

Improving Decision Making and Managing Knowledge

Reading:

Laudon & Laudon
chapter 10

Additional Reading:

Brien & Marakas
chapter 9

Outline

- ❑ Decision Making and Information Systems
- ❑ Systems for Decision Support
- ❑ Intelligent Systems for Decision Support
- ❑ Systems for Managing Knowledge

Better Decisions in Eastern Mountain Sports

➤ Problem

Very difficult to get Customer Purchasing Pattern → Outdated and clumsy information systems, unnecessary labor, poor inventory decisions



➤ Solution

- **Deploy a business intelligence system** to more efficiently collect and communicate important data
 - ◆ After evaluation selected *WebFOCUS* and *iWay middleware*, Other options
- *iWay* extracts point of sales data from legacy enterprise system (IBM AS/400)
- Loads into data mart Server → Series of Executive Dashboards (common data view)
- *WebFOCUS* → Combines data from various sources (Server), accessible from web
 - ◆ Dashboards → Key performance indicators Sales, Inventory, Margin levels
 - ◆ Color Coded (RGY) System → Over, Under, as per Plan
 - ◆ Wikis and blogs → discuss/share tips/tactic/discussions (top selling items/store)
- Demonstrates IT's role in revamping outdated information systems
- Illustrates digital technology's role in improving decision making

Business Value of Improved Decision Making

- Measure value of *improved decision making*
- Decisions made at all levels of the firm
 - Some are common, routine, and numerous
 - Improving any single decision – small value, hundreds of thousands of “small” decisions adds up - large annual value

Decision	Maker	Number / year	Value of decision	Annual value to firm
Allocate support to most valuable customers	Accounts manager	12	\$100,000	\$1,200,000
Predict call center daily demand	Call Center management	4	150,000	600,000
Decide parts inventory level daily	Inventory manager	365	5,000	1,825,000
Identify competitive bids from major suppliers	Senior management	1	2,000,000	2,000,000
Schedule production to fill orders	Manufacturing manager	150	10,000	1,500,000
Allocate labor to complete job	Production floor manager	100	4,000	400,000

Types of Decisions

➤ Unstructured

- Decision situations where it is not possible to specify in advance most of the decision procedures to follow
- Decision maker must provide judgment to solve problem
- Novel, important, nonroutine
- No well-understood or agreed-on procedure for making them

➤ Structured

- Repetitive and routine
- Involve definite procedure for handling them so do not have to be treated as new

➤ Semi-Structured

- Decision procedures that can be pre-specified, but not enough to lead to a definite recommended decision

Information Requirements

Decision Characteristics

Unstructured

Semistructured

Structured

Senior
Management

Middle Management

Operational Management
Individual Employees and Teams

Examples of Decisions

Decide entrance or exit
from markets
Approve capital budget
Decide long-term goals

Design a marketing plan
Develop a departmental
budget
Design a new corporate
Web site

Determine overtime
eligibility
Restock inventory
Offer credit to customers
Determine special offers
to customers

Senior managers, middle managers, operational managers, and employees have different types of decisions and information requirements

Information Systems for Decisions

	Management Information Systems	Decision Support Systems
Decision support provided	Provide information about the performance of the organization	Provide information and techniques to analyze specific problems
Information form and frequency	Periodic, exception, demand, and push reports and responses	Interactive inquiries and responses
Information format	Prespecified, fixed format	Ad hoc, flexible, and adaptable format
Information processing methodology	Information produced by extraction and manipulation of business data	Information produced by analytical modeling of business data

Decision Making Process

➤ Intelligence

- Discovering, identifying, understanding
- Problems occurring in the organization — Why?
- Where, what effects it is having on the firm

➤ Design

- Identifying and exploring various solutions

➤ Choice

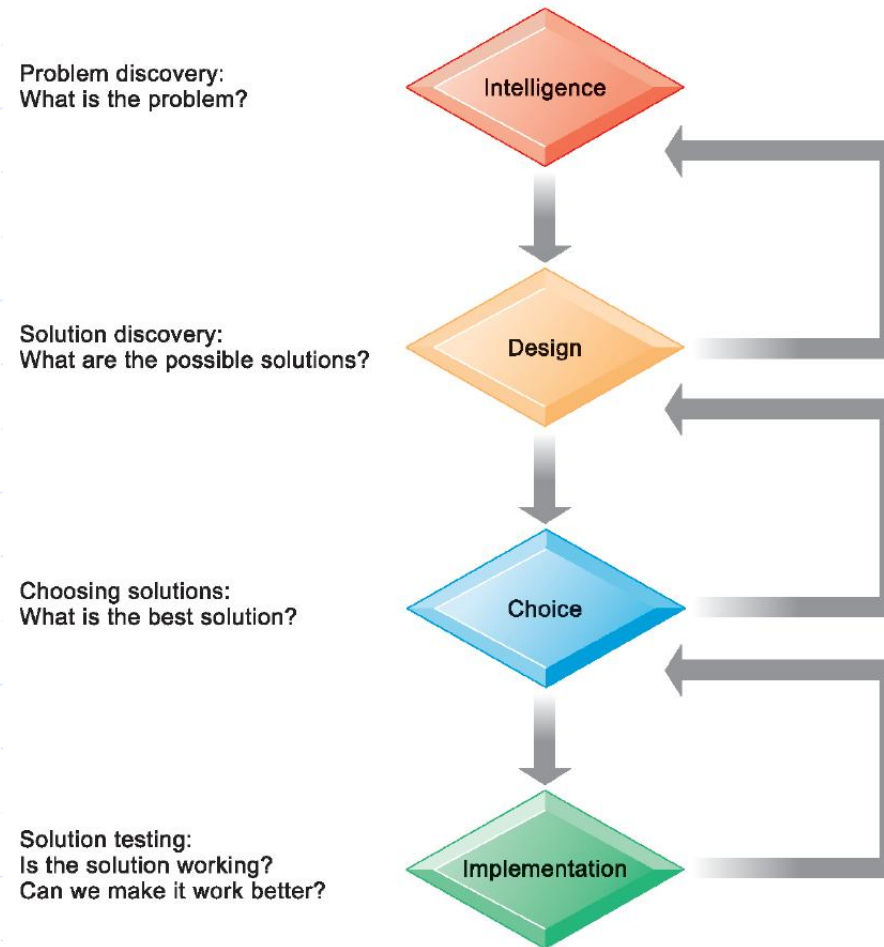
- Choosing among solution alternatives

➤ Implementation

- Making chosen alternative work and monitoring how well solution is working

Decision Making Process

➤ Four Stages of Decision Making Process



Quality of Decisions

- Accuracy
 - Decision reflects reality
- Comprehensiveness
 - Decision reflects a full consideration of the facts and circumstances
- Fairness
 - Decision faithfully reflects the concerns and interests of affected parties
- Speed (efficiency)
 - Decision making is efficient with respect to time and other resources
- Coherence
 - Decision reflects rational process that can be explained to others and made understandable
- Due Process
 - Decision is the result of a known process and can be appealed to a higher authority

Systems for Supporting Decisions

- Management Information Systems (MIS)
- Decision Support Systems (DSS)
- Executive Support Systems (ESS)
 - Becoming widely used by managers, analysts, knowledge workers
 - Also known as 'everyone info system', EIS, Enterprise IS
 - Spread into ranks of middle management, business professionals
 - One popular EIS software package → only 3% users are top executives
 - Conoco's EIS → most senior managers and over 4000 world employees
- Group Decision Support Systems (GDSS)
- Intelligent Techniques

Systems For Supporting Decisions

➤ Management Information Systems

- Help managers monitor and control a business by providing information on the firm's performance
- Typically produce fixed and regularly scheduled reports based on data from TPS

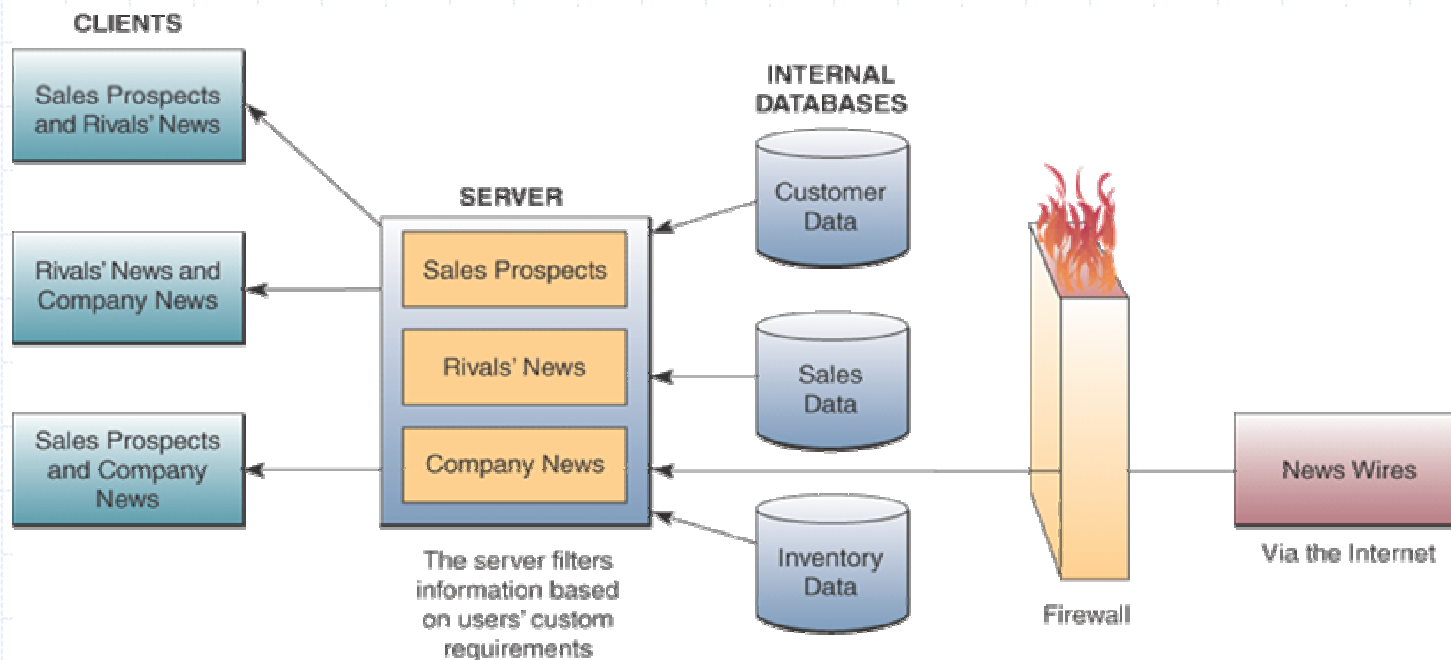
➤ MIS Reporting Alternatives

- Periodic Scheduled Reports
 - ◆ Prespecified format on a regular basis
- Exception Reports
 - ◆ Reports about exceptional conditions
 - ◆ May be produced regularly or when exception occurs
- Demand Reports and Responses
 - ◆ Information available when demanded
- Push Reporting
 - ◆ Information pushed to manager's networked station, webcasting

Systems For Supporting Decisions

➤ MIS Reporting Alternatives

■ Push Reporting



Online Analytical Processing

➤ OLAP

- Dynamic nature of business, web enabled software products that supports OLAP
- Enables managers and analysts to examine and manipulate large amounts of detailed and consolidated data from many perspectives
- Done interactively in real time with rapid response
- Basic Analytical Operations
 - ◆ Consolidation
 - Aggregation of data
 - ◆ Drill-down
 - Display detail data that comprise consolidated data
 - ◆ Slicing and Dicing
 - Ability to look at the database from different viewpoints

Systems For Supporting Decisions

➤ Decision Support Systems

- Support semi-structured and unstructured problem analysis
- Earliest DSS were model-driven
- Data-driven DSS
 - ◆ Use OLAP & data mining to analyze large pools of data in corporate systems

➤ Using DSS

- What-if Analysis
 - ◆ End user makes changes to variables, or relationships among variables, and observes the resulting changes in the values of other variables
- Sensitivity Analysis
 - ◆ Value of only one variable is changed repeatedly and the resulting changes in other variables are observed
- Goal-Seeking
 - ◆ Reverse direction of analysis done in 'what-if' analysis
 - ◆ Set a target value for a variable and then repeatedly change other variables until the target value is achieved
 - ◆ Also called 'how can' analysis
- Optimization
 - ◆ More complex extension of goal-seeking analysis
 - ◆ Goal is to find the optimum value for one or more target variables given certain constraints
 - ◆ One or more other variables are changed repeatedly until the best values for the target variables are discovered (Microsoft Excel → Solver)

Components of DSS

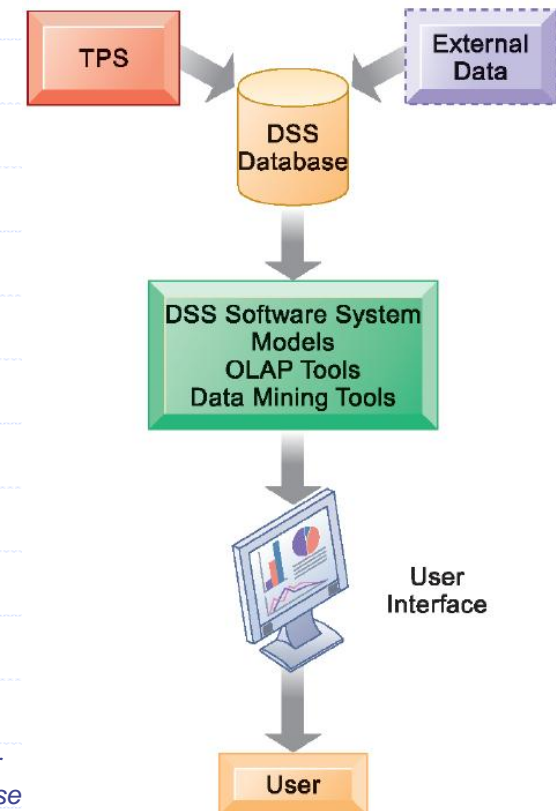
➤ DSS Database

- Collection of current or historical data from a number of applications or groups

➤ DSS Software System

- Software tools that are used for data analysis
 - ◆ OLAP tools
 - ◆ Data mining tools
 - ◆ Mathematical and analytical models

➤ DSS User Interface



The main components of the DSS are the DSS database, the DSS software system, and the user interface. The DSS database may be a small database residing on a PC or a large data warehouse

Components of DSS

➤ DSS - Sensitivity Analysis

This table displays the results of a sensitivity analysis of the effect of changing the sales price of a necktie and the cost per unit on the product's break-even point. It answers the question, "What happens to the break-even point if the sales price and the cost to make each unit increase or decrease?"

Total fixed costs	19000					
Variable cost per unit	3					
Average sales price	17					
Contribution margin	14					
Break-even point	1357					
		Variable Cost per Unit				
Sales	1357	2	3	4	5	6
Price	14	1583	1727	1900	2111	2375
	15	1462	1583	1727	1900	2111
	16	1357	1462	1583	1727	1900
	17	1267	1357	1462	1583	1727
	18	1188	1267	1357	1462	1583

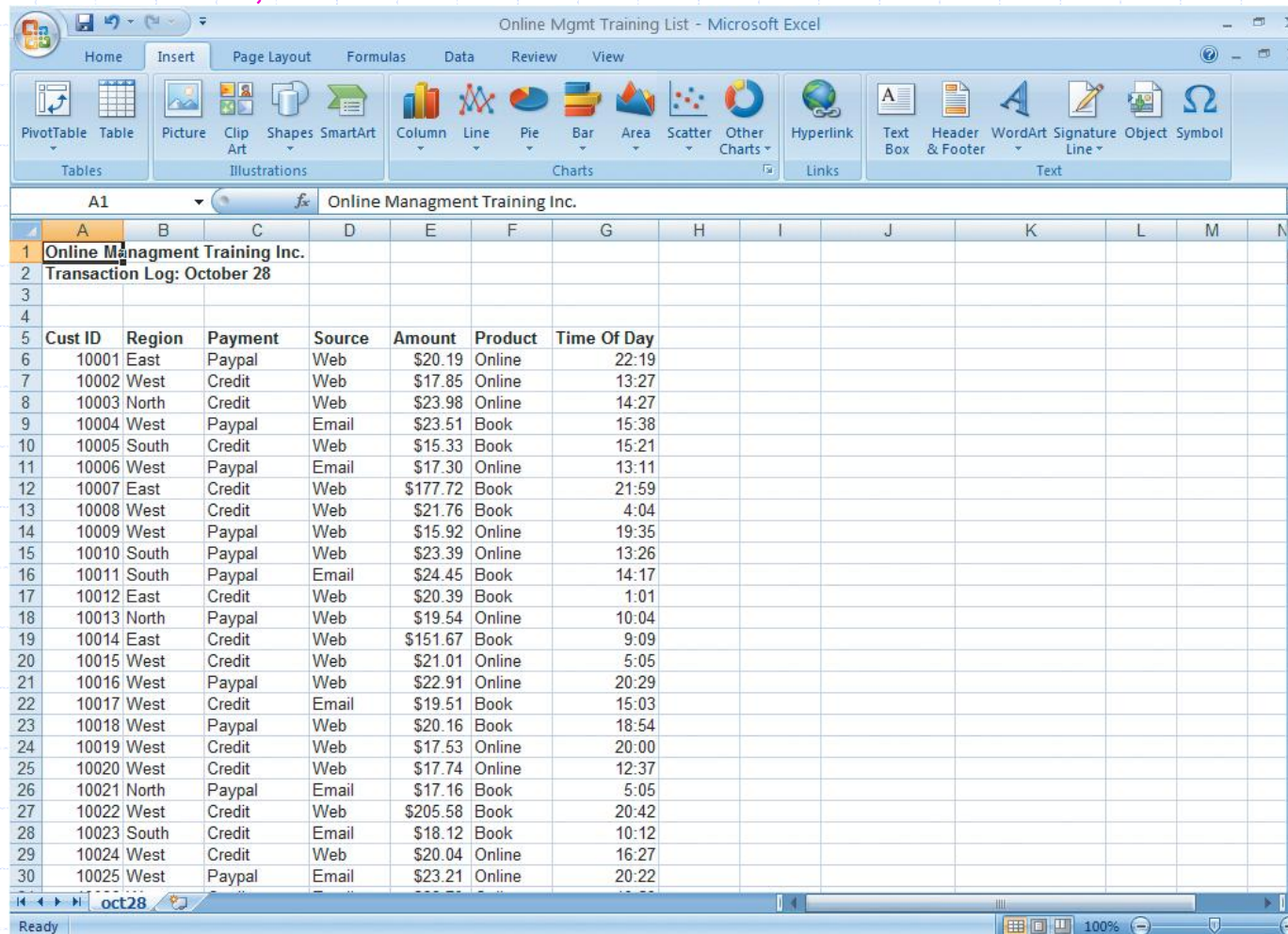
Components of DSS

➤ Using Spreadsheet Tables to Support Decision Making

- Spreadsheet tables can answer multiple dimensions of questions
 - ◆ Time of day and average purchase
 - ◆ Payment type and average purchase
 - ◆ Payment type, region, and source
- Pivot table
 - ◆ Displays two or more dimensions of data in a convenient format

Components of DSS

- Sample List of Transactions for Online Management Training Inc. on October 28, 2007



Online Mgmt Training List - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Online Management Training Inc.												
2	Transaction Log: October 28												
3													
4													
5	Cust ID	Region	Payment	Source	Amount	Product	Time Of Day						
6	10001	East	Paypal	Web	\$20.19	Online	22:19						
7	10002	West	Credit	Web	\$17.85	Online	13:27						
8	10003	North	Credit	Web	\$23.98	Online	14:27						
9	10004	West	Paypal	Email	\$23.51	Book	15:38						
10	10005	South	Credit	Web	\$15.33	Book	15:21						
11	10006	West	Paypal	Email	\$17.30	Online	13:11						
12	10007	East	Credit	Web	\$177.72	Book	21:59						
13	10008	West	Credit	Web	\$21.76	Book	4:04						
14	10009	West	Paypal	Web	\$15.92	Online	19:35						
15	10010	South	Paypal	Web	\$23.39	Online	13:26						
16	10011	South	Paypal	Email	\$24.45	Book	14:17						
17	10012	East	Credit	Web	\$20.39	Book	1:01						
18	10013	North	Paypal	Web	\$19.54	Online	10:04						
19	10014	East	Credit	Web	\$151.67	Book	9:09						
20	10015	West	Credit	Web	\$21.01	Online	5:05						
21	10016	West	Paypal	Web	\$22.91	Online	20:29						
22	10017	West	Credit	Email	\$19.51	Book	15:03						
23	10018	West	Paypal	Web	\$20.16	Book	18:54						
24	10019	West	Credit	Web	\$17.53	Online	20:00						
25	10020	West	Credit	Web	\$17.74	Online	12:37						
26	10021	North	Paypal	Email	\$17.16	Book	5:05						
27	10022	West	Credit	Web	\$205.58	Book	20:42						
28	10023	South	Credit	Email	\$18.12	Book	10:12						
29	10024	West	Credit	Web	\$20.04	Online	16:27						
30	10025	West	Paypal	Email	\$23.21	Online	20:22						

Components of DSS

- Pivot Table
- Examines the Regional Distribution of Customers
- Created using Excel 2007

The screenshot displays the Microsoft Excel 2007 interface. The main worksheet, titled 'Online Mgmt Training List - Microsoft Excel', contains a data table with columns: Cust ID, Region, Payment, Source, Amount, Product, and Time Of Day. A PivotTable is located on the right side of the worksheet, with 'Row Labels' set to 'Region' and 'Values' set to 'Count of Cust ID'. The PivotTable shows the following data:

Region	Count of Cust ID
East	101
North	92
South	106
West	211
Grand Total	510

The 'PivotTable Field List' task pane is open, showing the 'Choose fields to add to report:' section with 'Cust ID' and 'Region' selected. The 'Report Filter' section is empty. The 'Column Labels' section is empty. The 'Row Labels' section has 'Region' selected. The 'Values' section has 'Count of Cust ID' selected. The 'Defer Layout Update' checkbox is unchecked. The 'Update' button is visible.

Components of DSS

- Pivot Table
- Examines Customer Regional Distribution and Advertising Source

The screenshot shows a Microsoft Excel window titled 'Online Mgmt Training List - Microsoft Excel'. The 'PivotTable Tools' ribbon is active, showing the 'PivotTable Field List' task pane. The task pane lists the following fields: Cust ID, Region, Payment, Source, Amount, Product, and Time Of Day. The 'Region' and 'Source' fields are checked. The 'Report Filter' section shows 'Region' selected. The 'Column Labels' section shows 'Source' selected. The 'Row Labels' section is empty. The 'Values' section shows 'Count of Cust ID' selected. The 'Defer Layout Update' checkbox is unchecked. The 'Update' button is visible.

Count of Cust ID	Column Labels	Web	Grand Total
East	24	77	101
North	28	64	92
South	33	73	106
West	57	154	211
Grand Total	142	368	510

It appears nearly 30 percent of the customers respond to e-mail campaigns, and there are some regional variations

Data Visualization Systems

➤ DVS

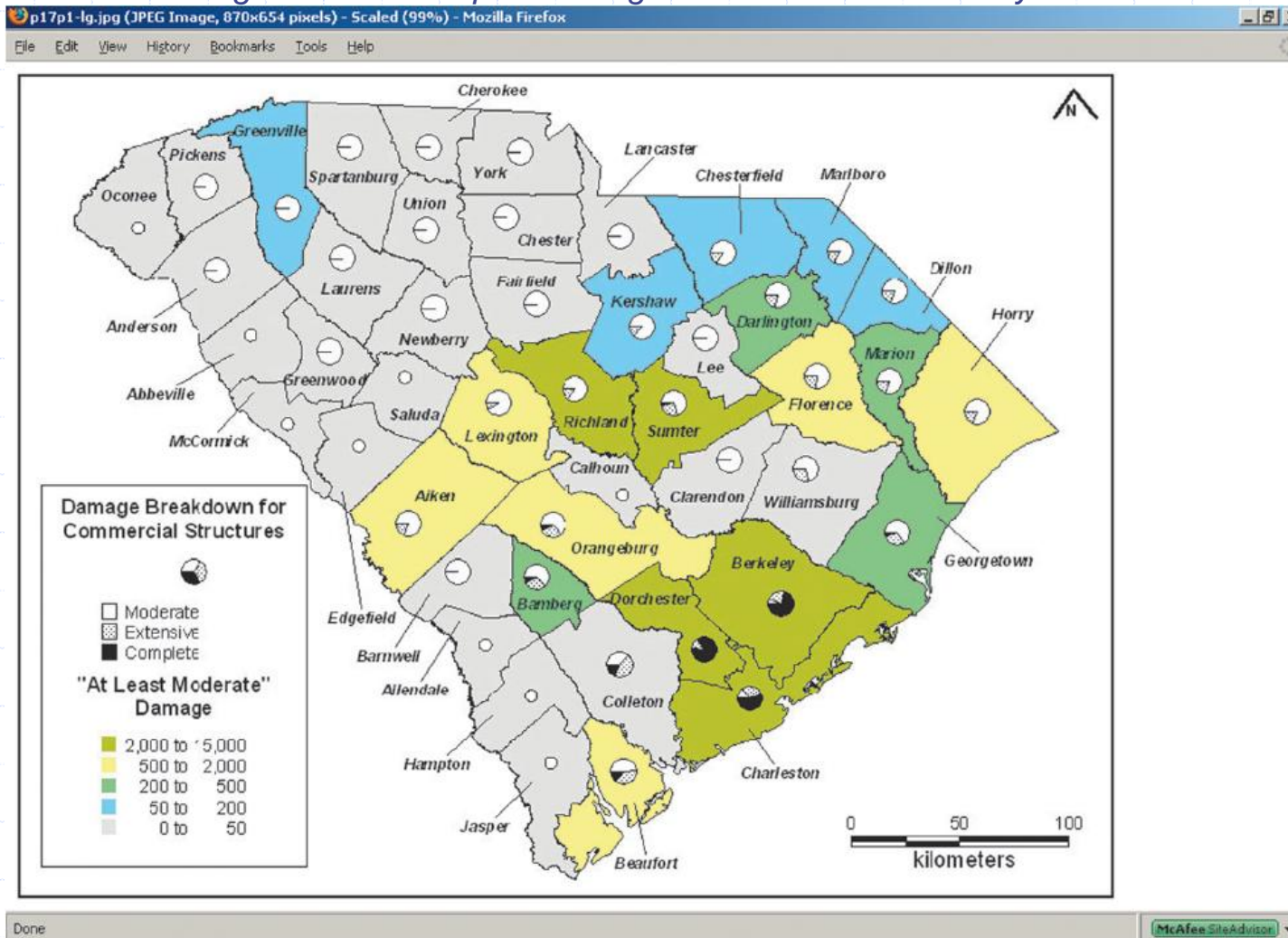
- DSS that represents complex data using interactive 3D graphical forms such as charts, graphs, and maps
- DVS tools help users to interactively sort, subdivide, combine, and organize data while it is in its graphical form

➤ Geographic Information Systems

- DSS that uses geographic databases to construct and display maps and other graphics displays
- That support decisions affecting the geographic distribution of people and other resources
- Often used with Global Position Systems (GPS) devices

Data Visualization Systems

South Carolina used a GIS-based program called HAZUS to estimate and map the regional damage and losses resulting from an earthquake of a given location and intensity



Customer Decision Support System

➤ CDSS

- Support customers in the decision-making process
 - ◆ Include → Search engines, intelligent agents, online catalogs, Web directories, newsgroups, e-mail, etc.
- Many firms have customer Web sites where all the information, models, or other analytical tools for evaluating alternatives are concentrated in one location
 - ◆ Example - T. Rowe Price online tools, guides for college planning, retirement planning, estate planning, etc.
 - ◆ Buying Digital Camera, Mobile, ...

Executive Support System

➤ ESS

- Bring together data from many different internal and external sources, often through a portal
- Combine many features of MIS and DSS
- Used to monitor organizational performance, track activities of competitors, identify changing market conditions, spot problems, identify opportunities, and forecast trends
- Provide top executives with immediate and easy access to information
- About the factors that are critical to accomplishing an organization's strategic objectives (**Critical success factors**)
- So popular, expanded to managers, analysts and other knowledge workers
- Information presented in forms tailored to the preferences of the executives using the system
 - ◆ Customizable graphical user interfaces
 - ◆ Exception reporting
 - ◆ Trend analysis
 - ◆ Drill down capability

Intelligent Systems for Decision Support

➤ Intelligent Techniques

- Many based on artificial intelligence (AI)
 - ◆ Computer-based systems (hardware and software) that attempt to emulate human behavior and thought patterns
- Attributes of Intelligent behavior
 - ◆ Think and reason
 - ◆ Use reason to solve problems
 - ◆ Learn or understand from experience
 - ◆ Acquire and apply knowledge
 - ◆ Exhibit creativity and imagination
 - ◆ Deal with complex or perplexing situations
- Include:
 - ◆ Expert systems
 - ◆ Case-based reasoning
 - ◆ Fuzzy logic
 - ◆ Neural networks
 - ◆ Genetic algorithms
 - ◆ Intelligent agents

Intelligent Systems for Decision Support

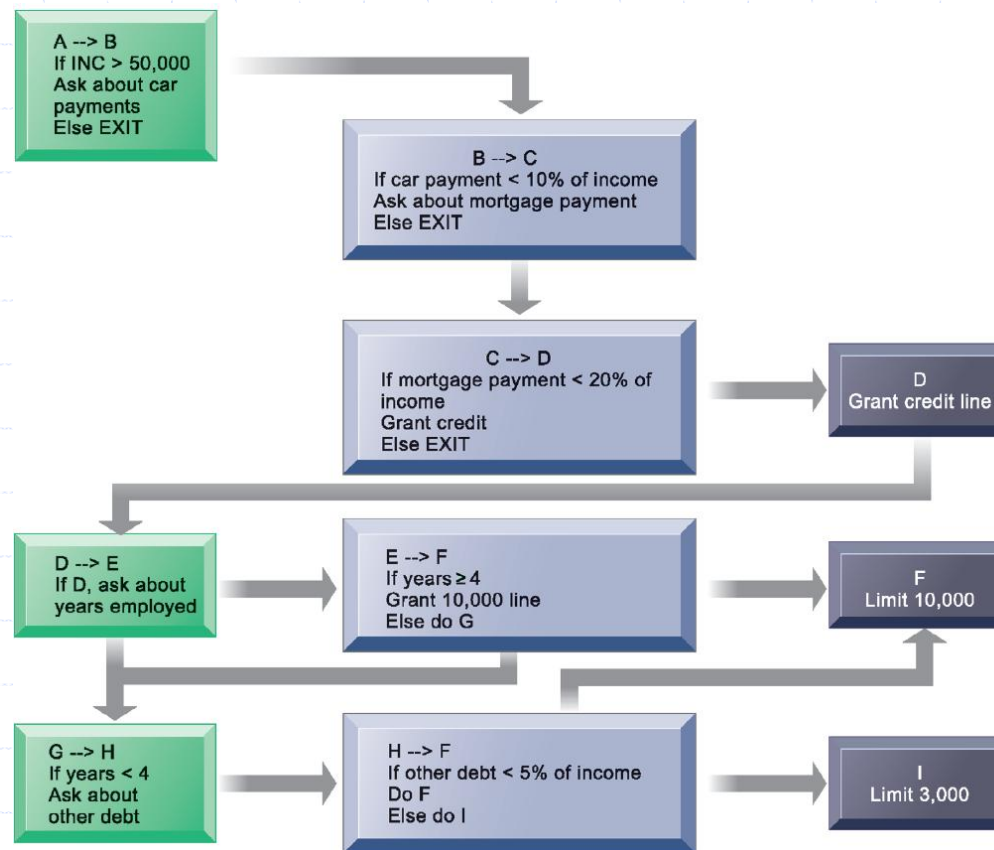
➤ Expert Systems

- A knowledge-based information system (KBIS) that uses its knowledge about a specific, complex application to act as an expert consultant to end users
- KBIS is a system that adds a knowledge base to the other components on an IS
- Model human knowledge as a set of rules that are collectively called the knowledge base
 - ◆ 200 – 10,000 rules, depending on complexity of decision making process
- Inference engine → Strategy to search and conclude decision
- Inference engine searches through the rules and *fires* those rules that are triggered by facts gathered and entered by the user

Intelligent Systems for Decision Support

➤ Rules in Expert System

An expert system rules are interconnected; the number of outcomes is known in advance; there are multiple paths to same outcome; and the system can consider multiple rules at a single time. The rules illustrated are for a simple credit-granting expert system.



Intelligent Systems for Decision Support

➤ Benefits of Expert System

- Faster and more consistent than human expert
- Can have the knowledge of several experts
- Does not get tired or distracted by overwork or stress
- Helps **preserve** and reproduce the knowledge of experts

➤ Limitations of Expert System

- Limited focus – Subjective problems
- Inability to learn – Must be taught new knowledge
- Maintenance problems
- Developmental costs – Cost of knowledge engineers, expert time
- Can only solve specific types of problems in a limited domain of knowledge

Intelligent Systems for Decision Support

➤ Suitability Criteria for Expert System

- Types of problems are most suitable for expert system solutions?
 - ◆ **Domain:** subject area relatively small and limited to well-defined area
 - ◆ **Expertise:** solutions require the efforts of an expert
 - ◆ **Complexity:** solution of the problem is a complex task that requires logical inference processing (not possible in conventional information processing)
 - ◆ **Structure:** solution process must be able to cope with ill-structured, uncertain, missing and conflicting data
 - ◆ **Availability:** an expert exists who is articulate and cooperative
- Hundreds of rules (assumptions, facts), several months to develop
 - ◆ Experts → within minutes
- How to develop Expert System?
 - ◆ Easiest approach → Expert System Shells
 - ◆ Software package without kernel (knowledge base)
 - ◆ Rule editors, Inference generators

Intelligent Systems for Decision Support

➤ Case based Reasoning

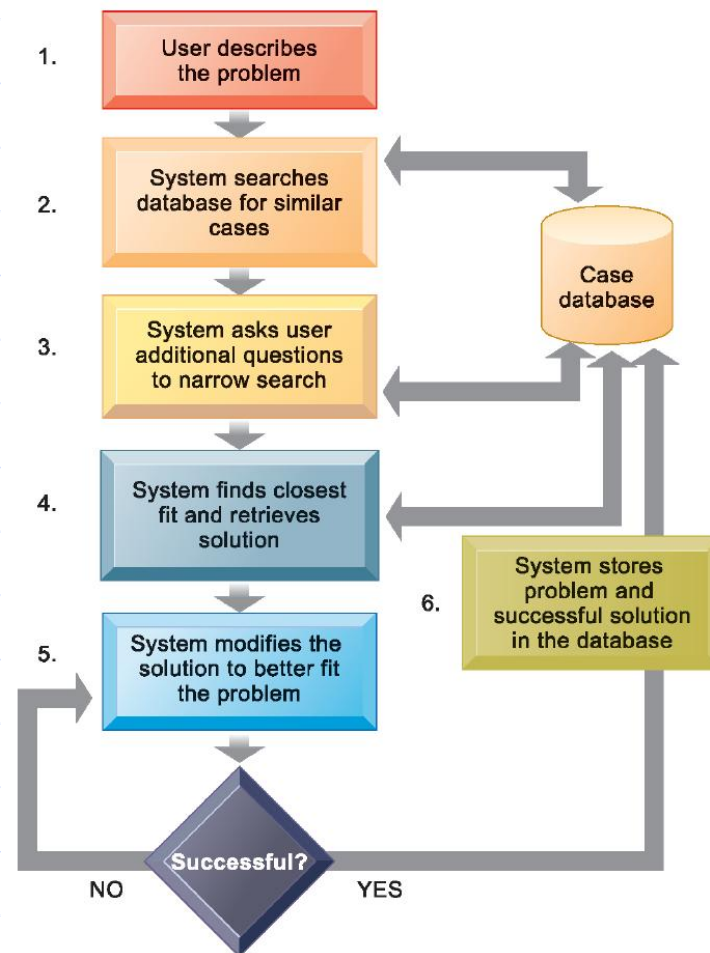
- Knowledge and past experiences of human specialists are represented as cases and stored in a database for later retrieval
- System searches for stored cases with problem characteristics similar to new one, finds closest fit, and applies solutions of old case to new case
- Successful and unsuccessful applications are tagged and linked in database
- Used in medical diagnostic systems, customer support

Intelligent Systems for Decision Support

➤ Case based Reasoning

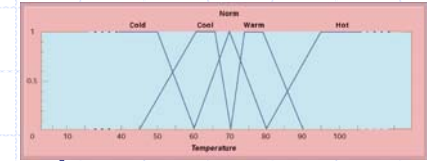
Knowledge → Database of past cases and their solutions

Six-step process to generate solutions to new problems encountered by the user



Intelligent Systems for Decision Support

➤ Fuzzy Logic



- Method of reasoning that resembles human reasoning
- Allows for approximate values and inferences and incomplete or ambiguous data instead of relying only on crisp data
- Uses terms such as “very high” rather than precise measures
- Rule-based technology that represents imprecision in categories (e.g. “cold” vs. “cool”) by creating rules that use approximate or subjective values
- Describes a particular phenomenon or process linguistically and then represents that description in a small number of flexible rules
- Provides solutions to problems requiring expertise that is difficult to represent in the form of crisp IF-THEN rules
 - ◆ Example - *Sendai*, Japan subway system uses fuzzy logic controls to accelerate so smoothly that standing passengers need not hold on
 - ◆ Incremental changes in the input to *produce* Smooth changes in the output instead of discontinuous ones

Intelligent Systems for Decision Support

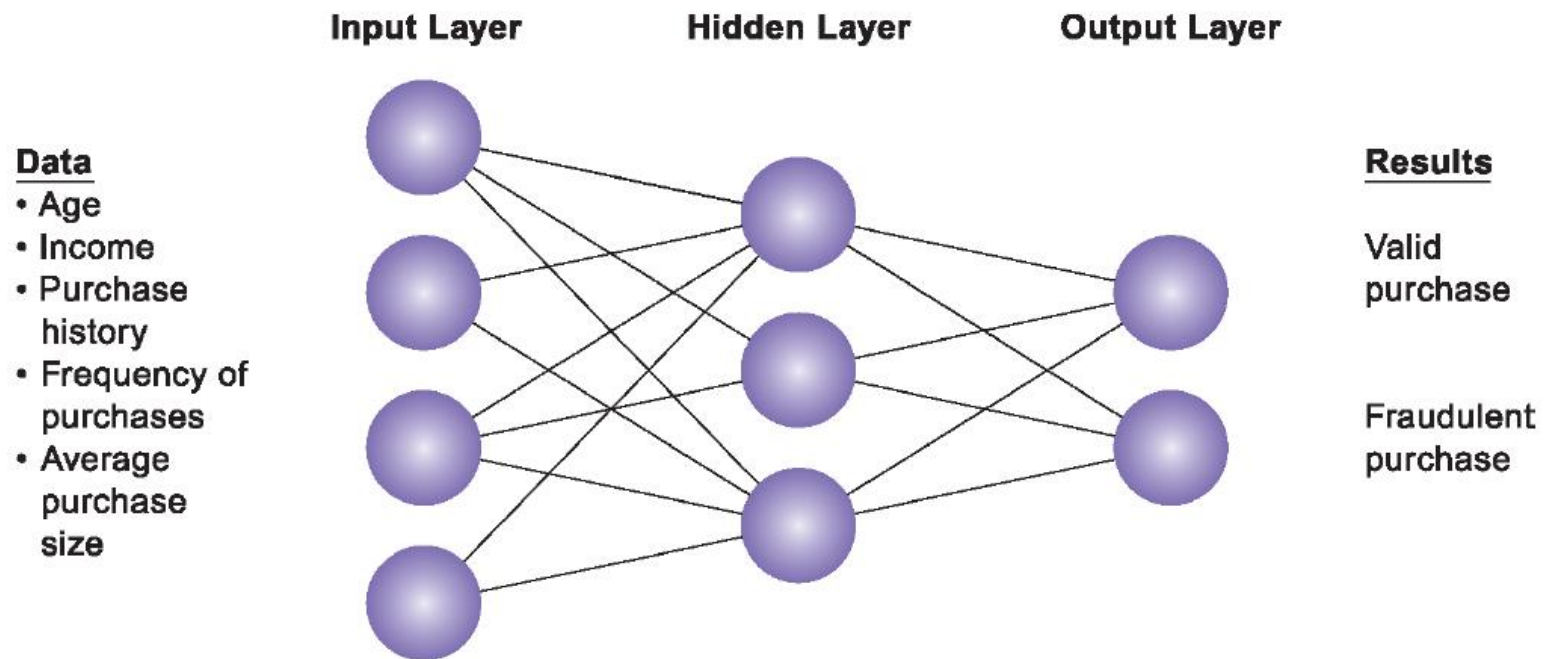
➤ Neural Network

- Computing systems modeled after the brain's mesh-like network of interconnected processing elements, called neurons
- Interconnected processors operate in parallel and interact with each other
- “Learn” patterns from large quantities of data by searching for relationships, building models, and correcting over and over again the model's own mistakes
- Humans may “train” the network by feeding it data for which the inputs produce a known set of outputs or conclusions
- Useful for solving complex, poorly understood problems for which large amounts of data have been collected

Intelligent Systems for Decision Support

➤ How Neural Network Works?

- In this example, the neural network has been trained to distinguish between valid and fraudulent credit card purchases



Intelligent Systems for Decision Support

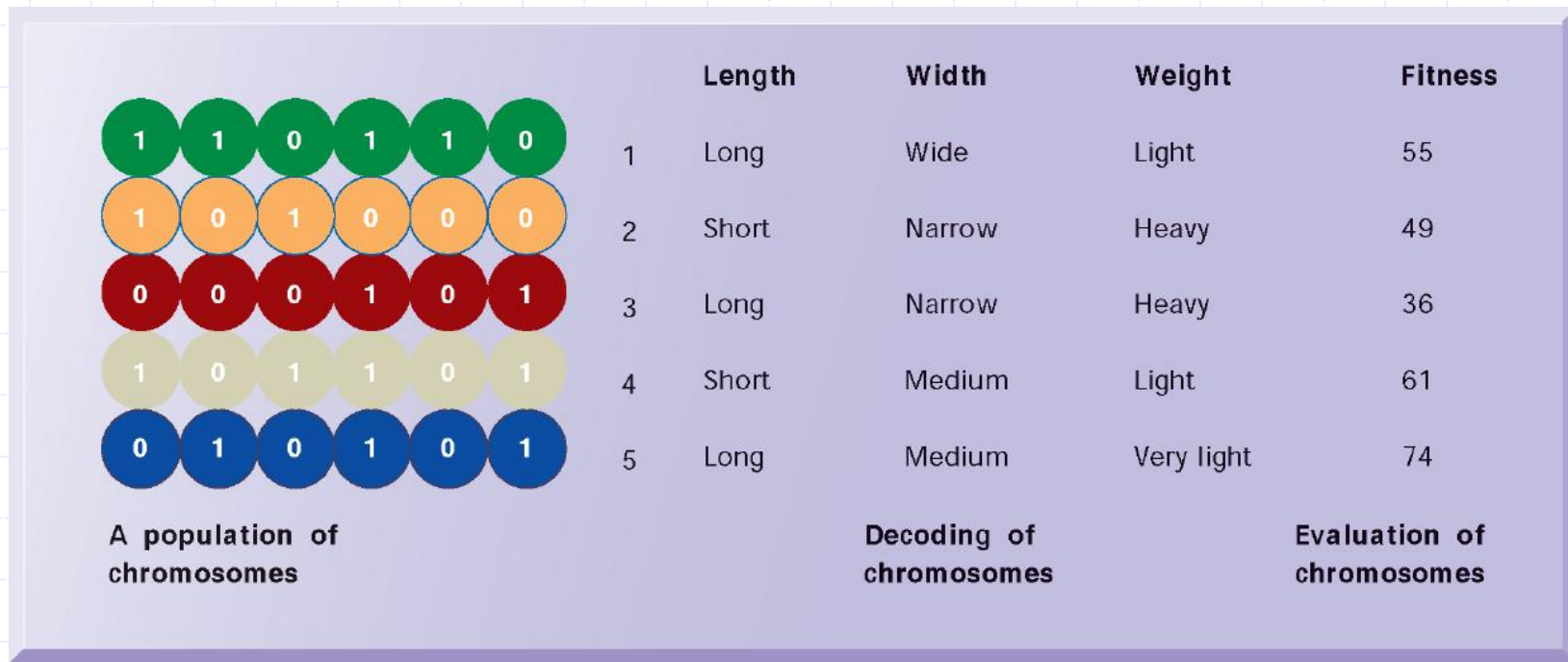
➤ Genetic Algorithms

- Darwinian (survival of the fittest), randomizing, and other mathematical functions
- Based on techniques inspired by evolutionary biology: inheritance, mutation, selection, etc.
- To simulate an evolutionary process that can yield increasingly better solutions to a problem
- Work by representing a solution as a string of 0s and 1s, then searching randomly generated strings of binary digits to identify best possible solution
- Used to solve complex problems that are very dynamic and complex, involving hundreds or thousands of variables or formulas

Intelligent Systems for Decision Support

➤ How Genetic Algorithms Works?

- Initial population of *chromosomes*, each representing a different solution
- Genetic algorithm → Iterative process to refine the initial solutions
- Better ones, those with the higher fitness, are more likely to emerge as the best solution



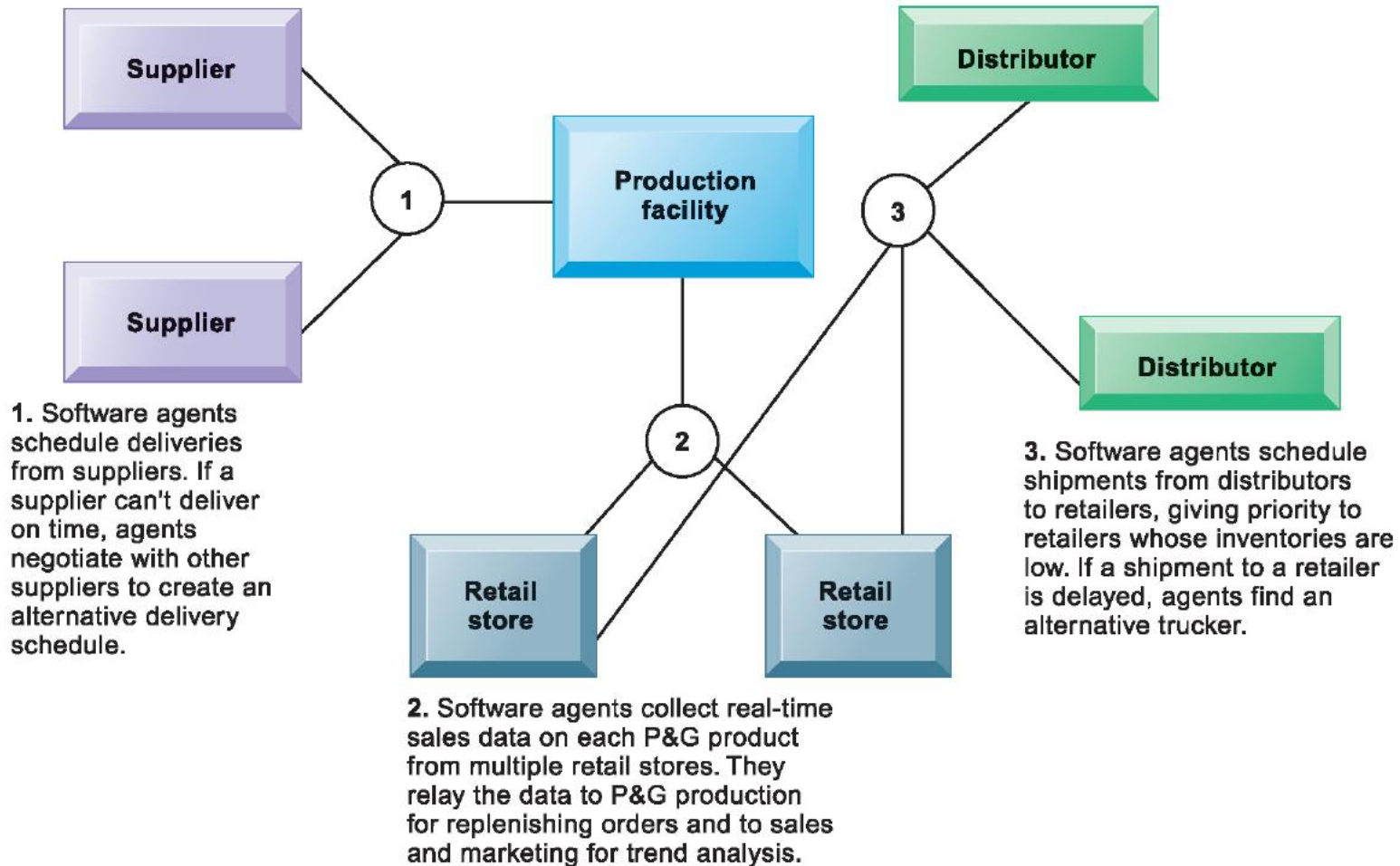
Intelligent Systems for Decision Support

➤ Intelligent Agents

- A software surrogate for an end user or a process that fulfills a stated need or activity
- Programs that work in the background without direct human intervention to carry out specific, repetitive, and predictable tasks for user, business process, or software application
- Shopping bots - Uses its built-in and learned knowledge base
- Also called **software robots** or **bots**
 - ◆ Procter & Gamble (P&G) programmed group of semiautonomous agents to emulate behavior of supply-chain components, such as trucks, production facilities, distributors, and retail stores and created simulations to determine how to make supply chain more efficient

Intelligent Systems for Decision Support

➤ Intelligent Agents



Intelligent Systems for Decision Support

➤ Major Types of Intelligent Agents

- **Interface Tutors** → observe user computer operations, correct user mistakes, and provide hints and advice on efficient software use
 - ◆ *Wizards* found in *Microsoft Office* & well known software
- **Presentation** → show information in a variety of forms and media based on user preferences
- **Network Navigation** → discover paths to information and provide ways to view information based on user preferences
- **Role-Playing** → play what-if games and other roles to help users understand information and make better decisions

Systems for Managing Knowledge

➤ Knowledge Management

- Business processes developed for creating, storing, transferring, and applying knowledge
- Increases the ability of organization to learn from environment and to incorporate knowledge into business processes and decision making
- Knowing how to do things effectively and efficiently in ways that other organizations cannot duplicate is major source of profit and competitive advantage

Systems for Managing Knowledge

➤ Enterprise-Wide Knowledge Management

- Three kinds of knowledge in firms
 - ◆ Structured → Structured text documents (reports, presentations)
 - ◆ Semistructured → E-mail, voice mail, digital pictures, bulletin-board postings
 - ◆ Tacit knowledge (unstructured) → Knowledge residing in *heads of employees*, rarely written down
- Enterprise-wide knowledge management systems
 - ◆ Deal with all three types of knowledge
 - ◆ General-purpose, firm-wide systems that collect, store, distribute, and apply digital content and knowledge
 - ◆ Searching, Storing, Locating employees with such expertise

Systems for Managing Knowledge

➤ Enterprise-Wide Content Management Systems

- Capabilities for knowledge capture, storage
- Repositories for documents and best practices
- Capabilities for collecting and organizing semi-structured knowledge such as e-mail

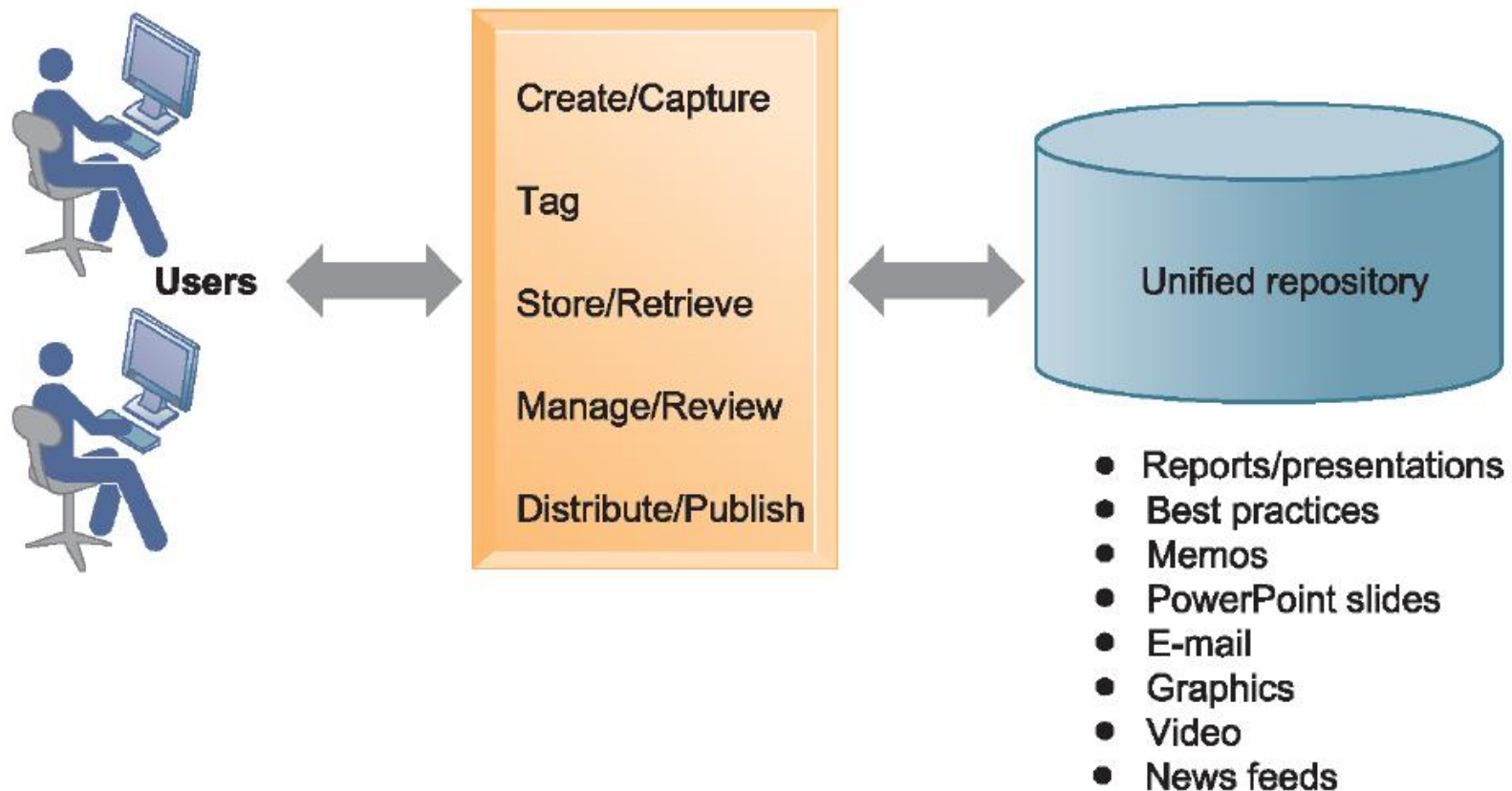
➤ Classification schemes

- Key problem in managing knowledge, categorize
- Each knowledge object must be tagged for retrieval
 - ◆ BAE Systems → Employed *Autonomy Content Management System*
 - ◆ Aggregates stru/unstructured content from emails, resumes, profiles, and over 10,000 news feed per day
 - ◆ Automatically categorizes and tags the contents and alerts about 130,000 employees
 - ◆ Reduced time spent in retrieving information by 90%

Systems for Managing Knowledge

➤ Enterprise-Wide Content Management Systems

- Capabilities for **classifying, organizing, and managing structured and Semi-structured** knowledge
- Makes it available **throughout the enterprise**



Systems for Managing Knowledge

➤ Enterprise-Wide Knowledge Management Systems

- Digital asset management systems
 - ◆ Manage unstructured digital data like photographs, graphic images, video, audio
- Knowledge network systems (Expertise location and management systems)
 - ◆ Provide online directory of corporate experts in well-defined knowledge domains
 - ◆ Use communication technologies to make it easy for employees to find appropriate expert in firm
- Collaboration tools
 - ◆ Blogs
 - ◆ Wikis (tracking changes and reverting to earlier versions)
 - ◆ Social bookmarking

Systems for Managing Knowledge

➤ Enterprise Knowledge Network Systems



- A knowledge network maintains a database of firm experts, as well as accepted solutions to known problems
- Facilitates the communication between employees looking for knowledge and experts who have that knowledge
- Solutions created in this communication - added to a database of solutions in the form of frequently asked questions (FAQs), best practices, or other documents