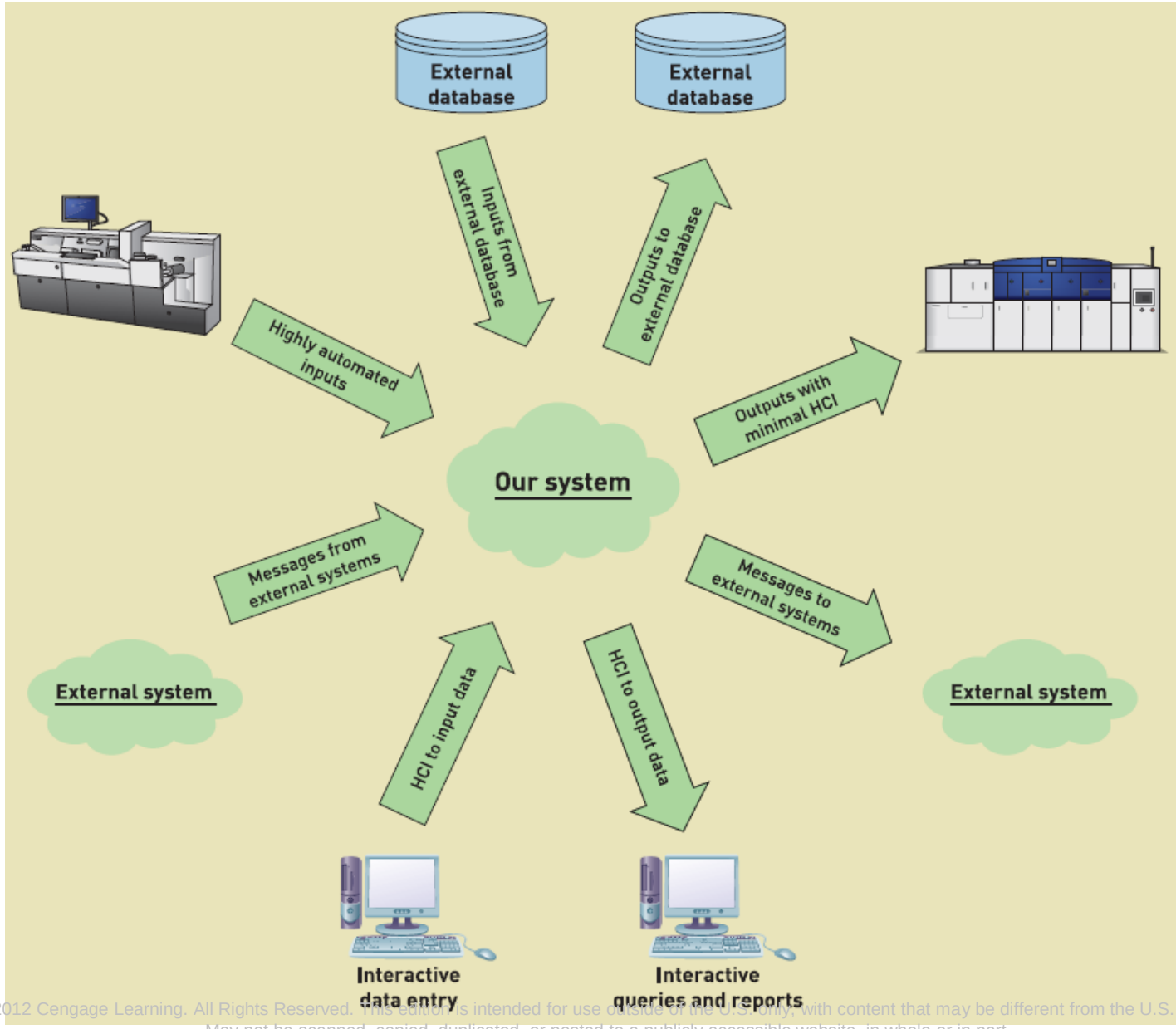


Identifying System Interfaces
Inputs/outputs with minimal human intervention



- Inputs from and outputs to other systems
  - These are direct interfaces with other information systems, normally formatted as network messages.
- Highly automated inputs and outputs
  - These are captured by devices (such as scanners) or generated by persons who start a process that proceeds without further human intervention.
- Inputs and outputs to external databases
  - These can supply input to or accept output from a system.

Identifying System Interfaces

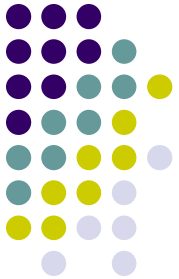


XML for System Interfaces

- Extensible Markup Language (XML) -- extension of HTML that embeds self-defining data structures within textual messages
  - XML tags -- character sequences (such as <name> and </name>) that define the beginning, end, and meaning of the text that appears between them

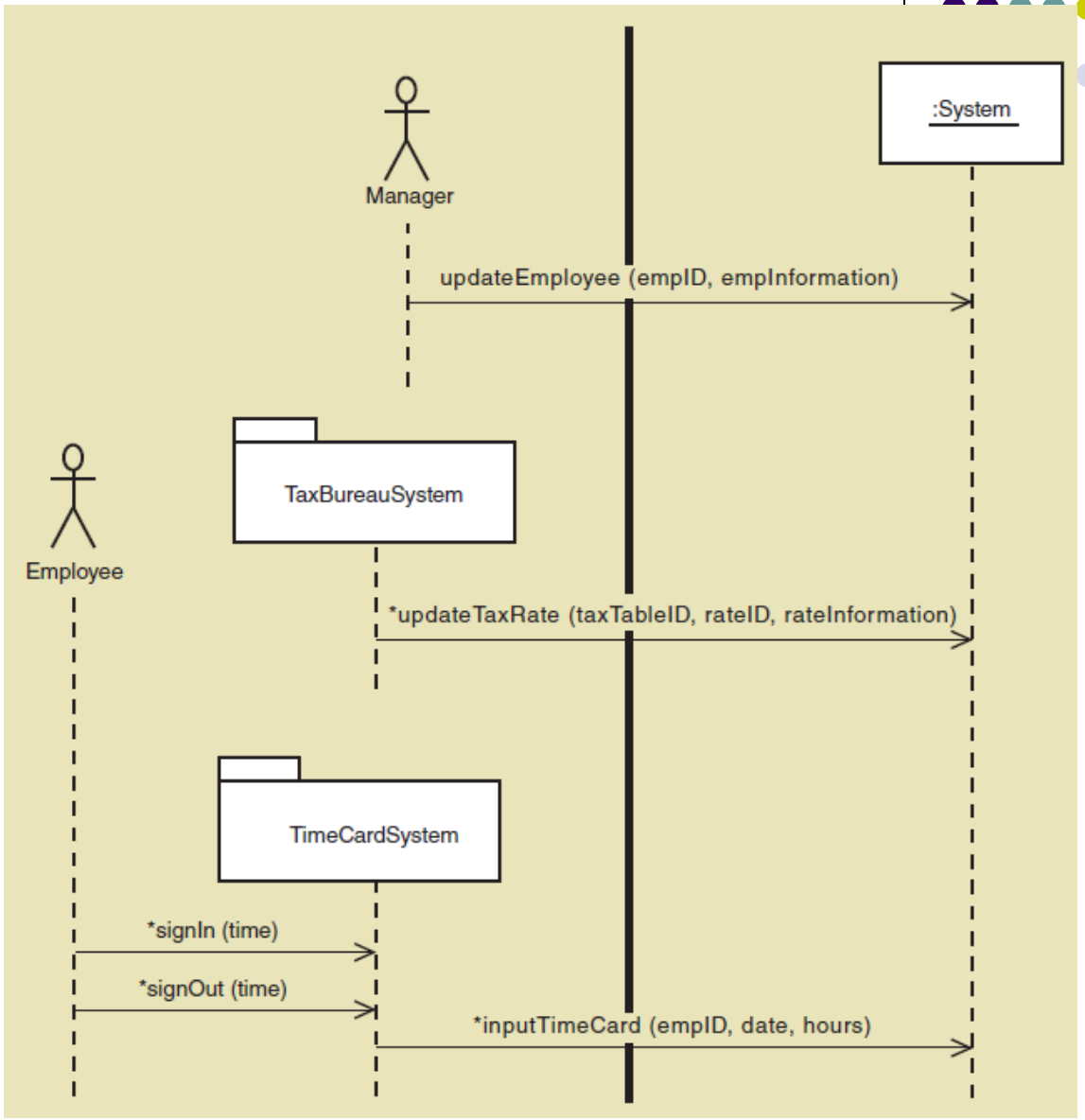
```
<customer record>
     <accountNumber>RMO10989</accountNumber>
     <name>William Jones</name>
     <billingAddress>
          <street>120 Roundabout Road</street>
          <city>Los Angeles</city>
          <state>CA</state>
          <zip>98115</zip></billingAddress>
     <shippingAddress>
          <street>120 Roundabout Road</street>
          <city>Los Angeles</city>
          <state>CA</state>
          <zip>98115</zip></shippingAddress>
     <dayPhone>215.767.2334</dayPhone>
     <nightPhone>215.899.8763</nightPhone>
</customer record>
```

System Inputs

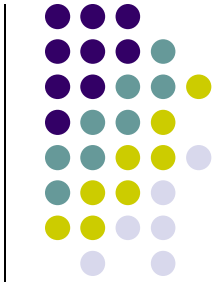


- Primary Objective is Error Free Input
  - Use electronic devices wherever possible
  - Avoid human involvement as much as possible
  - If information is already available in electronic form, use it instead of re-entering information
  - Validate and correct information at time and location entered
- Device Examples
  - Magnetic card strip readers, bar code readers, optical character recognition, radio frequency ID tags (RFID), touch screen, electronic pens, digitizers, speech recognition

- Defining System Inputs Details
  - Sequence Diagram
  - Details for messages

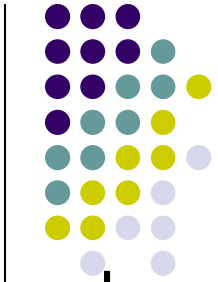


System Outputs



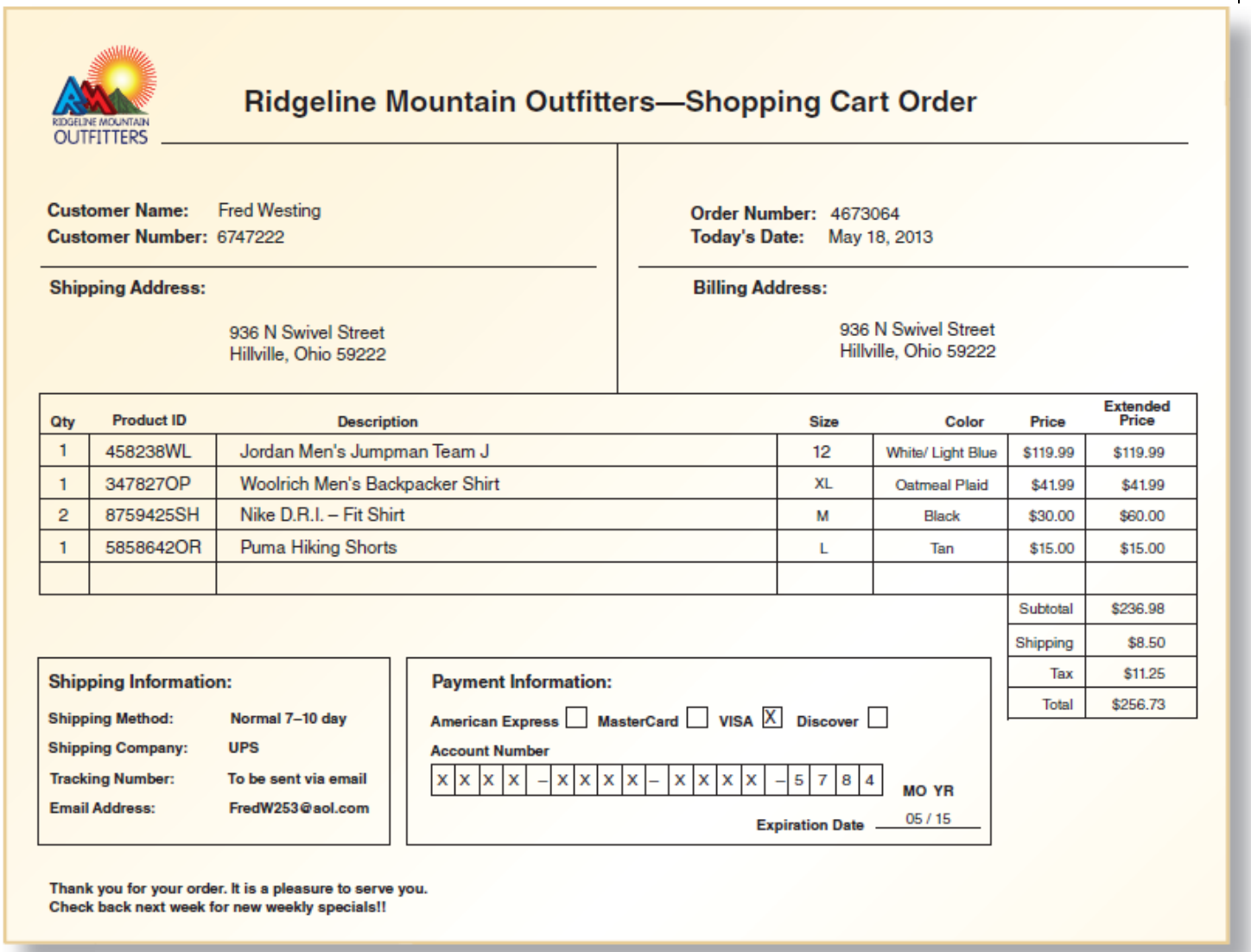
- Detailed reports -- reports that contain specific information on business transactions
- Summary reports -- reports that summarize detail or recap periodic activity
- Exception reports -- reports that provide details or summary information about transactions or operating results that fall outside a predefined normal range of values
- Executive reports -- reports used by high level managers to assess overall organizational health and performance

System Outputs



- Internal outputs -- reports or other outputs produced for use within the organization
  - Types of internal reports apply here
- External outputs -- reports or other outputs produced for use by people outside the organization
  - Statements, notices, stockholder reports
  - Higher quality, color, reflect image of organization
- Turnaround documents -- external outputs that includes one or more parts intended to be returned with new data or information
  - Bills

External Output Example



RIDGELINE MOUNTAIN OUTFITTERS

Ridgeline Mountain Outfitters—Shopping Cart Order

Customer Name: Fred Westing
Customer Number: 6747222

Order Number: 4673064
Today's Date: May 18, 2013

Shipping Address:

936 N Swivel Street
Hillville, Ohio 59222

Billing Address:

936 N Swivel Street
Hillville, Ohio 59222

Qty	Product ID	Description	Size	Color	Price	Extended Price
1	458238WL	Jordan Men's Jumpman Team J	12	White/ Light Blue	$119.99	$119.99
1	347827OP	Woolrich Men's Backpacker Shirt	XL	Oatmeal Plaid	$41.99	$41.99
2	8759425SH	Nike D.R.I. – Fit Shirt	M	Black	$30.00	$60.00
1	5858642OR	Puma Hiking Shorts	L	Tan	$15.00	$15.00
					Subtotal	$236.98
					Shipping	$8.50
					Tax	$11.25
					Total	$256.73

Shipping Information:

Shipping Method: Normal 7–10 day
Shipping Company: UPS
Tracking Number: To be sent via email
Email Address: FredW253@aol.com

Payment Information:

American Express ☐ MasterCard ☐ VISA ☒ Discover ☐

Account Number

X X X X – X X X X – X X X X – 5 7 8 4

MO YR

Expiration Date 05 / 15

Thank you for your order. It is a pleasure to serve you.
Check back next week for new weekly specials!!

Internal Output Example

Detailed control break report

Ridgeline Mountain Outfitters — Products and Items

ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO12587	Spr/Fall	Mens C	8201	$39.00	$34.95	No

Description Outdoor Nylon Jacket with Lining

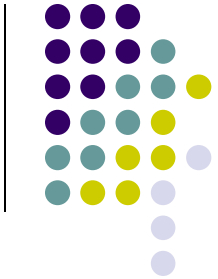
Size	Color	Style	Units in Stock	Reorder Level	Units on Order
Small	Blue		691	150	
	Green		723	150	
	Red		569	150	
	Yellow		827	150	
Medium	Blue		722	150	
	Green		756	150	
	Red		698	150	
	Yellow		590	150	
Large	Blue		1289	150	
	Green		1455	150	
	Red		1329	150	
	Yellow		1370	150	
Xlarge	Blue		1498	150	
	Green		1248	150	
	Red		1266	150	
	Yellow		1322	150	

ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO28497	All	Footwe	7993	$49.95	$44.89	No

Description Hiking Walkers with Patterned Tread Durable Uppers

Size	Color	Style	Units in Stock	Reorder Level	Units on Order
7	Brown		389	100	
	Tan		422	100	
8	Brown		597	100	
	Tan		521	100	
9	Brown		633	100	
	Tan		654	100	
10	Brown		836	100	
	Tan		954	100	
11	Brown		862	100	
	Tan		792	100	
12	Brown		754	100	
	Tan		788	100	
13	Brown		830	100	
	Tan		921	100	

Drill Down Online Report
Summary and Detailed



Monthly Sales Summary

Year 2013 *Month* January

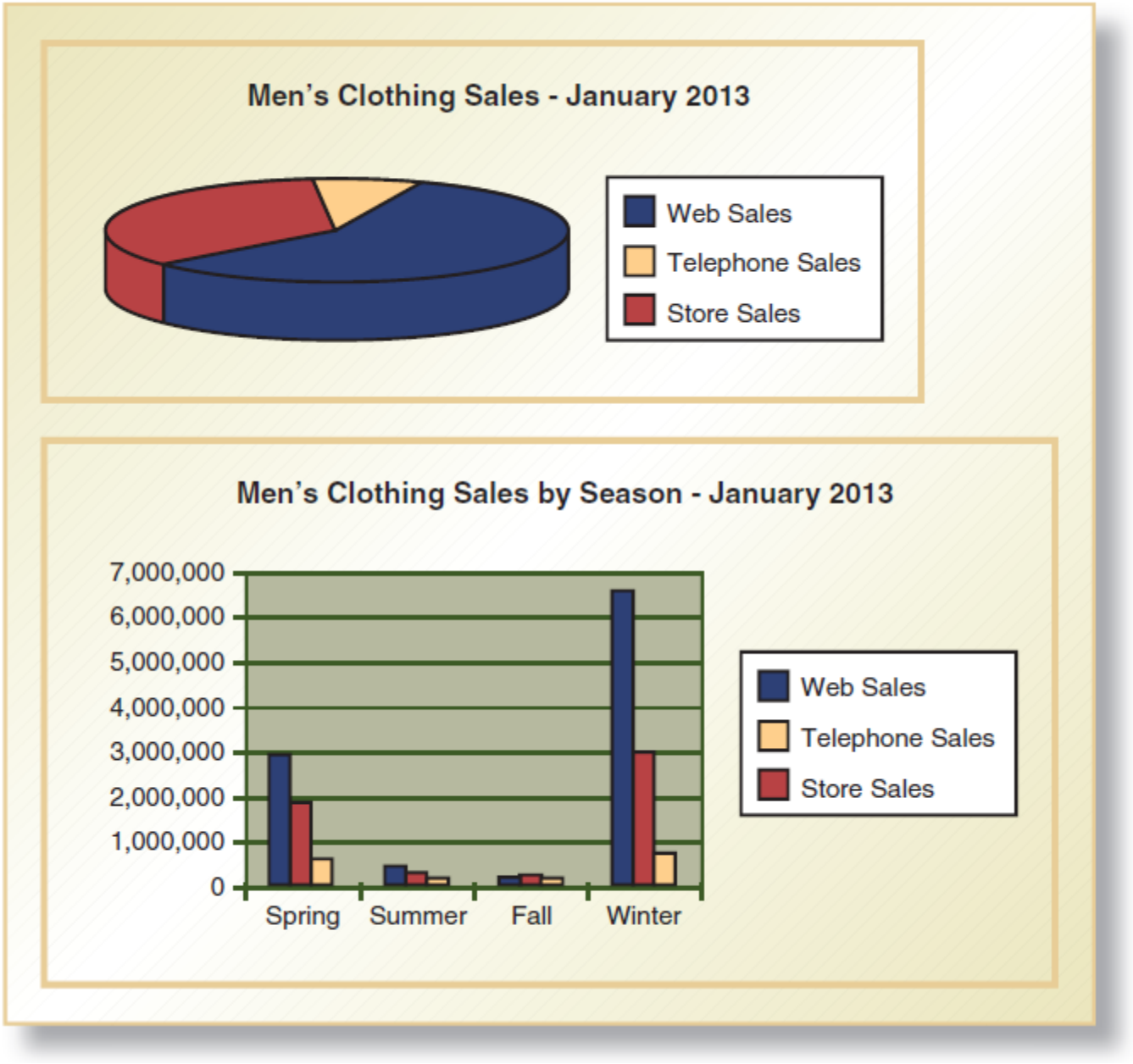
Category	*Season Code*	*Web Sales*	*Telephone Sales*	*Mail Sales*	*Total Sales*
Footwear	All	$ 289,323	$ 1,347,878	$ 540,883	$ 2,178,084
Men's Clothing	Spring	$ 1,768,454	$ 2,879,243	$ 437,874	$ 4,691,484
	Summer	213,938	387,121	123,590	724,649
	Fall	142,823	129,873	112,234	384,930
	Winter	2,980,489	6,453,896	675,290	10,109,675
	All	1,839,729	4,897,235	349,234	7,086,198
Totals			14,747,368	$ 1,698,222	$ 23,391,023
Women's Clothing	Spring				965,610
	Summer				
	Fall				
	Winter				
	All				
Totals					

Monthly Sales Detail

Year 2013 *Month* January *Category* Men's Clothing *Season* Winter

Product ID	*Product Description*	*Web Sales*	*Telephone Sales*	*Mail Sales*	*Total Sales*
RMO12987	Winter Parka	$ 1,490,245	$ 3,226,948	$ 337,640	$ 5,054,833
RMO13788	Fur-Lined Gloves	149,022	322,695	33,765	505,482
RMO23788	Wool Sweater	596,097	1,290,775	135,058	2,021,930
RMO12980	Long Underwear	298,050	645,339	68,556	1,003,005
RMO32998	Fleece-Lined Jacket	447,075	1,258,079	100,271	1,805,425
Total		$ 2,980,489	$ 6,743,836	$ 675,290	$ 10,394,615

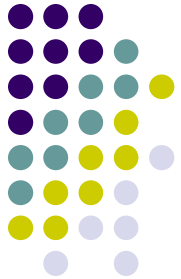
Graphical Outputs



Summary

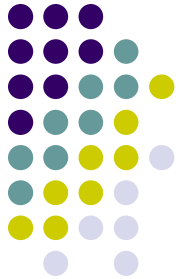
- There are two types of interfaces – user interfaces and system interfaces
- User interfaces involve direct user interaction with the system. System interfaces require minimal or no user interaction
- The design of the user interface has a long history as human computer interaction (HCI) and relies on user-centered design, which focuses early on users, evaluates designs to ensure usability, and uses iterative development
- Metaphors are used to think about the nature of the user interface, and they include direct manipulation, desktop, document, and dialog metaphors.

Summary (continued)



- Key user interface concepts include affordance and visibility for controls
- Other key principles include consistency, shortcuts, feedback, dialog closure, error handling, reversal of actions, and reducing short term memory loads
- Use cases are organized into one or more menu hierarchies to arrange functionality for users
- Dialogs and storyboards are used to design the interaction for each use case based on use case flow of activates and system sequence diagrams
- Guidelines are available for designing for Windows, Web browsers, and Handheld devices

Summary (continued)



- System interfaces include inputs and outputs to other systems, highly automated inputs and outputs, and inputs and outputs to external databases.
- Designing system inputs involves identifying devices and mechanisms, identifying inputs and the data content, and determining the controls necessary
- Designing system outputs includes designing detailed reports, summary report, exception reports, and executive reports
- Outputs are also classified as internal, external, or turnaround
- Electronic reports and other outputs can include drill down, graphics, and multimedia