Lesson 8

Systems that Span Organizational Boundaries

Decision Support, Expert and Knowledge Management systems

Systems That Span Organizational Boundaries

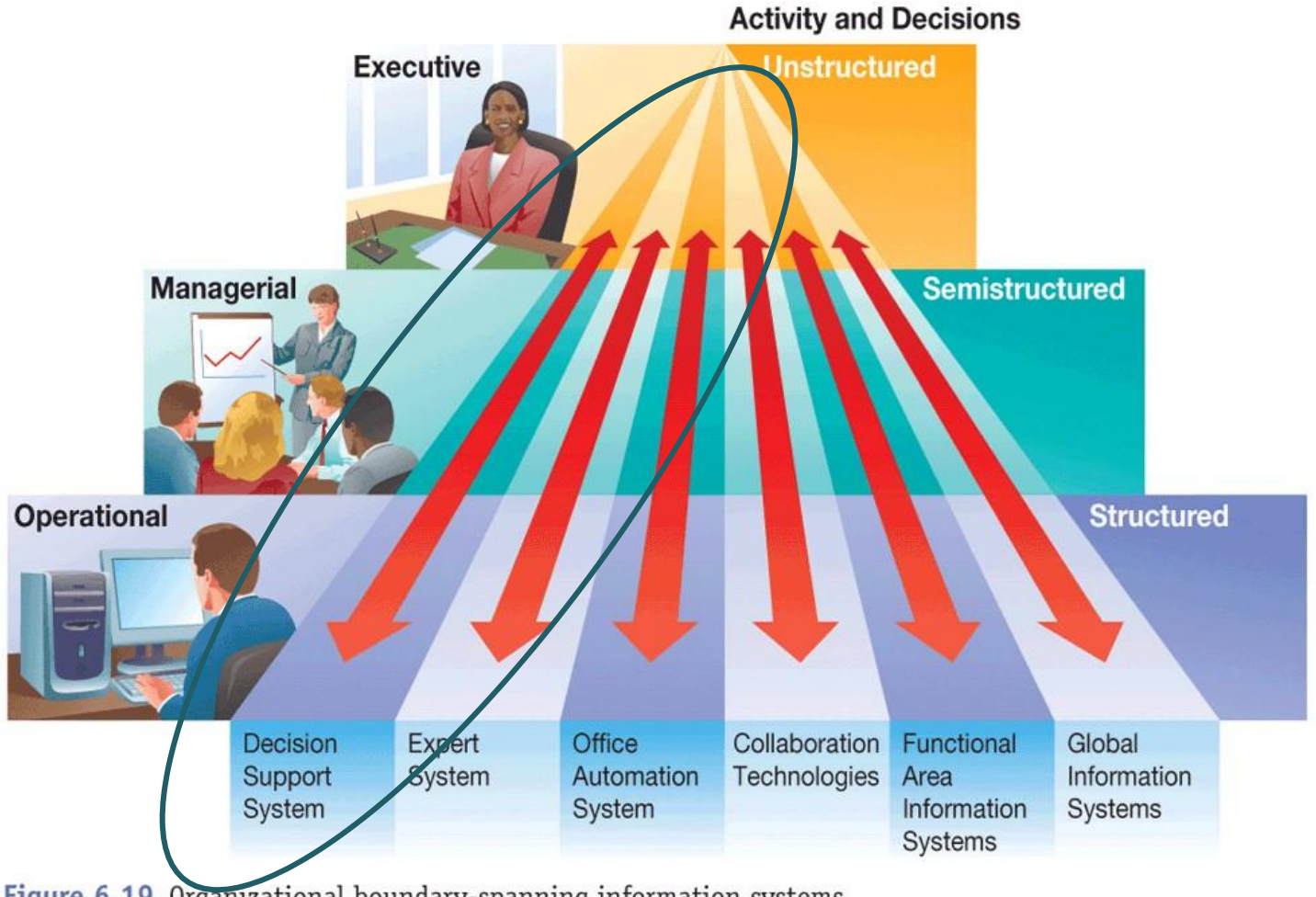


Figure 6.19 Organizational boundary-spanning information systems.

Decision Support Systems

- Computerized information systems designed to help business owners, executives, and managers **resolve complicated business problems** and/or **questions**
  - Structured vs. Unstructured decisions
- **Structured** Decisions
  - Decisions that are taken based upon specific pre-set parameters that support the decision. To make the decision, it is known what data is required, and there is an assumptions that the required data will always be available. Little flexibility for decision-maker
- **Unstructured** Decisions
  - Decisions made when all elements of business environment are not completely understood. (new products, marketing strategy). Data might be incomplete at the moment of making the decision More focus on the individual who makes the decision.

Decision Support Systems

- **Decision Support Systems**
  - **Special-purpose** information systems designed to support managerial-level employees in organizational decision making
- **System Details**
  - These systems use **computational software** to construct models for analysis (most common is MS Excel) to solve problems (e.g. sales or resource forecasts)
- **Supported Activities**:
  - **“What-if” analysis** – changing one or more variables in the model to observe the effect (e.g. What is the payment if the interest rate increases by 1% ?)

Characteristics of Decision Support Systems

Inputs	Data and models; data entry and data manipulation commands (via user interface)
Processing	Interactive processing of data and models; simulations, optimization, forecasts
Outputs	Graphs and textual reports; feedback to system operator (via user interface)
Typical Users	Midlevel managers (although a DSS could be used at any level of the organization)

Area	Common DSS Models
Accounting	Cost analysis, discriminant analysis, break-even analysis, auditing, tax computation and analysis, depreciation methods, budgeting
Corporate Level	Corporate planning, venture analysis, mergers and acquisitions
Finance	Discounted cash flow analysis, return on investment, buy or lease, capital budgeting, bond refinancing, stock portfolio management, compound interest, after-tax yield, foreign exchange values
Marketing	Product demand forecast, advertising strategy analysis, pricing strategies, market share analysis, sales growth evaluation, sales performance
Personnel	Labour negotiations, labour market analysis, personnel skills assessment, employee business expense, fringe benefit computations, payroll and deductions
Production	Product design, production scheduling, transportation analysis, product-mix inventory level, quality control, learning curve, plant location, material allocation, maintenance analysis, machine replacement, job assignment, material requirement planning
Management Science	Linear programming, decision trees, simulation, project evaluation and planning, queuing, dynamic programming, network analysis
Statistics	Regression and correlation analysis, exponential smoothing, sampling, time-series analysis, hypothesis testing

Decision Support Systems

- A **DSS** may be **developed by people** outside of the Information Systems Department

- A **DSS** also can have **capability for ad hoc reporting** from the database (warehouse)

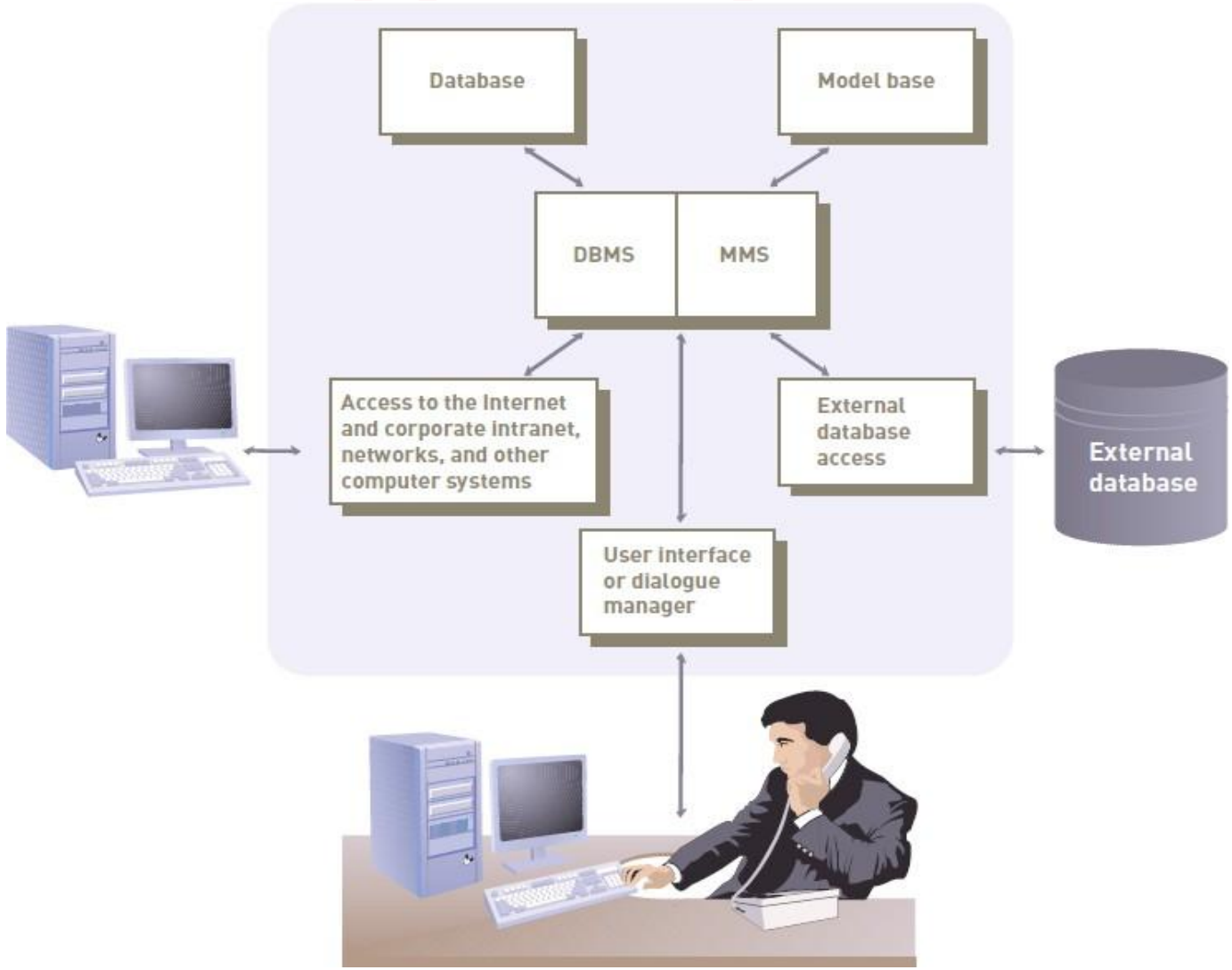
- **Examples** of decision support:
  "**should we buy out a company**? should we expand into another product line?" [why semi-structured?]

Decision Support Systems

Typically include:

- **Database Management System** (DBMS)
- **Model Base** that uses the database:
  - Structured representation of some aspect of reality
  - Through modeling we can examine effects of decisions
  - A model always includes assumptions e.g., inflation rate, net earnings level over 5 years; cost increases
- **User-friendly interface** (dialog), often involving graphics

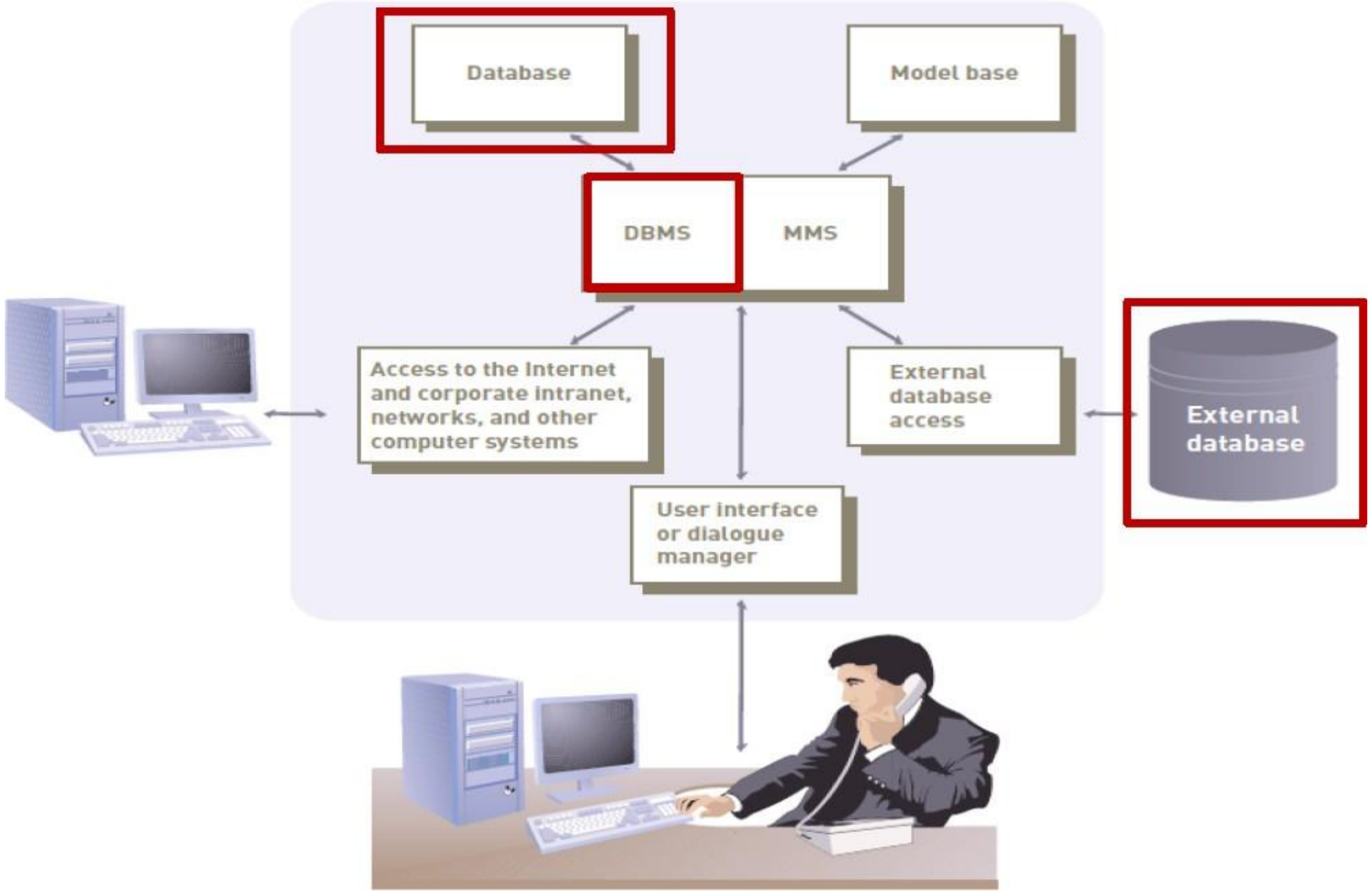
Decision Support Systems



Components of a Decision Support System

1. **Database Management System (DBMS):**
    - Allows managers and decision makers to perform qualitative analysis on data stored in company's databases, data warehouses, and data marts
    - Can also be used to connect to external databases
    - **Data-driven DSS**:
        - Performs qualitative analysis based on the company's databases

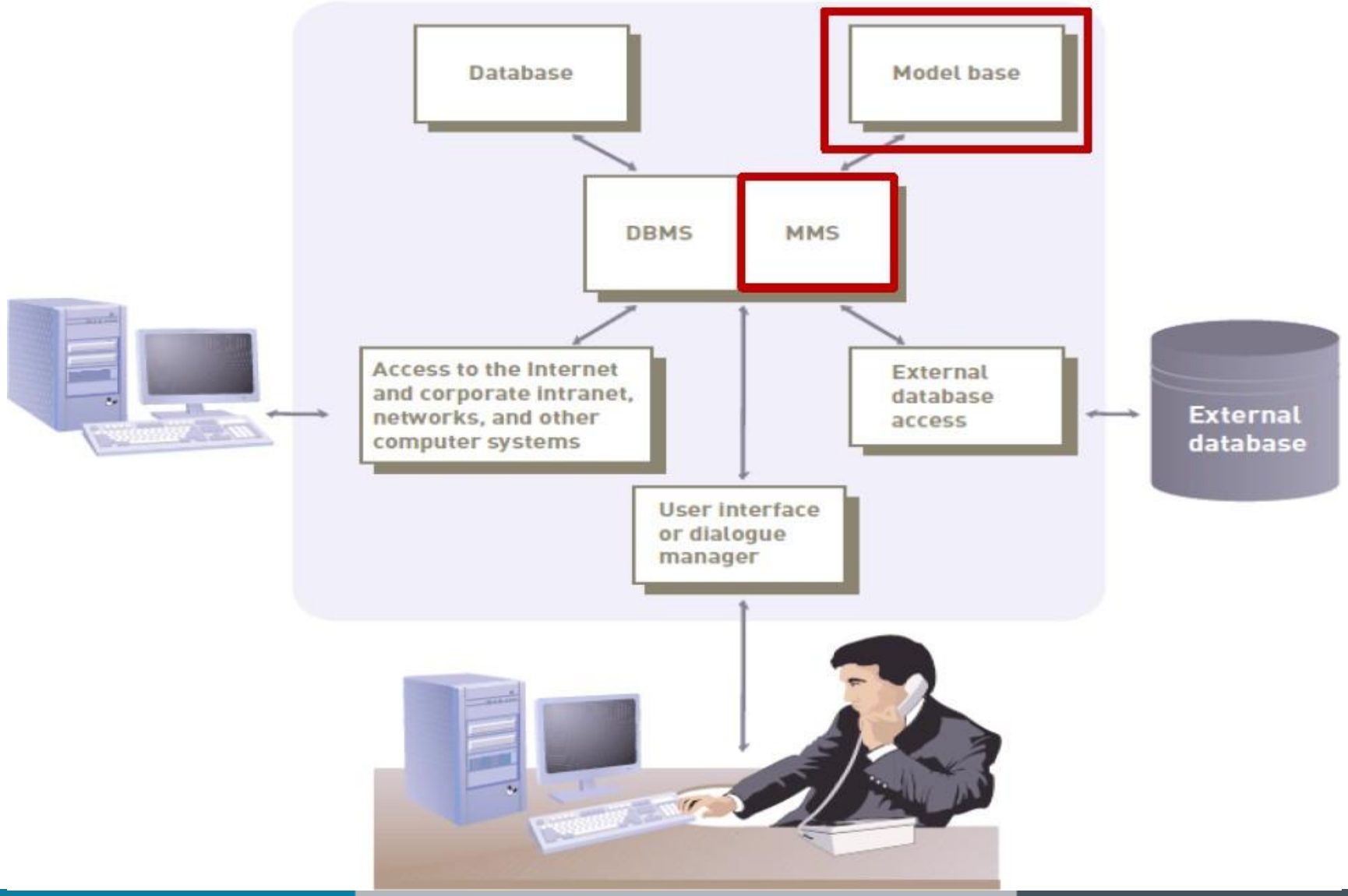
Components of a Decision Support System (DSS)



Components of a Decision Support System

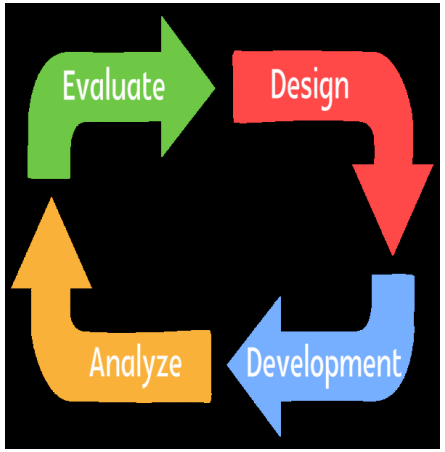
2. **Model base:**
- Allows managers and decision makers to perform *quantitative analysis* on both internal and external data
- Model management software (MMS):
  - Coordinates the use of models in DSS
- **Model-driven DSS**:
  - Performs mathematical or quantitative analysis

Components of a Decision Support System (DSS)



The Model Base (Examples)

Model Type	Description	Software
Financial	Provides cash flow, internal rate of return, and other investment analysis	Spreadsheet, such as Microsoft Excel
Statistical	Provides summary statistics, trend projections, hypothesis testing, and more	Statistical programs, such as SPSS or SAS
Graphical	Assists decision makers in designing, developing, and using graphic displays of data and information	Graphics programs, such as Microsoft PowerPoint
Project Management	Handles and coordinates large projects; also used to identify critical activities and tasks that could delay or jeopardize an entire project if they are not completed in a timely and cost-effective fashion	Project management software, such as Microsoft Project

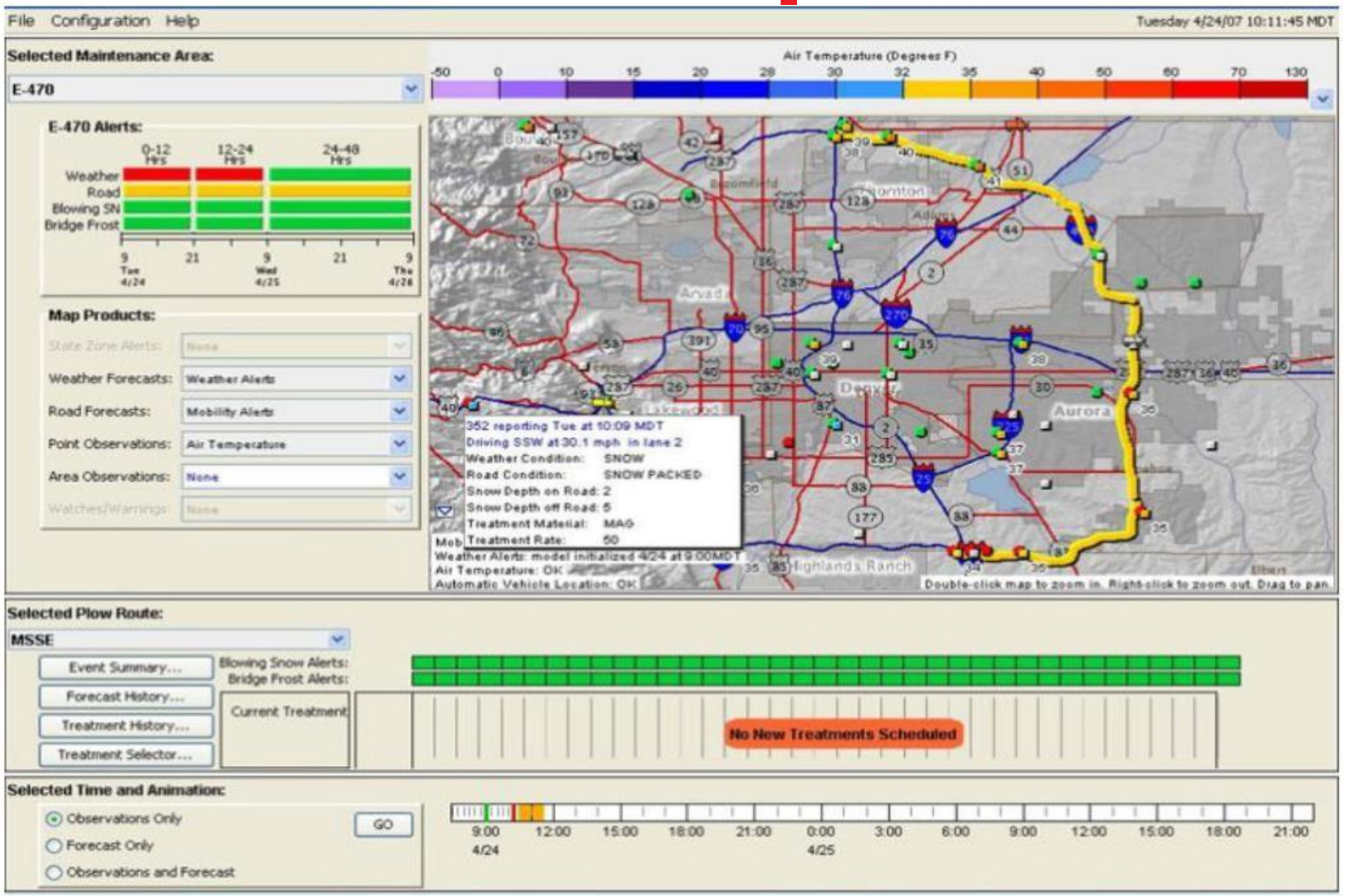


Components of a Decision Support System (DSS)

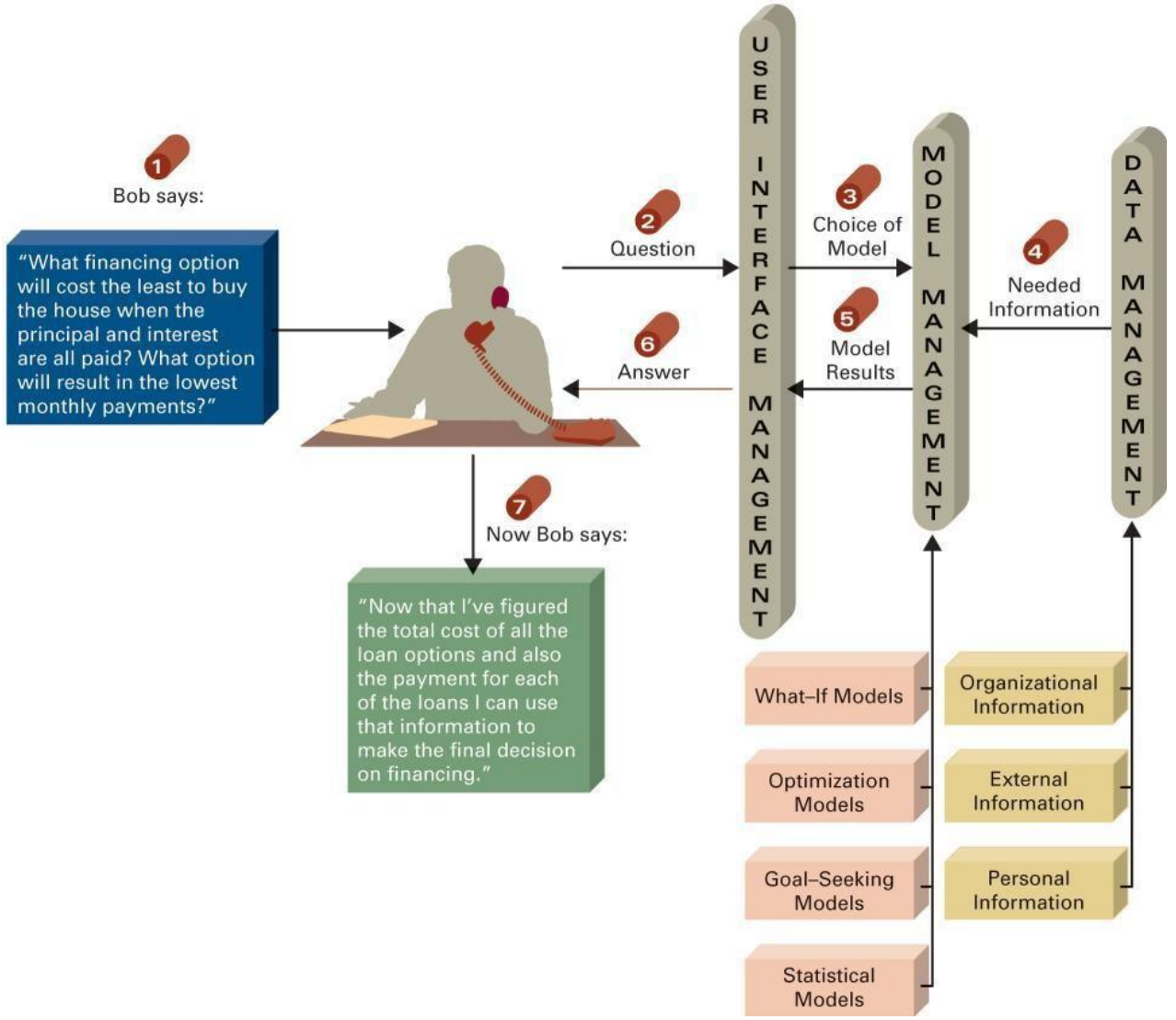
3. User Interface or Dialogue Manager:

- Allows decision makers to easily access and manipulate the DSS and to use common business terms and phrases
- Allows users to interact with the DSS to obtain information
- Assists with all aspects of communications between user and hardware and software that constitute the DSS
- Allows for manipulation of variables

User Interface Example



Three Fundamental DSS Components



Model Driven DSS vs. Data Driven DSS

- A **Model Driven DSS** uses various models such as statistical model, simulation model or financial model for decision makings and to come up with a decision or strategy. Decisions are based on models.

- A **Data Driven DSS** emphasizes access to and manipulation of a time- series of internal company data and sometimes external data to aid decision makings. So, decisions are based on analyzed data.

Model Driven DSS

Uses various models such as statistical model, simulation model or financial model for decision makings

Model-Driven DSS Concepts

- A more primitive example of a DSS is a spreadsheet used for “what-if” analysis
- There are Excel templates built for certain types of decisions [terms: *template, model;* explain these]
- Template: Frame to define in general terms an aspect of reality. Instances of this aspect are created by filling in information on the template
- Model: A representation of a process in real life (can be graphical or numerical). Contains variables that can be modified.

Model-Driven Ex. – Loan Calculator

Variables to be Analyzed

Interest Rate	Loan Duration
4% per year	3 years
6% per year	4 years
8% per year	5 years

Loan Calculator Model

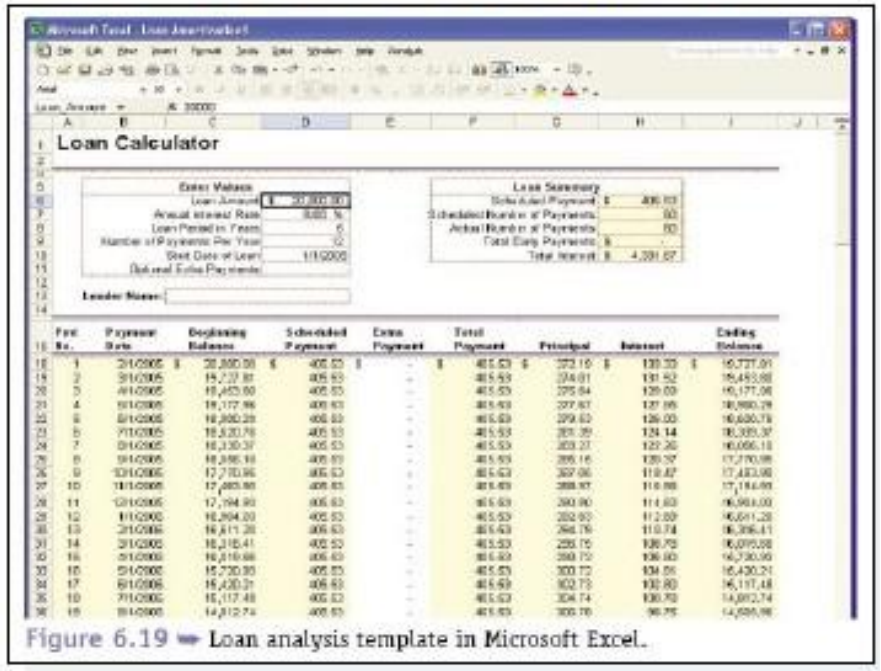
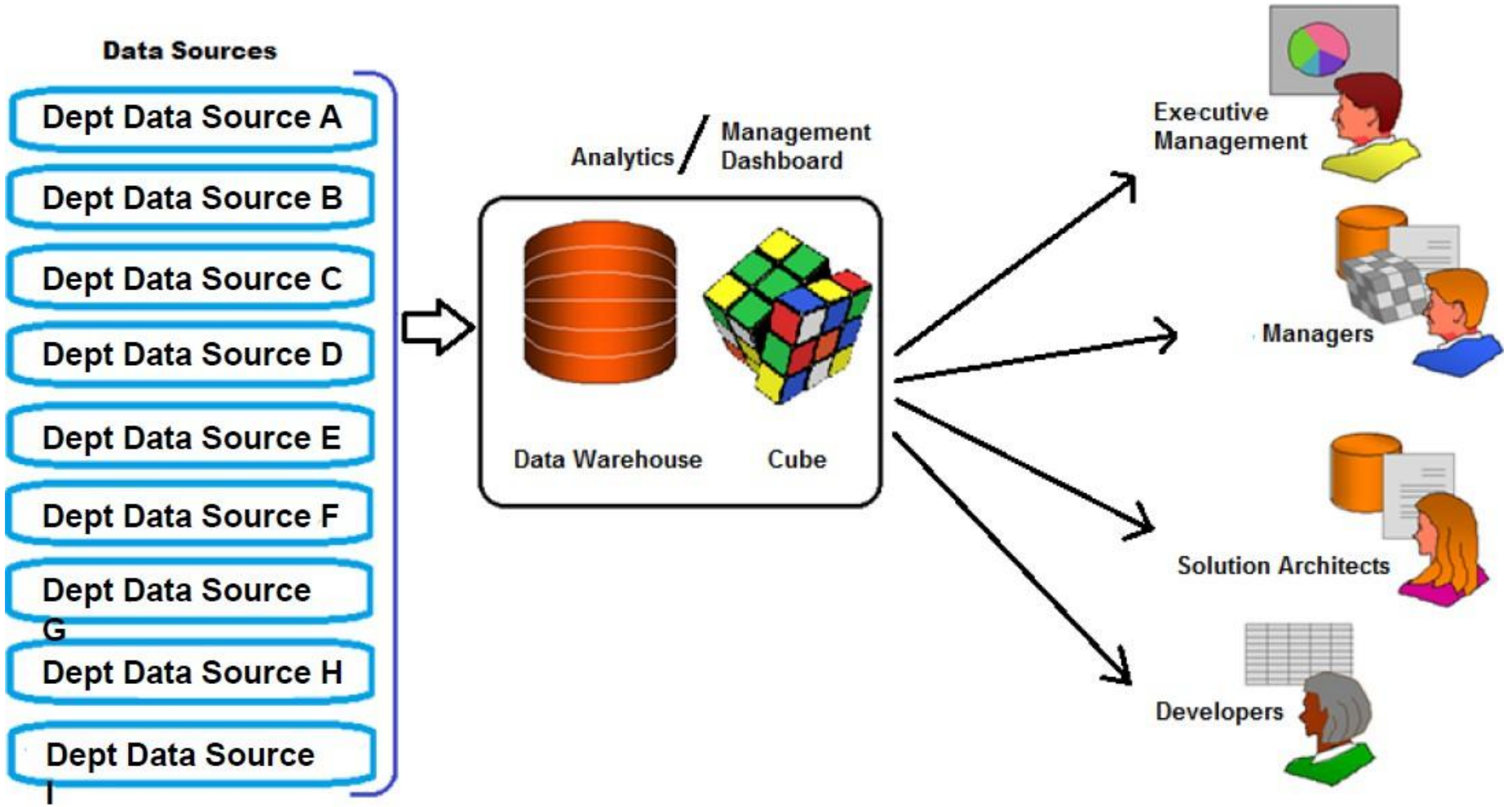


Figure 6.19 ➥ Loan analysis template in Microsoft Excel.

Analysis Results

Interest Rate	Loan Duration	Monthly Payment	Total Paid	Total Interest	Feasible Payment
4% per year	3 years	$590.48	21,257.27	$1,257.27	No
6% per year	4 years	$488.26	$23,436.41	$3,436.41	No
8% per year	5 years	$405.53	$24,331.67	$4,331.67	Yes

Data Driven DSS



Emphasizes access to and manipulation of a time-series of internal company data and sometimes external data to aid decision makings

Model Driven DSS vs. Data Driven DSS

Model-Driven DSS	Data-Driven DSS
User interacts primarily with a (mathematical) model and its results	User interacts primarily with the data
Helps to solve well-defined and structured problems (what-if-analysis)	Helps to solve mainly unstructured problems
Contains in general various and complex models	Contains in general simple models
Large amounts of data are not necessary	Large amounts of data are crucial
Helps to understand the impact of decisions on organizations	Helps to prepare decisions by showing developments in the past and by identifying relations or patterns
Software technology can be deployed on the desktop to execute the model (i.e. MS Excel, MS Access)	Query applications that are run on the central system against a corporate database or warehouse

A Comparison of DSS and MIS

- DSS differs from an MIS in numerous ways, including:
  - The type of problems solved
  - The support given to users
  - The decision emphasis and approach
  - The type, speed, output, and development of the system used
  - See comparison of DSS with MIS

A Comparison of DSS and MIS

Factor	DSS	MIS
Problem Type	Can handle unstructured problems that cannot be easily programmed.	Normally used only with structured problems.
Users	Supports individuals, small groups, and the entire organization. In the short run, users typically have more control over a DSS.	Supports primarily the organization. In the short run, users have less control over an MIS.
Support	Supports all aspects and phases of decision making; it does not replace the decision maker—people still make the decisions.	In some cases, makes automatic decisions and replaces the decision maker.
Emphasis	Emphasizes actual decisions and decision-making styles.	Usually emphasizes information only.
Approach	Serves as a direct support system that provides interactive reports on computer screens.	Typically serves as an indirect support system that uses regularly produced reports.
System	Uses computer equipment that is usually online (directly connected to the computer system) and related to real time (providing immediate results). Computer terminals and display screens are examples—these devices can provide immediate information and answers to questions.	Uses printed reports that might be delivered to managers once per week, so it cannot provide immediate results.
Speed	Is flexible and can be implemented by users, so it usually takes less time to develop and is better able to respond to user requests.	Provides response time usually longer than a DSS.
Output	Produces reports that are usually screen oriented, with the ability to generate reports on a printer.	Is oriented toward printed reports and documents.
Development	Has users who are usually more directly involved in its development. User involvement usually means better systems that provide superior support. For all systems, user involvement is the most important factor for the development of a successful system.	Is frequently several years old and often was developed for people who are no longer performing the work supported by the MIS.

Web-based DSS Examples for End Customers

- Evaluate alternative investment in mortgage portfolios
  - Fidelity.com (online investor center)

  Model-Driven DSS
- Evaluate and compare air fares
  - Travelocity.ca
  - Expedia.ca

  Data-Driven DSS
- Evaluate and compare various automobile prices
  - Edmunds.com

  Data-Driven DSS

More Data-Driven DSS Examples

- **Canadian gov't**: PRAIRIE CROP PROTECTION PLANNER
  - Farmer describes: spraying equipment, size of field, current chemical prices
  - Model calculates: application rates, costs per acre, amount of chemical needed

- **US**: helps farmers decide in which regions of Nebraska to plant grapevines to avoid freezing

More Data-Driven DSS Examples

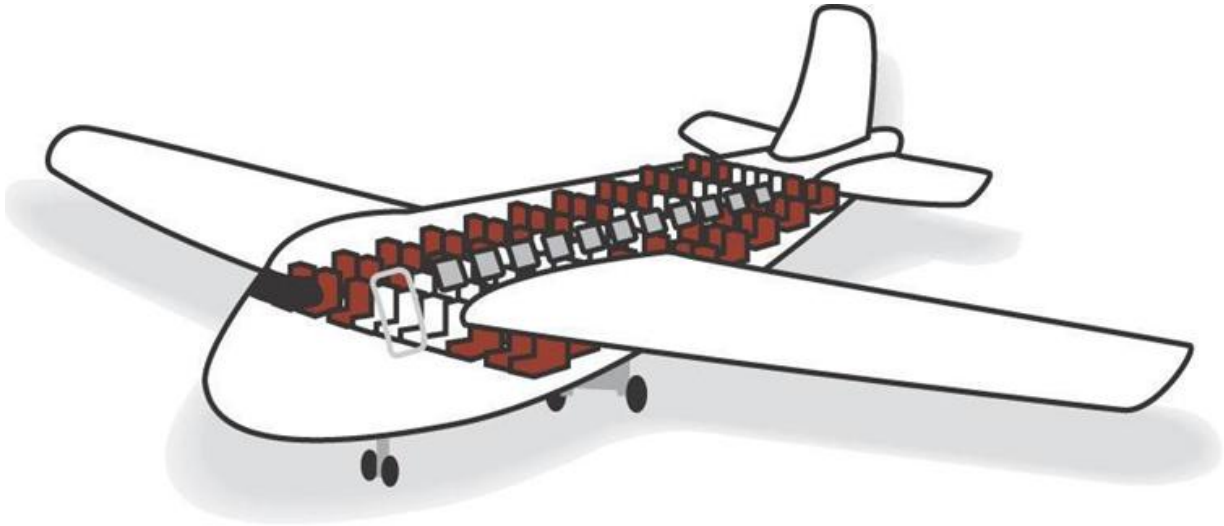
- **Airline industry**: DSS helps to find proper pricing to maximize overall revenue from selling seats for each flight:
    - Manager enters departure airport, arrival airport, # of stops, times of departure and arrival, # days in advance for reservation, # persons, size of plane, utilized capacity on similar previous flights etc.
    - System suggests variable ticket prices

Data-Driven DSS - Airline Industry

- Yield management systems are designed to maximize the amount of revenue that an airline generates on each flight.

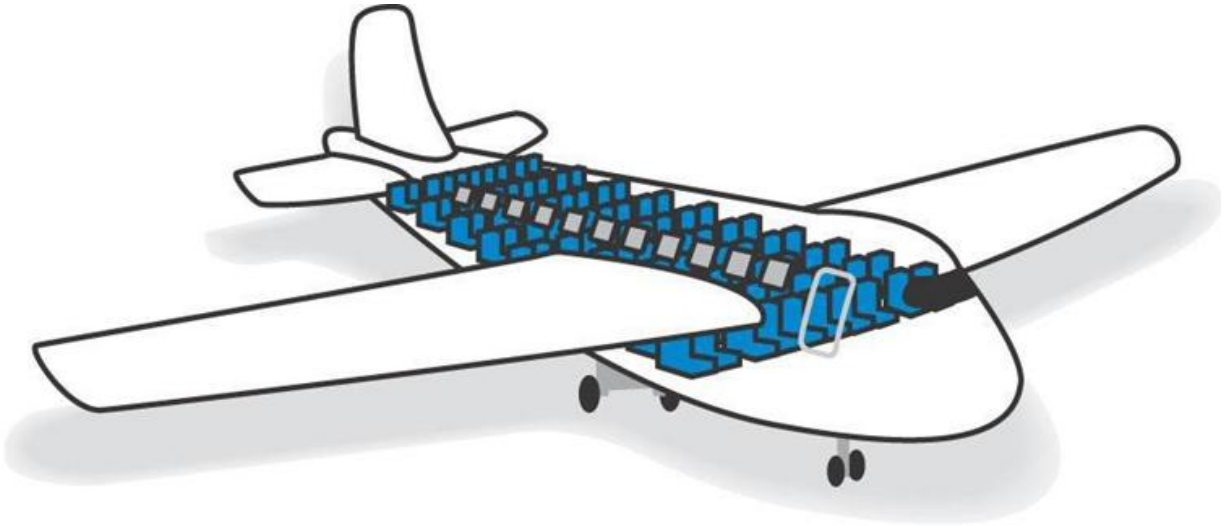
- Yield management systems are the reason that an airfare you're quoted over the phone can be $100 higher when you call back an hour later.

Data-Driven DSS - Airline Industry



Average seat = $420
Yield = $50,400

120 seats occupied at average price of $420 per seat = $50,400 total yield for the flight.



Average seat = $325
Yield = $65,000

200 seats occupied at average price of $325 per seat = $65,000 total yield for the flight.

The Airline Industry

- **HC-Simulation Software to Optimize Healthcare Processes -** http://www.youtube.com/watch?v=7CwoMsVyo2Y

- **Flexsim Healthcare Urgent Care Tutorial**
- Video 1 http://www.youtube.com/watch?v=neBCg7N1UyM
- Video 2 http://www.youtube.com/watch?v=dgKflwbfrvk
- Video 3 http://www.youtube.com/watch?v=dNLqgC-CazM

Systems That Span Organizational Boundaries

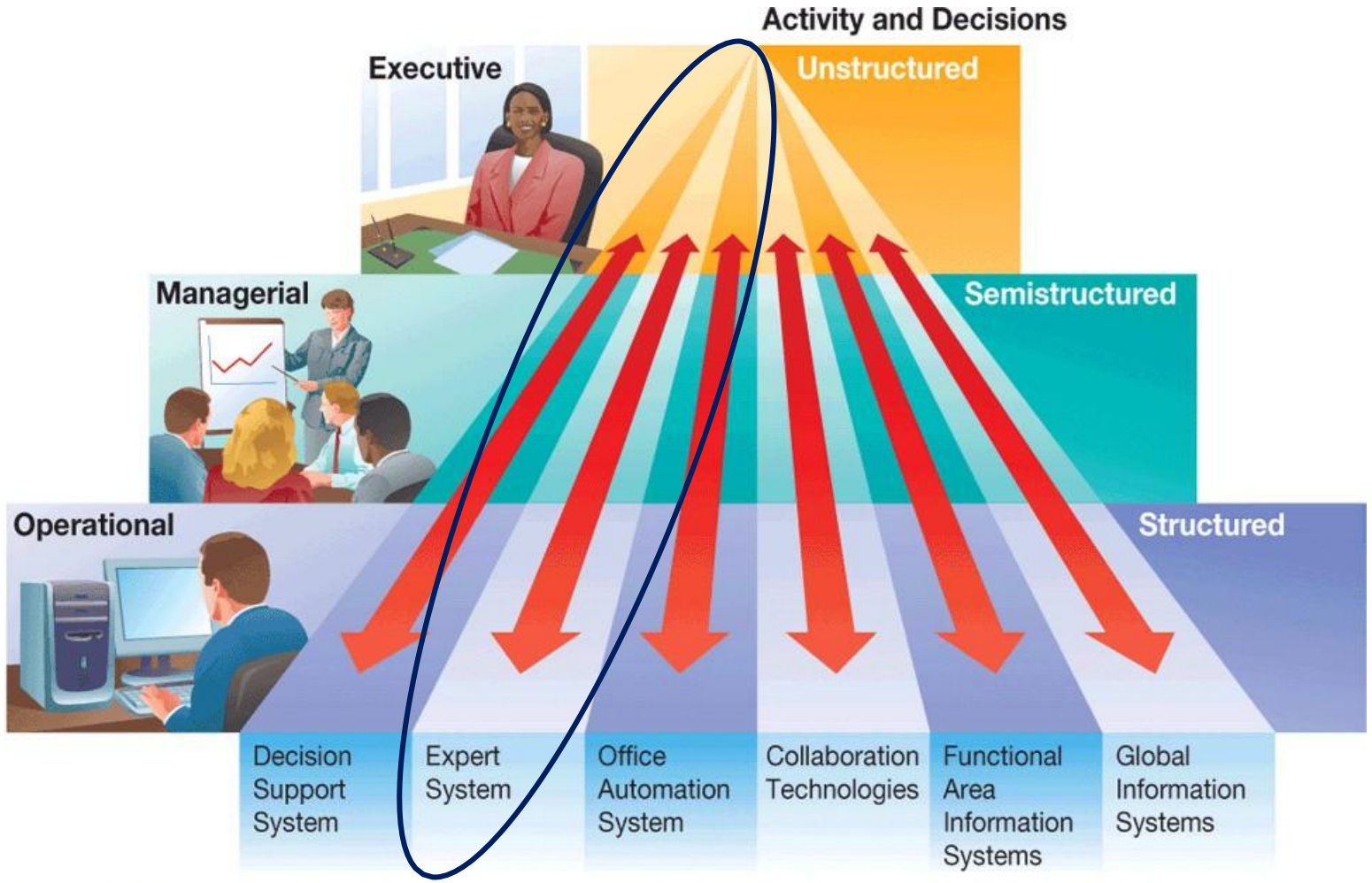


Figure 6.19 Organizational boundary-spanning information systems.

Expert Systems

- **Expert Systems** Special-purpose systems used by operational level employees to make decisions usually made by more experienced employees or an expert in the field
- **System Details** These systems use **inference engines** that match **facts** and **rules**, sequence **questions** for the user, draw a **conclusion**, and present a **recommendation** to the user
- **Supported Activities**: These systems support many activities, including:
  - Medical Diagnosis
  - Machine Configuration
  - Financial Planning
  - Software Application Assistance (help wizards)

System Architecture: Expert Systems

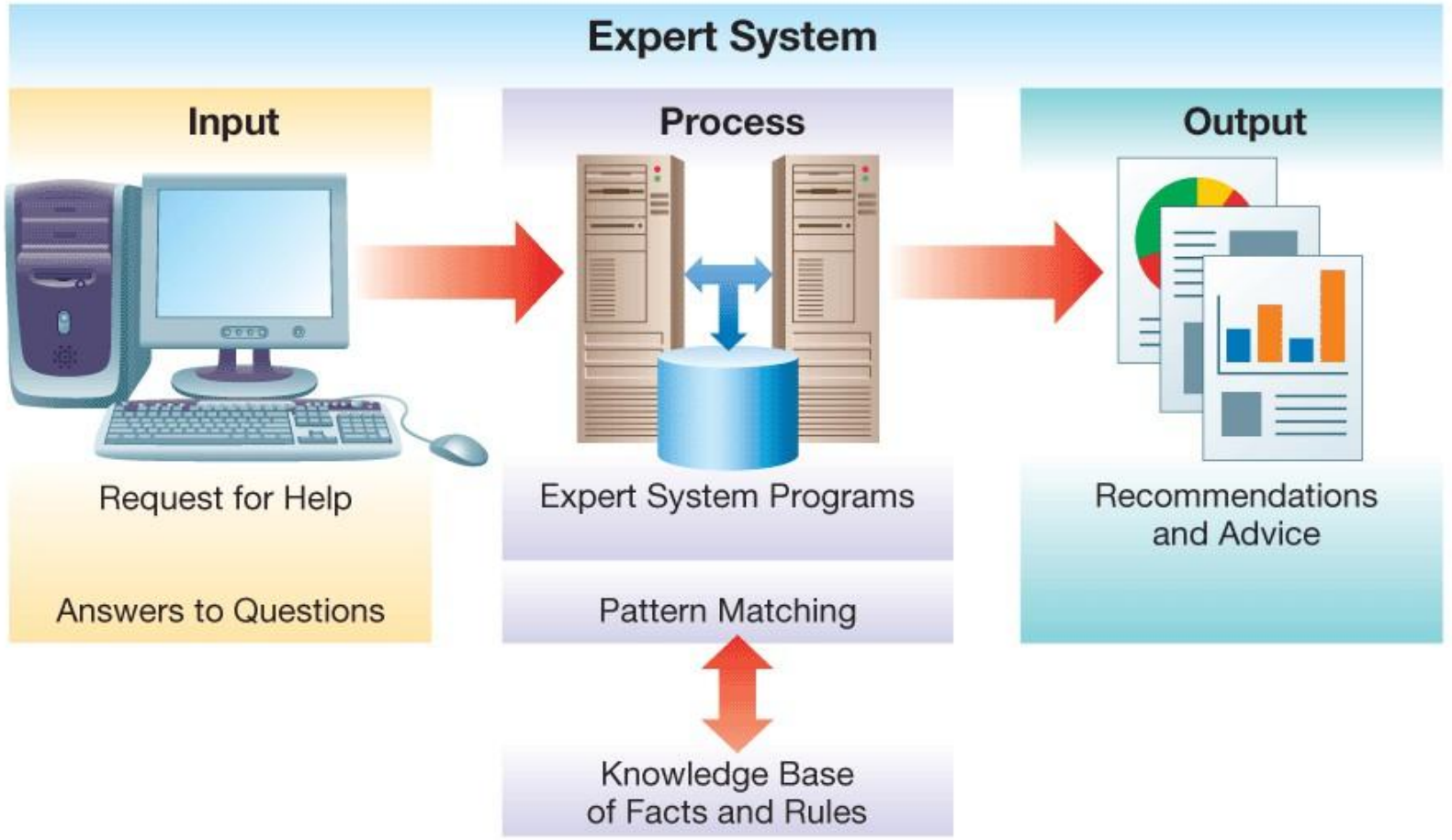


Figure 6.22 Architecture of an expert system using the basic systems model.

Expert System Example

End user

The end-user usually sees an expert system through an example of which follows:

Q. Do you know which restaurant you want to go to?

A. No

Q. Is there any kind of food you would particularly like?

A. No

Q. Do you like spicy food?

A. No

Q. Do you usually drink wine with meals?

A. Yes

Q. When you drink wine, is it French wine?

A. Yes

Expert System Example

As can be seen from this dialog, **the system is leading the user through a set of questions**, the purpose of which is to determine a suitable set of restaurants to recommend. This dialog begins with the system asking if the user already knows the restaurant choice (a common feature of expert systems) and immediately illustrates a characteristic of expert systems; **users may choose not to respond to any question. In expert systems, dialogs are not pre-planned.** There is no fixed control structure. Dialogs are synthesized from the current information and the contents of the knowledge base. Because of this, not being able to supply the answer to a particular question does not stop the consultation.

Expert System Example

Explanation system Another major distinction between expert systems and traditional systems is illustrated by the following answer given by the system when the user answers a question with another question, "**Why**", as occurred in the above example. The answer is:

A. I am trying to determine the type of restaurant to suggest. So far Chinese is not a likely choice. It is possible that French is a likely choice. I know that if the diner is a wine drinker, and the preferred wine is French, then there is strong evidence that the restaurant choice should include French.

Expert Systems

- Such systems are different than traditional reporting or DSS systems
- They apply *artificial intelligence* to situations where many **facts** and complex **decision rules** are involved, such that only a few people can solve such problems well
- An expert system mimics the thinking of an expert

Expert Systems

- Expert system manipulate *knowledge* and not just *information*
- e.g. what drug and in what dose to give for particular types of cancer
  - Many factors involved
  - Many questions must be asked
  - Many IF … THEN rules
    - A rule is a way of encoding knowledge
- An ES should be able to explain its reasoning to the user

Expert Systems

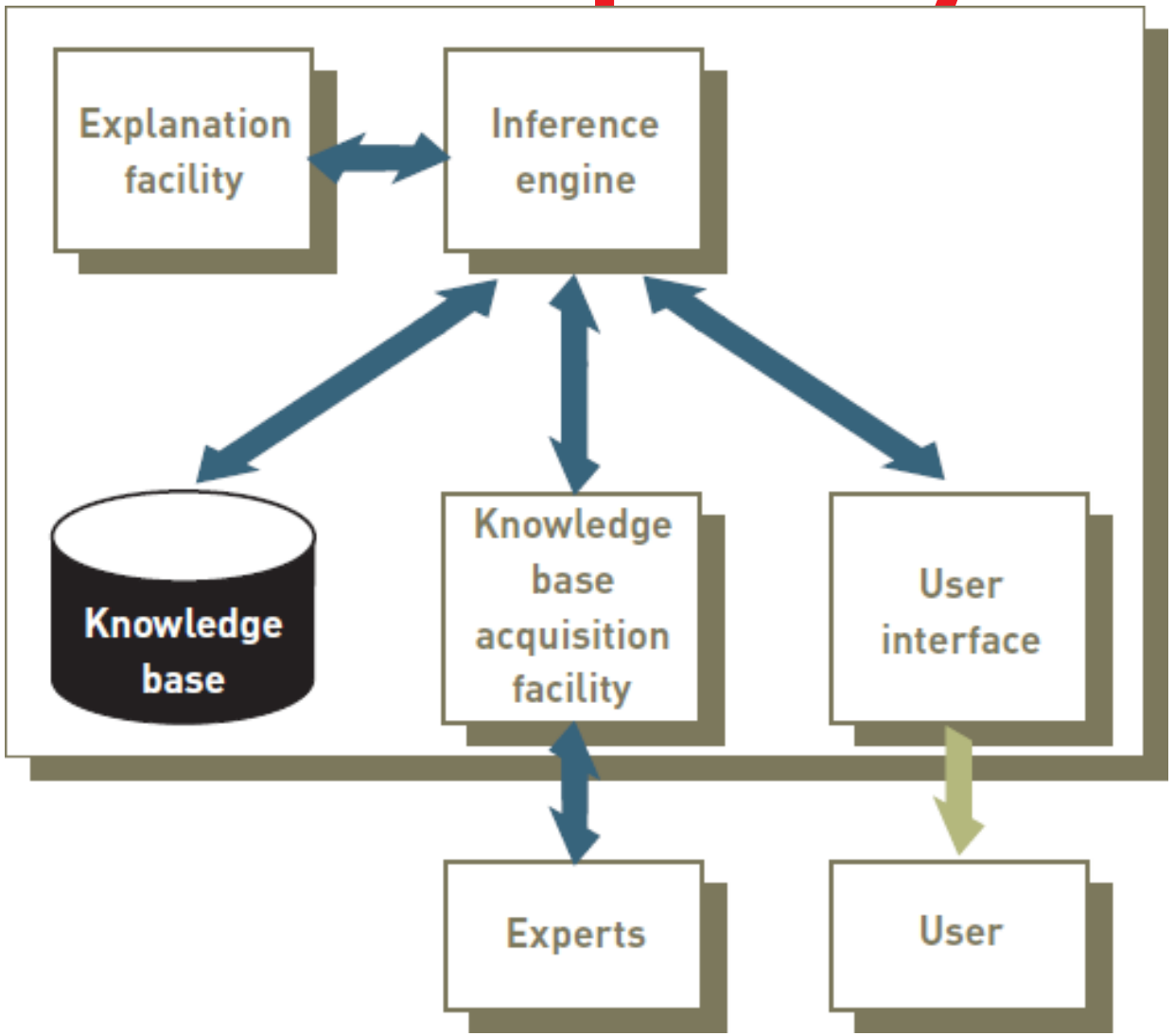
- Why develop them?
  - to retain expert's knowledge if (s)he retires or dies
  - to pool expertise from several experts
  - to clone the expert's knowledge and have it available in many places at
  - once (e.g., cancer treatment in remote Manitoba areas)

- They can be developed through detailed programming or through an "expert system shell" such as VP Expert

Expert Systems Structure

- **Knowledge** base
  - Facts and rules
- **Inference engine**
  - Software that takes user input and “sifts through” the knowledge base mimicking the mind of an expert
- This is **Artificial Intelligence (AI)**

Components of Expert Systems



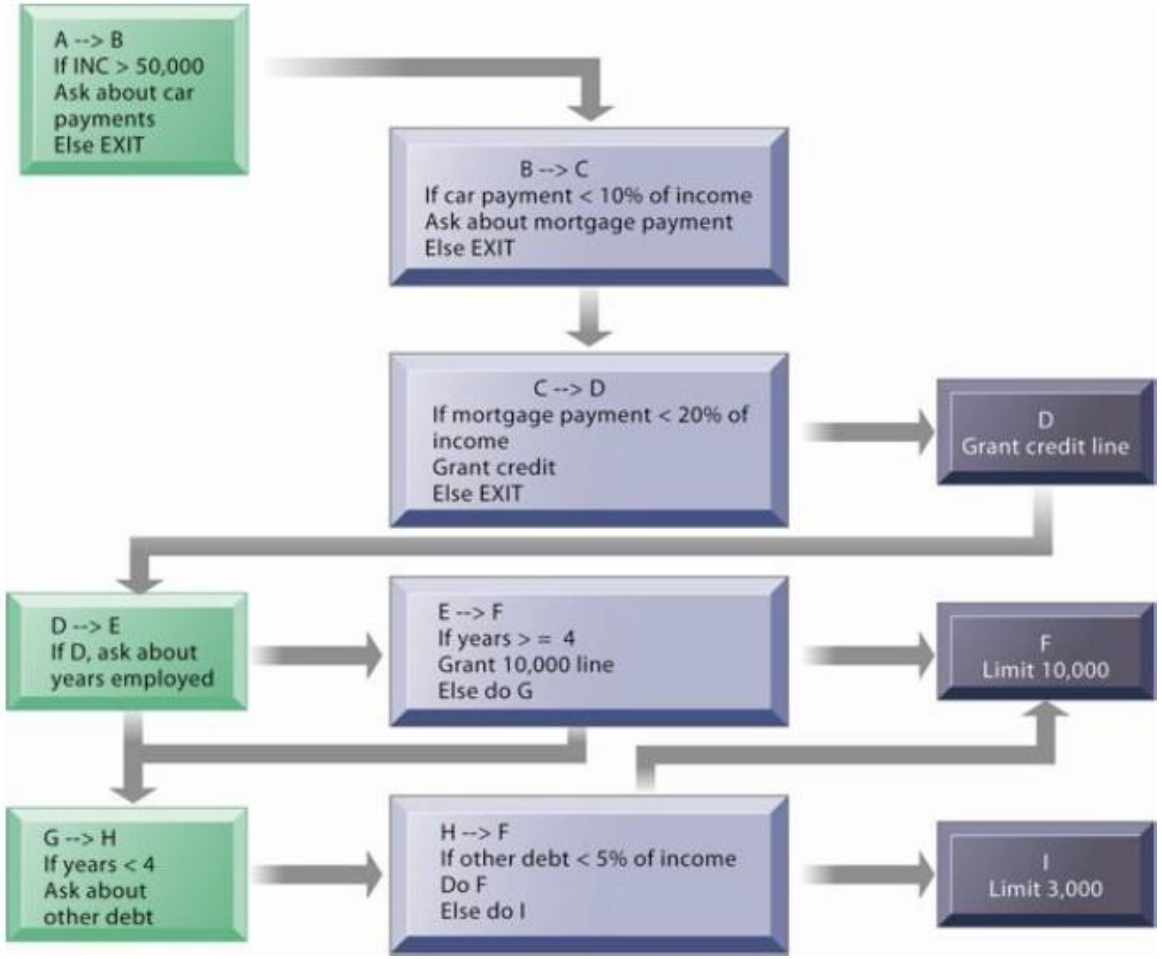
Expert System Development

- A **Knowledge Engineer** has special expertise in eliciting information and expertise from experts
- He/She translates the expert's knowledge into a set of (if .. then) rules

Expert System Development

"IF … THEN" Rules in an Expert System

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



Expert Systems Examples

- Parker, Smartphone Parking Application
- AMDOCS, Call Centre System

IBM's Watson for healthcare

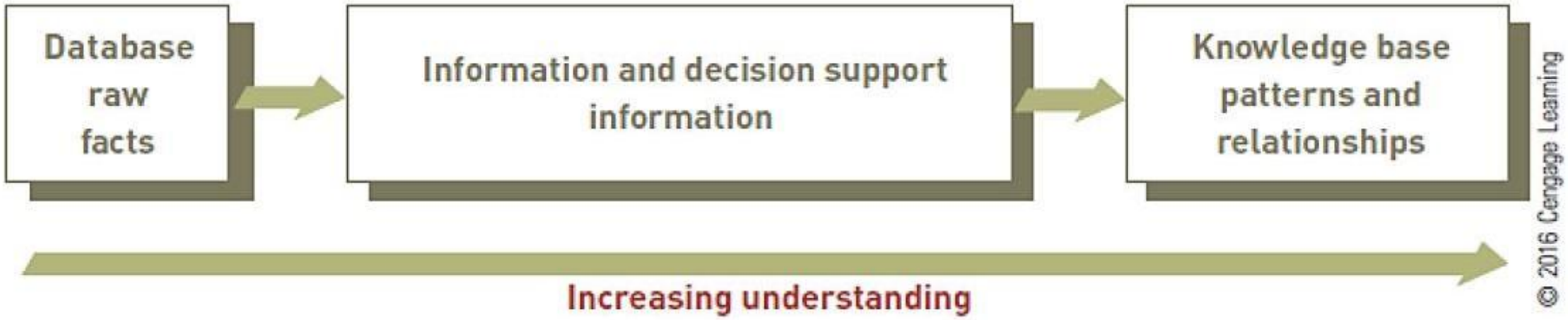
- Watson mines patient data to find relevant facts about family history, current medications and other existing conditions.
- It combines this information with current findings from tests and instruments and then examines all available data sources to form hypotheses and test them.
- Watson can incorporate treatment guidelines, electronic medical record data, doctors and nurses notes, research, clinical studies, journal articles, and patient information into the data available for analysis.
- Watson will then provide a list of potential diagnoses along with a score that indicates the level of confidence for each hypothesis
- IBM Watson: How it Works
- IBM's Breakthrough: Watson May Help Beat Cancer
- Using Watson Analytics in the restaurant business

Knowledge Management Definitions

- **Knowledge Management**
  - The process an organization uses to gain the greatest value from its knowledge assets
- **Knowledge Assets**
  - All underlying skills routines, practices, principles, formulae, methods, heuristics, and intuitions whether explicit or tacit
- **Explicit Knowledge**
  - Anything that can be documented, archived, measured, or codified often with the help of information systems
- **Tacit Knowledge**
  - The processes and procedures on how to effectively perform a particular task stored in a person's mind

Knowledge Management

- An expert system works on a knowledge base
  - It is part of a larger area called ‘knowledge management’



Knowledge Management System (KMS)

- **Best Practices**
  - Procedures and processes that are widely accepted as being among the most effective and/or efficient

- **Primary Objective**
  - How to recognize, generate, store, share, manage this tacit knowledge (Best Practices) for deployment and use

- **Technology**
  - Generally not a single technology but rather a collection of tools that include communication technologies (e.g. e-mail, groupware, instant messaging), and information storage and retrieval systems (e.g. database management system) to meet the Primary Objective

Knowledge Management Systems

- Data consists of raw facts
- **Information**:
  - Collection of facts organized so that they have additional value beyond the value of the facts themselves
- **Knowledge**:
  - Awareness and understanding of a set of information and the ways that information can be made useful to support a specific task or reach a decision
- **Knowledge Management System** (KMS):
  - Organized collection of people, procedures, software, databases, and devices
  - Used to create, store, share, and use the organization's knowledge and experience

Knowledge Management Systems*

The differences between **Data, Information, Knowledge**

Data	There are 20 PCs in stock at the retail store.
Information	The store will run out of inventory in a week unless more is ordered today.
Knowledge	Call 800-555-2222 to order more inventory.

Data and Knowledge Management Workers and Communities of Practice

- **Data workers:**
  - Secretaries, administrative assistants, bookkeepers, etc.

- **Knowledge workers:**
  - Create, use, and disseminate knowledge
  - Professionals in science, engineering, or business

Data and Knowledge Management Workers and Communities of Practice

- **Chief Knowledge Officer (CKO):**
  - Top-level executive who helps the organization use a KMS to create, store, and use knowledge to achieve organizational goals

- **Communities of Practice (COP):**
  - Group of people dedicated to a common discipline or practice
  - May be used to create, store, and share knowledge

Obtaining, Storing, Sharing and Using Knowledge

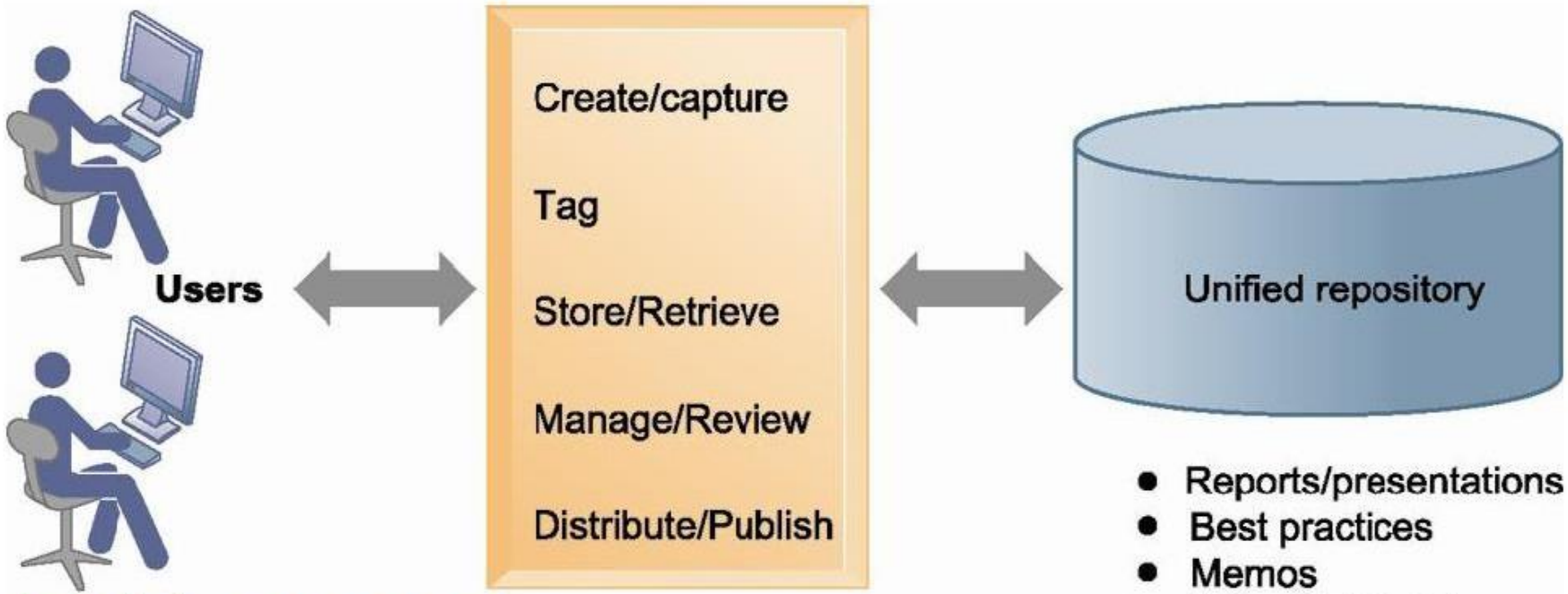
- **Knowledge workers:**
  - Often work in teams

- **Knowledge repository:**
  - Includes documents, reports, files, and databases

- **Knowledge map:**
  - Directory that points the knowledge worker to the needed knowledge

Obtaining, Storing, Sharing, and Using Knowledge

An Enterprise Knowledge Management System



An enterprise knowledge management system has capabilities for classifying, organizing, and managing structured and semi structured knowledge and making it available throughout the enterprise.

Lesson 8

Q&A