CSE 412: Artificial Intelligence

Topic – 8: Expert Systems

Department of Computer Science and Engineering
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References

- *"Fundamentals of Information Systems," 8th edt., Ralph M. Stair and George W. Reynolds, Cengage Learning.*
  - Chapter 7 (Knowledge Management and Specialized Information Systems)
- *"Introduction to Artificial Intelligence and Expert Systems," D. W. Patterson, Prentice Hall of India.*
  - Chapter 15 (Expert Systems Architectures)

Introduction

- An expert system consists of hardware and software that stores knowledge and makes inferences, enabling a novice to perform at the level of an expert.
- Expert systems have many applications:
  - Business
  - Diagnosis
  - Industry
  - Etc…

Characteristics and Limitations of an Expert System

- Can explain its reasoning or suggested decisions
- Can display “intelligent” behavior
- Can draw conclusions from complex relationships
- Can provide portable knowledge
- Can deal with uncertainty

Characteristics and Limitations of an Expert System…

- Not widely used or tested
- Difficult to use
- Limited to relatively narrow problems
- Cannot readily deal with "mixed" knowledge
- Possibility of error

Characteristics and Limitations of an Expert System…

- Cannot refine its own knowledge
- Difficult to maintain
- May have high development costs
  - **Expert system shell**
    - A collection of software packages and tools used to develop expert systems
- Raises legal and ethical concerns

Components of an Expert System

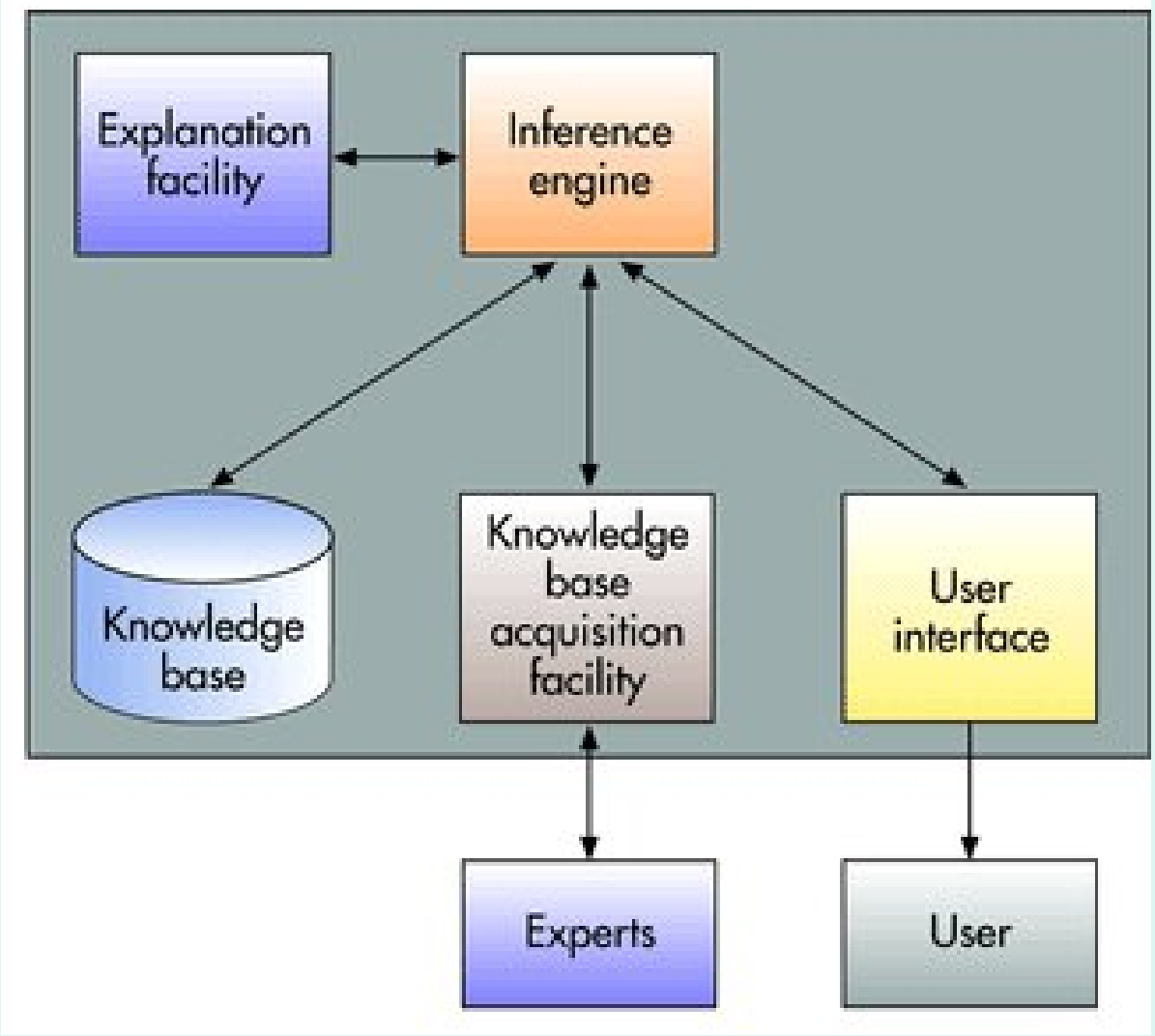


FIGURE 7.14. Components of an expert system.

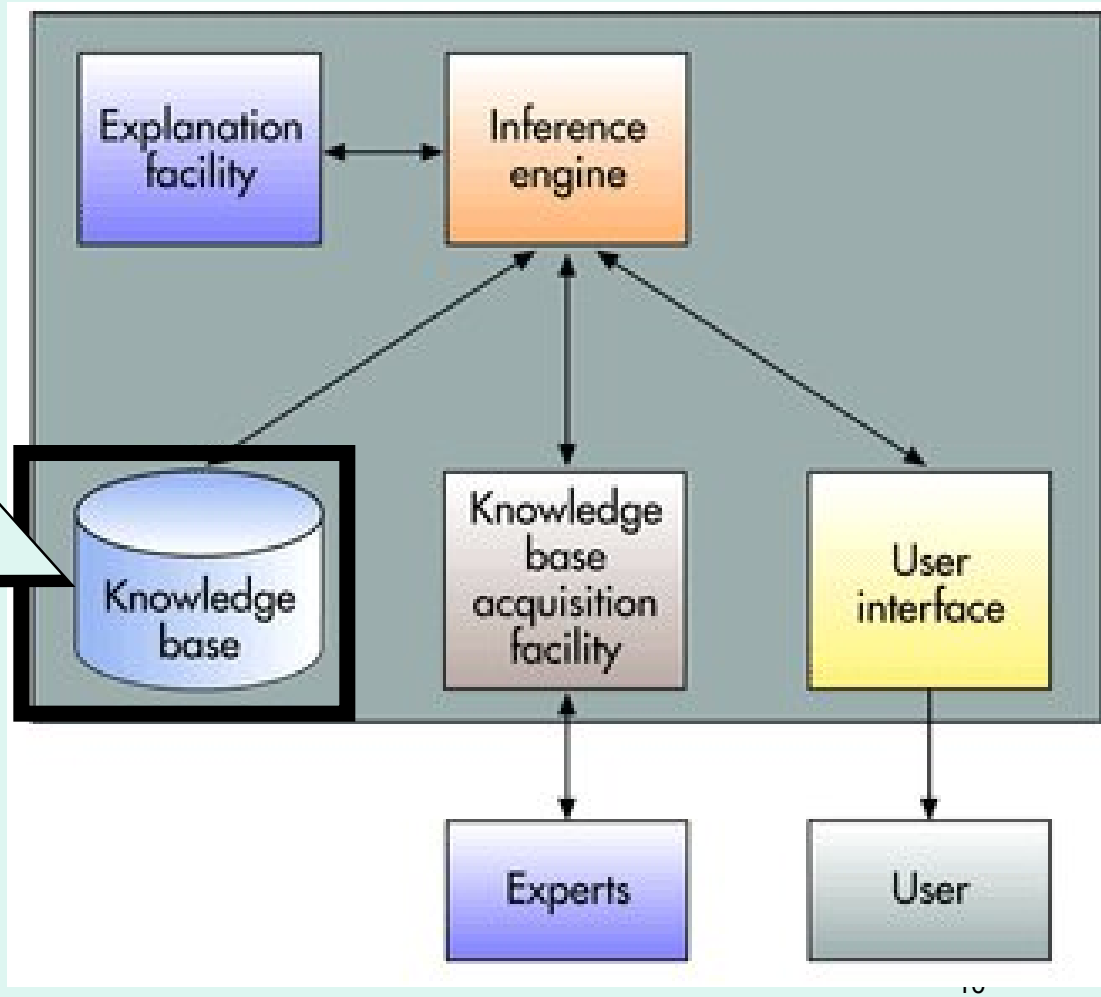
Components of an Expert System…

- An expert system consists of a collection of integrated and related components, including a knowledge base, an inference engine, an explanation facility, a knowledge base acquisition facility, and a user interface.
- A diagram of a typical expert system is shown in Fig. 7.14.
- In this figure, the user interacts with the interface, which interacts with the inference engine.
- The inference engine interacts with the other expert system components.
- These components must work together to provide expertise.
- This figure also shows the inference engine coordinating the flow of knowledge to other components of the expert system.

Components of an Expert System…

Knowledge Base
Stores all relevant information, data, rules, cases, and relationships used by the expert system.

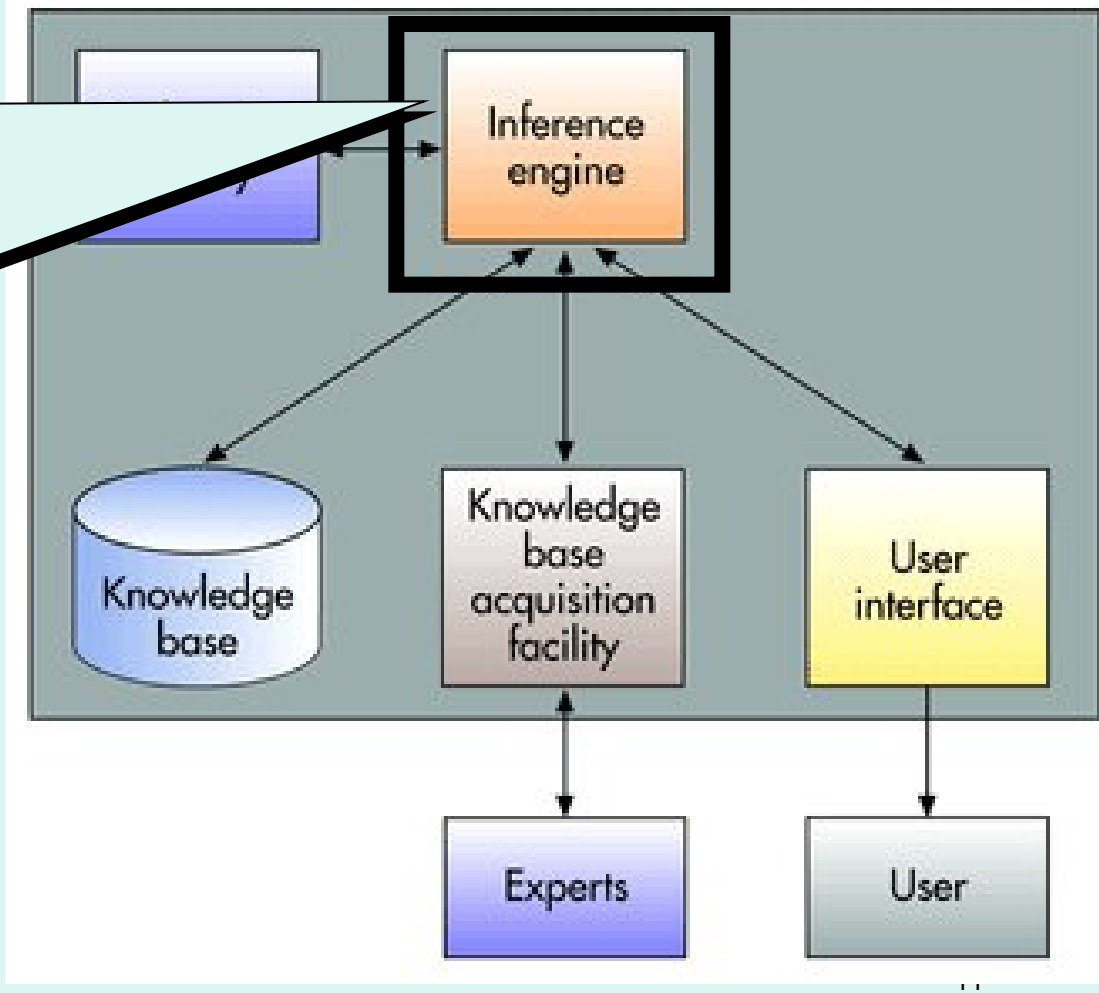
Uses
- Rules
- If-then Statements
- Fuzzy Logic



Components of an Expert System…

Inference Engine
Seeks information and relationships from the knowledge base and provides answers, predictions, and suggestions the way a human expert would.

Uses
- Backward Chaining
- Forward Chaining



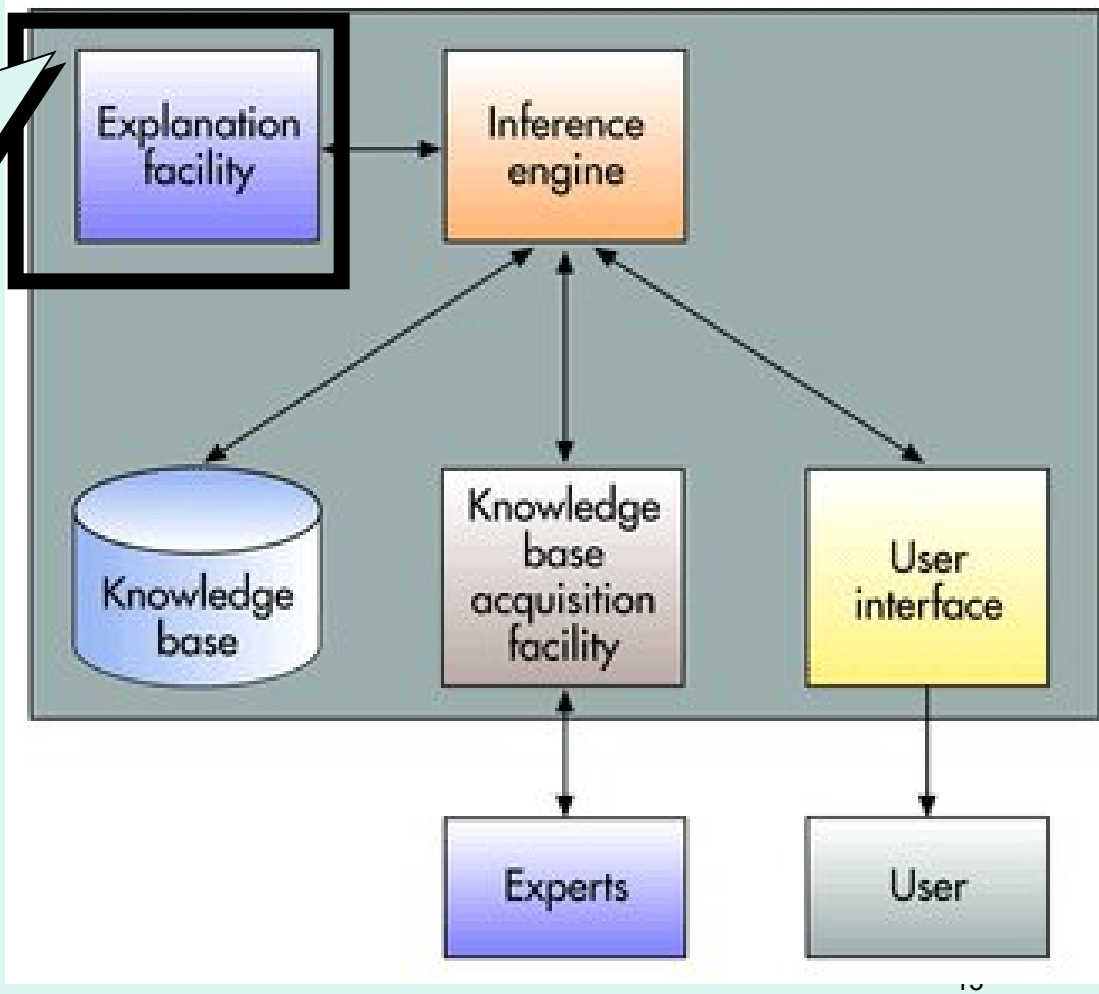
Components of an Expert System…

- Seeks information and relationships from the knowledge base and provides answers, predictions, and suggestions the way a human expert would.
- In other words, the inference engine is the component that delivers the expert advice.
- **Backward chaining**
  - Starting with conclusions and working backward to the supporting facts
- **Forward chaining**
  - Starting with the facts and working forwards to the conclusions

Components of an Expert System…

Explanation Facility
Allows a user to understand how the expert system arrived at certain conclusions or results.

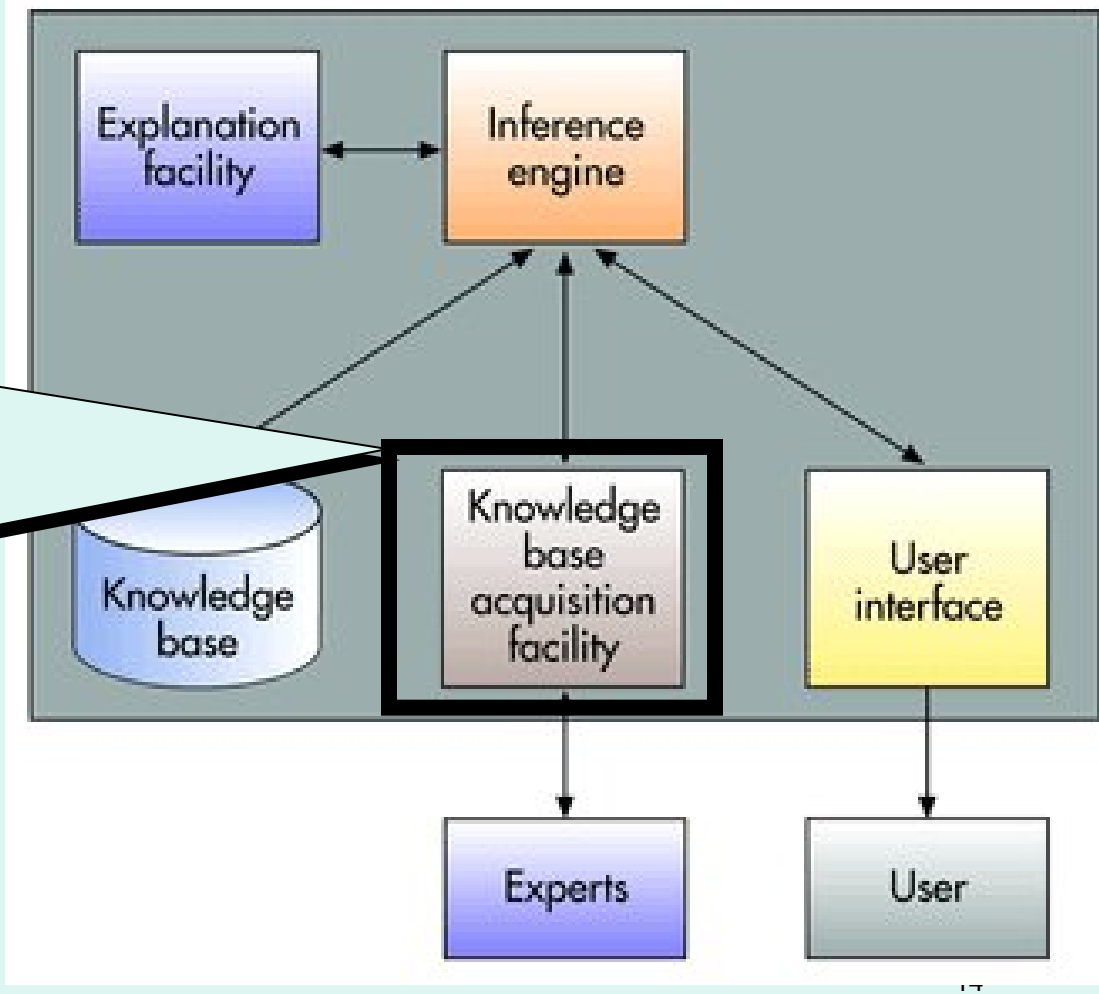
For example: it allows a doctor to find out the logic or rationale of the diagnosis made by a medical expert system



Components of an Expert System…

Knowledge acquisition facility
Provide convenient and efficient means of capturing and storing all the components of the knowledge base.

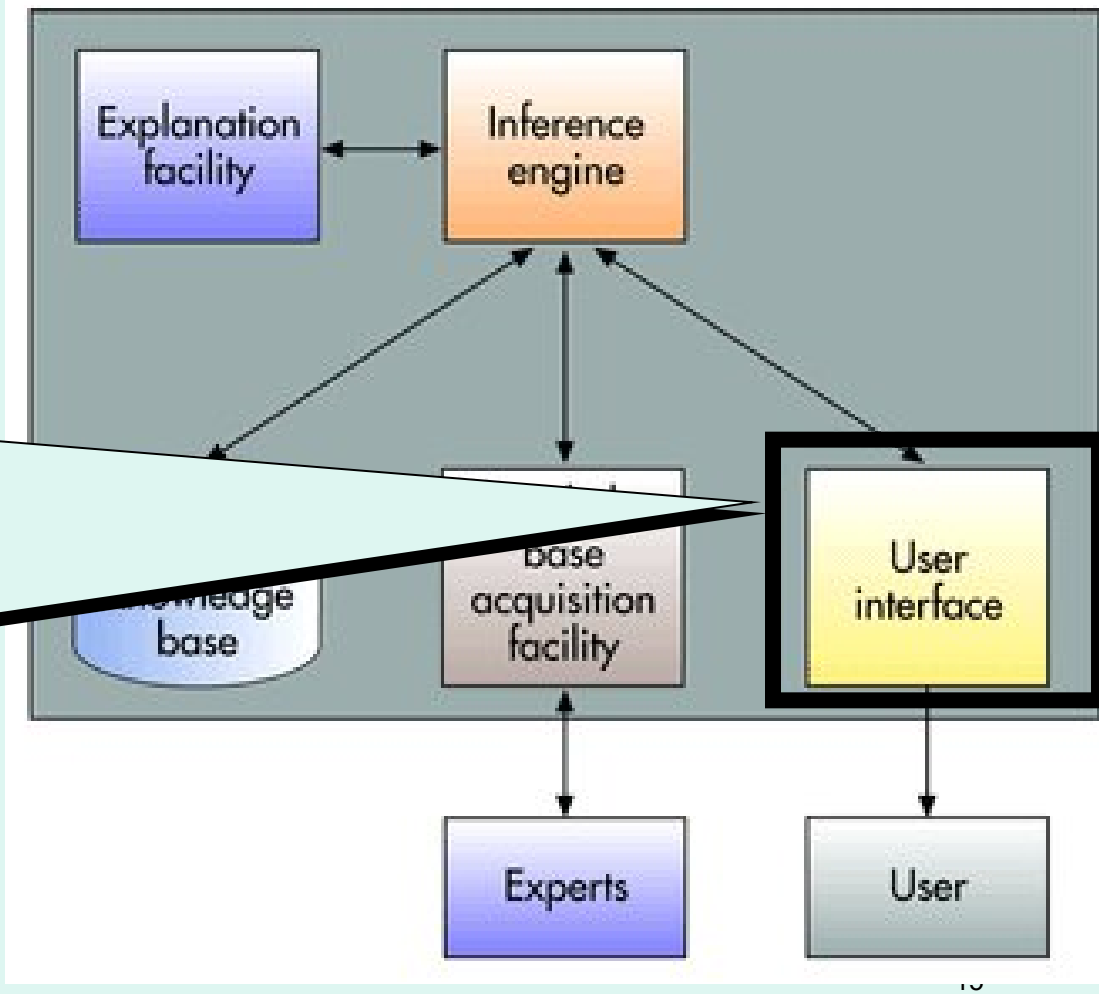
Acts as an interface between experts and the knowledge base.



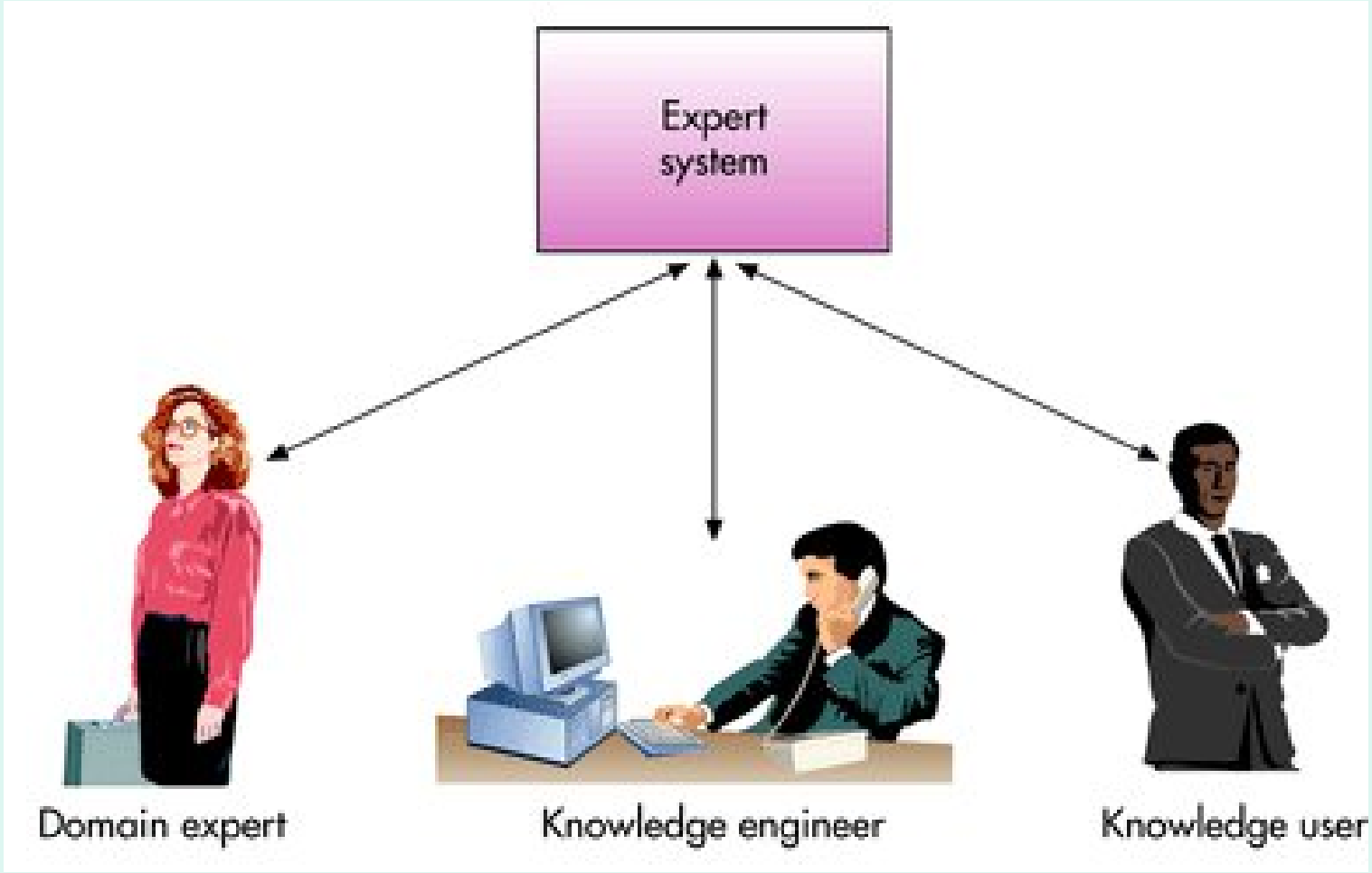
Components of an Expert System…

User Interface
Specialized user interface software employed for designing, creating, updating, and using expert systems.

The main purpose of the user interface is to make the development and use of an expert system easier for users and decision makers



Participants in Developing and Using Expert Systems



Participants in Developing and Using Expert Systems…

- **Domain**
  - The area of knowledge addressed by the expert system
- **Domain Expert**
  - The individual or group who has the expertise or knowledge one is trying to capture in the expert system
- **Knowledge Engineer**
  - An individual who has training or expertise in the design, development, implementation, and maintenance of an expert system
- **Knowledge User**
  - The individual or group who uses and benefits from the expert system

Expert Systems Development

Steps in the expert system development process

THANKS…