Knowledge Management, Knowledge based Expert system

Objective

- To access the **importance of knowledge management** in an organization
- Describe the applications that are **more useful for distributing, creating & sharing knowledge** in the firm
- Evaluate the **role of AI in knowledge management**
- Demonstrate **how organizations can use expert systems** & case based reasoning to capture knowledge
- Explain how organizations can **use neural networks & other intelligent techniques to improve knowledge base**

Knowledge Management(KM)- Introduction

- Refers to –

  The set of process developed in an org to create, gather, store & maintain & disseminate firm's knowledge
- Information Technology plays a major role - enabler for better business process
- Developing procedures & routines in business process to **optimize the creation, flow, learning, protection & sharing of knowledge** in the **firm- core management responsibility**
- **Responsible** head for knowledge management program- **Chief Knowledge officer**

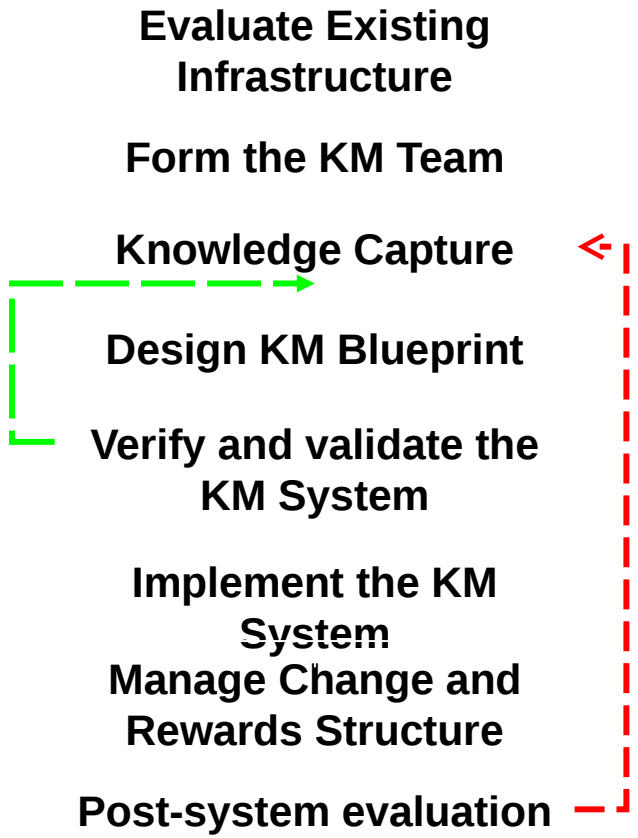
Knowledge Management contd…

- Producing unique product/service at lower cost based on superior knowledge(production process & design)
- Firm increasingly depends on digital technology these days
- Knowledge is a central productive & strategic asset,
- Organizational success depends on firm’s ability to produce, gather, store & disseminate knowledge

Stages of KM System Life Cycle

KM system development life cycle is largely composed

Iterative Rapid Prototyping



(1) Evaluate Existing Infrastructure

- The first stage is to evaluate existing infrastructure
- Where several questions that you need to ask for justification

<u>System justifications:</u>

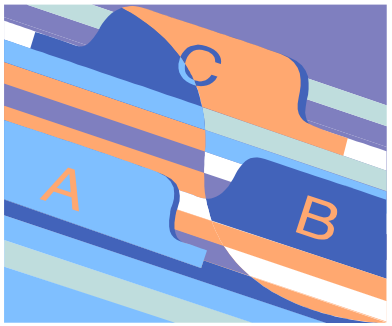
- What knowledge will be lost through retirement, transfer, or departure to other firms?
- Is the proposed KM system needed in several locations?
- Are experts available and willing to help in building a KM system?
- Does the problem in question require years of experience and tacit reasoning to solve?

(2) Form the KM Team

- After carefully evaluating the infrastructure, the next stage -form the KM team to develop KMS
- The team success will depend on a number of factors, including those shown here.
- Identify the ***key stakeholders*** of the prospective KM system.
- Team success depends on:
  - Ability of team members
  - Team size
  - Complexity of the project
  - Leadership and team motivation
  - Not promising more than can be realistically delivered

(3) Knowledge Capture

- The next stage after forming the KM team -knowledge capture
- **Explicit** knowledge captured in repositories from various media
- **Tacit** knowledge captured from company experts using various tools and methodologies
- Knowledge developers capture knowledge from experts in order to build the **knowledge base**

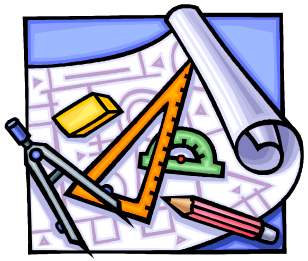


(3) Knowledge Capture contd…

How do firms obtain knowledge?

- Through variety of organizational learning mechanisms

(4) Design the KM Blueprint



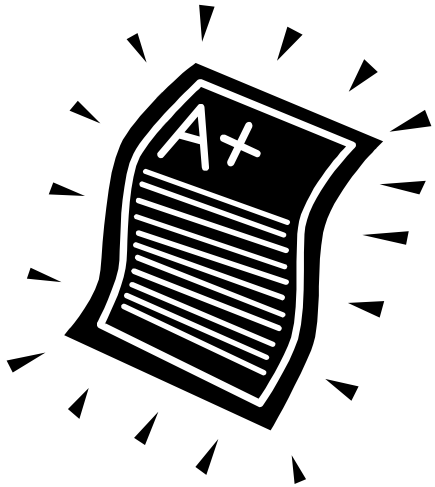
- Next, to develop the KM blueprint based on the knowledge captured

The KM blueprint addresses several issues:

- Finalize scope of proposed KM system with realized net benefits
- Decide on required system components
- Develop the key layers of the KM software architecture to meet company requirements
- System interoperability and scalability with existing company IT infrastructure

(5)Testing the KM System

- As the KM system is under development, it goes through a repetitive iteration of verification and validation
- Verification (functionality) vs. Validation (integrity)
- ***Verification*** procedure: ensures that the system has the right functions
- ***Validation*** procedure: ensures that the system has the right output
- **Validation of KM systems is not foolproof**



(6) Implement the KM System

- Finally, there will be the time when the KMS will be rolled out for users to use.
- Converting a new KM system into actual operation
- includes conversion of data or files
- also includes user training
- **Quality assurance is important**, which includes checking for:
  - Reasoning errors
  - Ambiguity
  - Incompleteness
  - False representation (false positive and false negative)
    - False +ve:-Eg: A perfectly legitimate transaction could trigger IDS to believe that an attack was in progress.
    - False _ve:-Eg:an attack takes place and the IDS doesn’t detect it

(7) Manage Change and Rewards Structure

- Finally, during implementation, encounter resistance from people
- because - fear of losing control.
- Goal is to minimize resistance to change
- Resistances via projection, avoidance, or aggression

(8) Post-system Evaluation

- Assess system impact in terms of effects on:
  - People
  - Procedures
  - Performance of the business
- Areas of concern:
  - Quality of decision making
  - Attitude of end users
  - Costs of Knowledge processing and update

Components of Knowledge Management Systems

- Technologies
  - Communication
    - Access knowledge
    - Communicates with others
  - Collaboration
    - Perform groupwork
    - Synchronous or asynchronous
    - Same place/different place
  - Storage and retrieval
    - Capture, storing, retrieval, and management of both explicit and tacit knowledge through collaborative systems

Components of Knowledge Management Systems

- Supporting technologies
  - **Artificial intelligence**
    - Expert systems, neural networks, fuzzy logic, intelligent agents
  - **Intelligent agents**
    - Systems that learn how users work and provide assistance
  - **Knowledge discovery in databases**
    - Process used to search for and extract information
      - Internal = data and document mining
      - External = model marts and model warehouses
  - **XML**
    - Extensible Markup Language
    - Enables standardized representations of data
    - Better collaboration and communication through portals

Knowledge Management System Implementation

- Challenge to identify and integrate components
  - Early systems developed with networks, groupware, databases
- Knowware
  - Technology tools that support knowledge management
    - Collaborative computing tools
      - Groupware
    - Knowledge servers
    - Enterprise knowledge portals
    - Document management systems
      - Content management systems
    - Knowledge harvesting tools
    - Search engines
    - Knowledge management suites
      - Complete out-of-the-box solutions

Knowledge Management System Implementation

- Implementation
  - Software packages available
    - Include one or more tools
  - Consulting firms
  - Outsourcing
    - Application Service Providers

Knowledge Management System Integration

- Database
  - Knowledge discovery in databases
- CRM
  - Provide tacit knowledge to users
- Supply chain management systems
  - Can access combined tacit and explicit knowledge
- Corporate intranets and extranets
  - Knowledge flows more freely in both directions
  - Capture knowledge directly with little user involvement
  - Deliver knowledge when system thinks it is needed

Human Resources

- Chief knowledge officer
  - Senior level
  - Sets strategic priorities
  - Defines area of knowledge based on organization mission and goals
  - Creates infrastructure
  - Identifies knowledge champions
  - Manages content produced by groups
  - Adds to knowledge base
- CEO
  - Champion knowledge management
- Upper management
  - Ensures availability of resources to CKO
- Communities of practice
- Knowledge management system developers
  - Team members that develop system
- Knowledge management system staff
  - Catalog and manage knowledge

Knowledge Management Valuation

- Asset-based approaches
  - Identifies intellectual assets
  - Focuses on increasing value
- Knowledge linked to applications and business benefits approaches
  - Balanced scorecard
  - Economic value added
  - Inclusive valuation methodology
  - Return on management ratio
  - Knowledge capital measure
- Estimated sale price approach

Factors Leading to Success and Failure of Systems

- Success
  - Companies must assess need
  - System needs technical and organizational infrastructure to build on
  - System must have economic value to organization
  - Senior management support
  - Organization needs multiple channels for knowledge transfer
  - Appropriate organizational culture
- Failure
  - System does not meet organization’s needs
  - Lack of commitment
  - No incentive to use system
  - Lack of integration

Knowledge based expert system

What is an Expert System (ES)?

- relies on internally represented knowledge to perform tasks
- utilizes reasoning methods to derive appropriate new knowledge
- usually restricted to a specific *problem domain*
- some systems try to capture common-sense knowledge
  - General Problem Solver (Newell, Shaw, Simon)
  - Cyc (Lenat)

Definitions “Expert System”

- a computer system that emulates the decision-making ability of a human expert in a restricted domain [Giarratano & Riley 1998]
- Edward Feigenbaum
  - “An intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solutions.” [Giarratano & Riley 1998]
- the term *knowledge-based system* is often used synonymously

Expert Systems

- A computer system that uses representation of human expertise in a specialized domain to perform functions similar to those normally performed by human expert
- Well designed systems initiate the reasoning processes experts use to solve specific problems
- Such systems can be used by experts as knowledge assistants
- ES are used to propagate scarce knowledge resources for improved, consistent results.

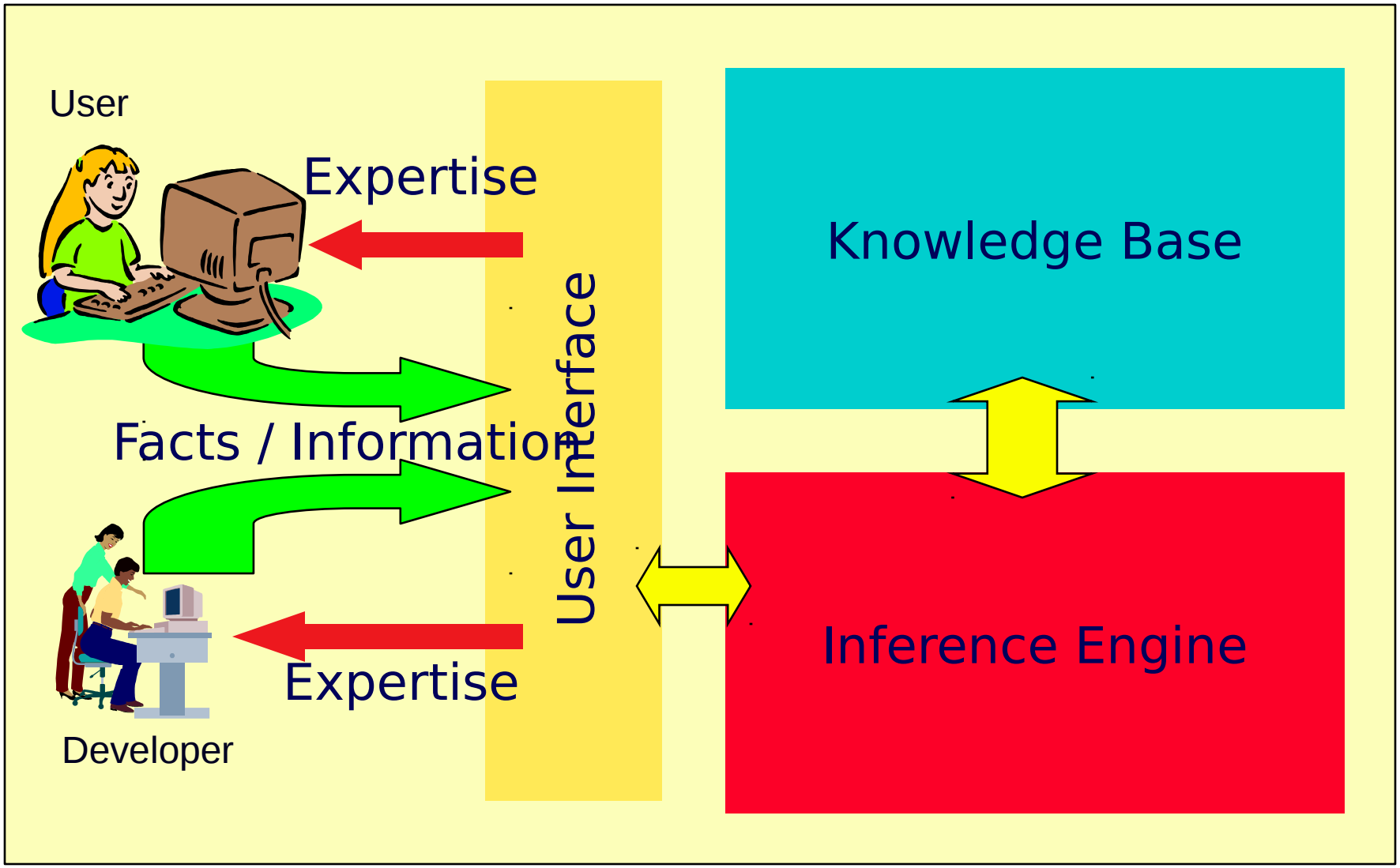
Expert Systems contd...

- Ultimately such system can perform better than any single human in making judgments in a specific usually narrow, area of expertise.

Expert Systems contd…

- **Expert system (ES)**: emulates knowledge of human expert
  - Solves problems
  - Makes decision
  - Makes expertise available to novices
  - Scope is limited to expert’s experience
  - Part of **artificial intelligence (AI)** research

Main Components of an ES

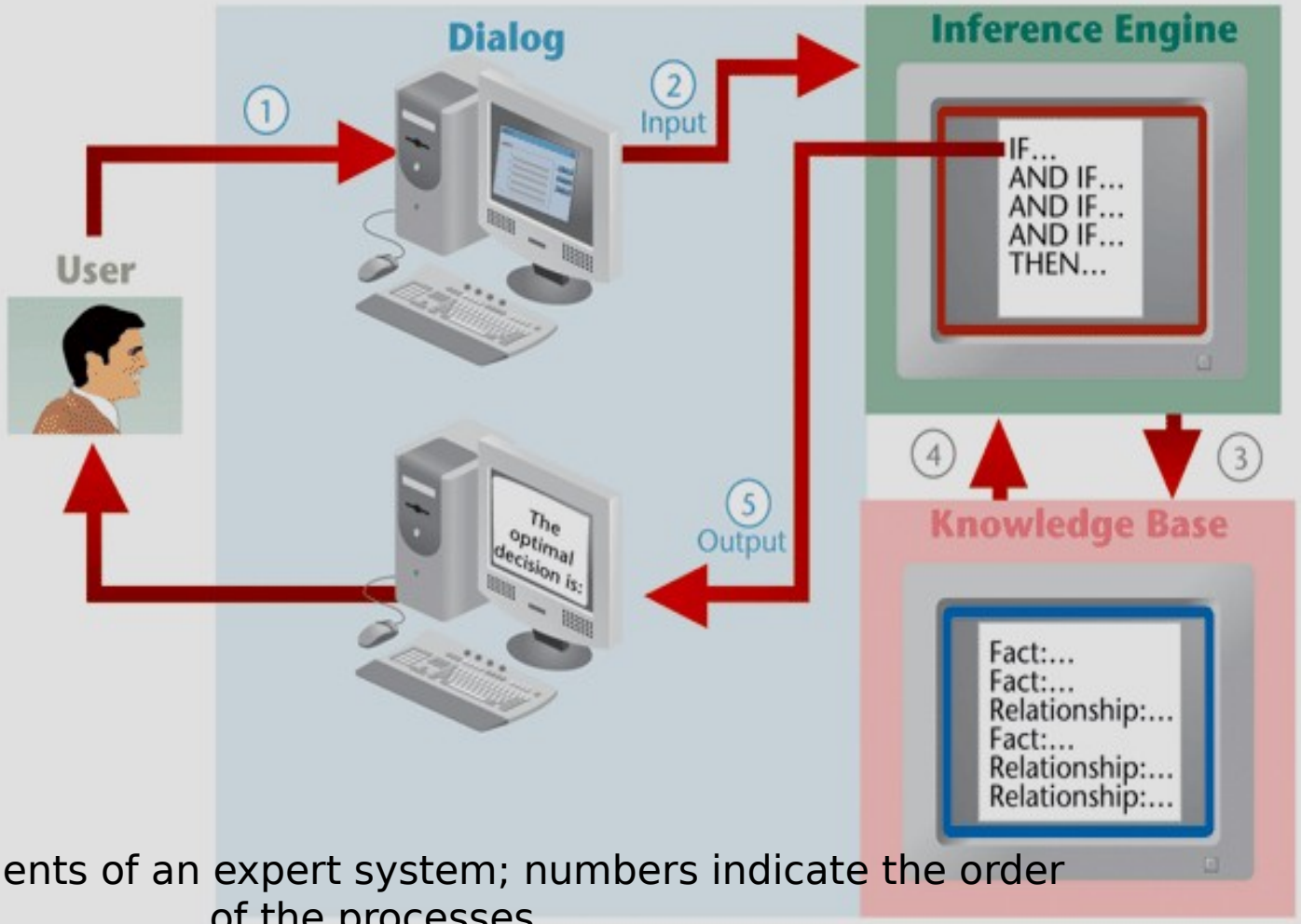


Expert Systems components

- **Knowledge base**: Used by ES
  - Collection of facts and relationships among them
  - Built on series of IF-THEN rules
- **Inference engine**: combines data input by user with data relationships
- **Neural networks**: Used by ES to mimic human brain learning
  - Refines itself based on decision success rate
  - Useful for detecting fraud

Expert Systems (continued)

FIGURE 10.6
Components of an expert system; numbers indicate the order of the processes



ure : Components of an expert system; numbers indicate the order of the processes

Expert Systems (continued)

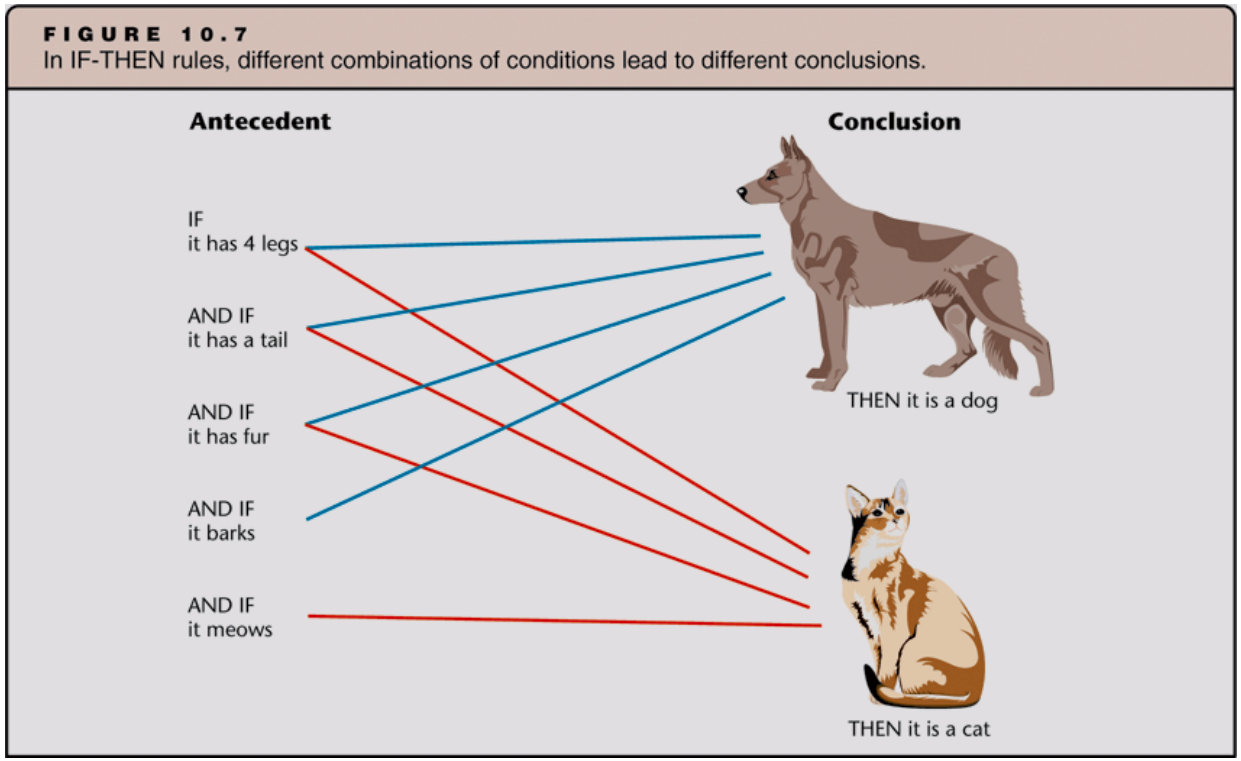


Figure : In IF-THEN rules, different combinations of conditions lead to Different conclusions

Expert Systems in Action

- ESs help many industries
  - Medical diagnosis
    - Help doctors with treatment advice
    - Diagnosis of symptoms
    - Can detect disease
  - Medical management
    - Discern which treatment patient should receive
    - Administrative decisions
  - Telephone network maintenance
    - Diagnose and fix network failures

Expert Systems in Action (continued)

Medical expert systems help diagnose patients and suggest treatments.

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Expert Systems in Action (continued)

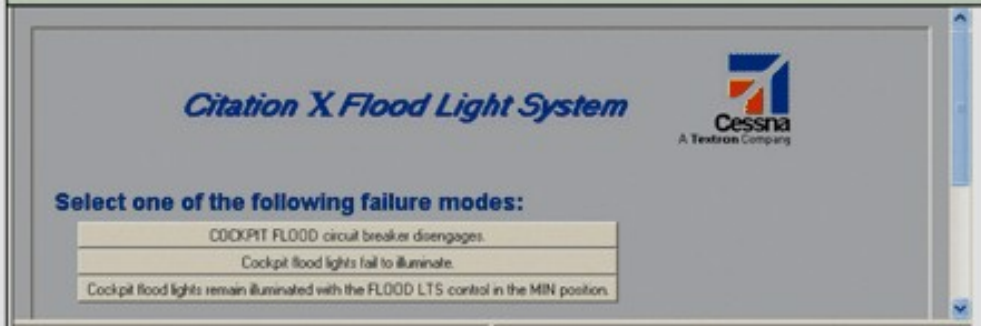
- ESs help many industries
  - Credit evaluation
    - Approve credit card charges
    - Analyzes credit
    - Based on financial reports
    - Used by loan officers
  - Detection of insider securities trading
    - Prevent trading of stocks based on private information
    - Analyze history

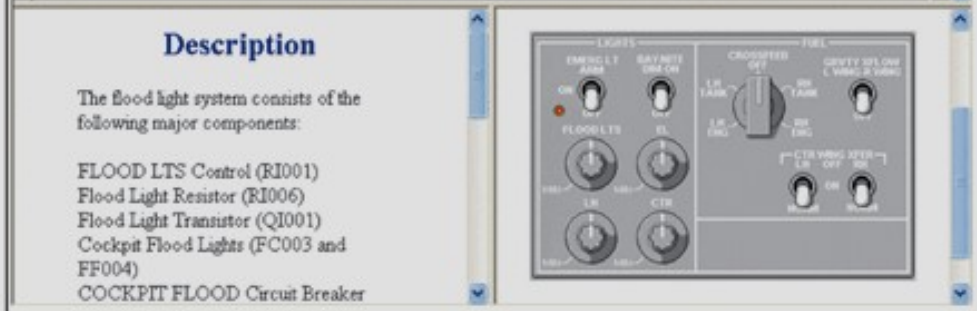
Expert Systems in Action (continued)

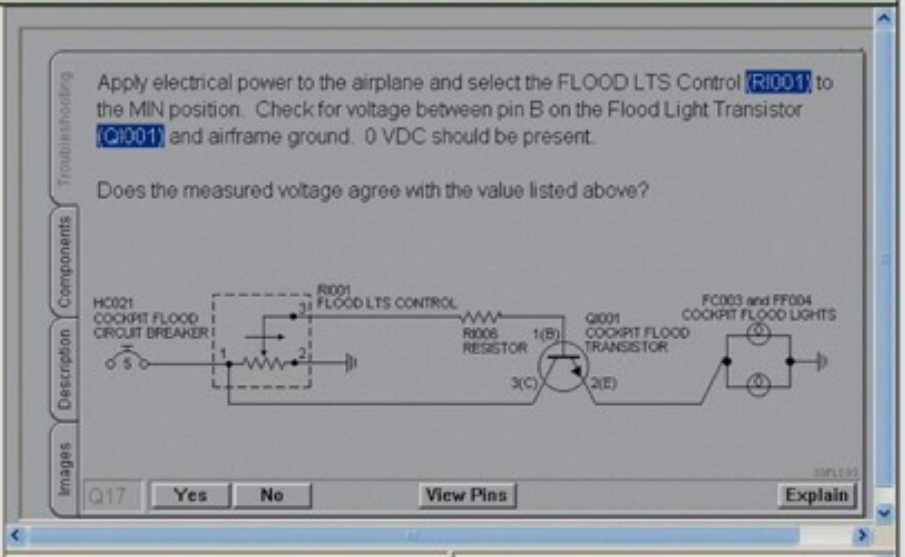
- ESs help many industries
  - Detection of common metals
    - Identify common metals and alloys
    - Based on results of chemical tests
  - Irrigation and pest management
    - Indicate crop market value
    - Detect toxins
  - Diagnosis and prediction of mechanical failure
    - Diagnose cause of failure

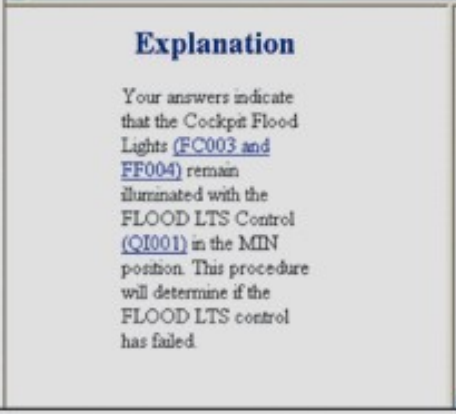
Expert Systems in Action (continued)

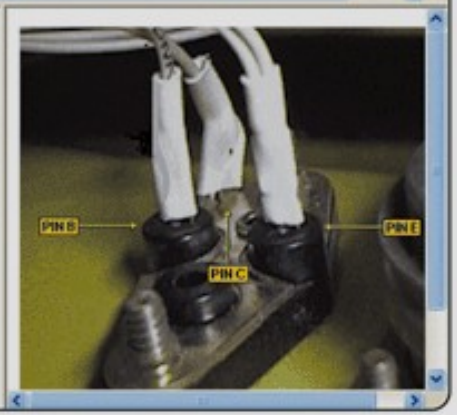
ESs help diagnose failures in systems. Here, and ES helps troubleshoot the failure of a cockpit floodlight in a Cessna executive jet.





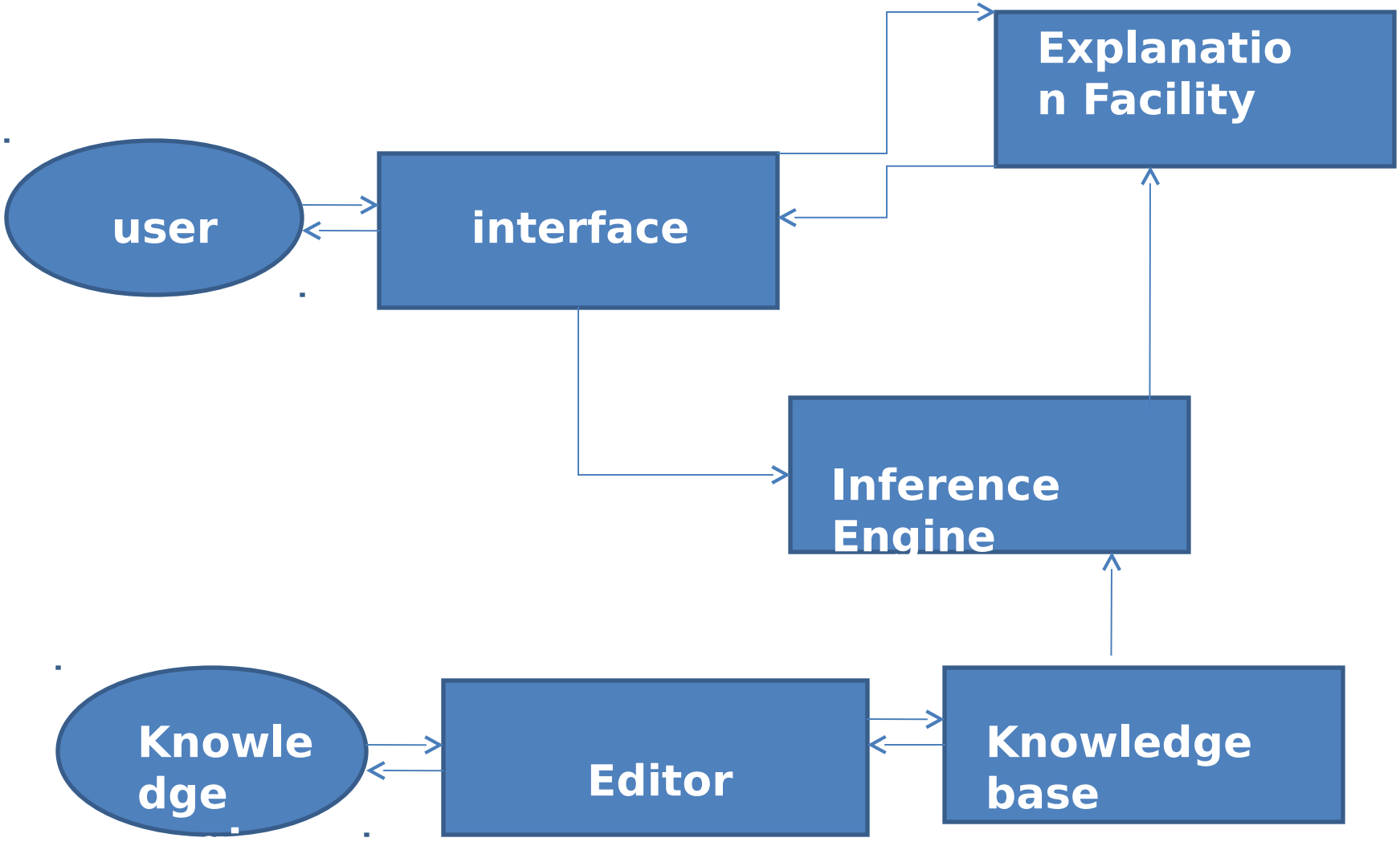






Courtesy of EXSYS, Inc., www.exsys.com

Architecture of Typical ES



Components of ES

1. Knowledge acquisition subsystem
   - The accumulation, transfer & transformation of problem solving expertise from experts or document knowledge sources to a computer program for constructing & expanding the knowledge base
   - Subparts
     - Knowledge base
     - Inference engine(brain control structure)
     - User interface

Components of ES contd…

2. Blackboard (workplace)
   - Working memory area that records plan(how to attach a problem), agenda (potential action awaiting execution) & solutions.
3. Explanation System(justifier)
   - Trace responsibilities for conclusions & explain ES behavior
4. Knowledge refining system
   - Explanation & feedbacks
5. Users
   - Non expert human who needs advice & training

Benefits of ES

1. Increased o/p & productivity
2. Decreased decision making time
3. Increased process & product quality
4. Reduce downtime
5. Capture of scarce expertise

Benefits of ES contd…

6. Flexibility
7. Easier equipment operation
8. Elimination of need for expensive equipment
9. Operation in hazardous environment.
10. Ability to work with incomplete & uncertain information
11. Knowledge transfer to remote locations
12. Enhancement of other IS

The Key to ES Success

- convincing ideas
  - rules, cognitive models
- practical applications
  - medicine, computer technology, …
- separation of knowledge and inference(deduce)
  - expert system *shell*
    - allows the re-use of the “machinery” for different domains
- concentration on domain knowledge
  - general reasoning is too complicated

When (Not) to Use ESs

- expert systems are not suitable for all types of domains and tasks
  - conventional algorithms are known and efficient
  - the main challenge is computation, not knowledge
  - knowledge cannot be captured easily
  - users may be reluctant to apply an expert system to a critical task

ES Tools

- ES languages
  - higher-level languages specifically designed for knowledge representation and reasoning
  - SAIL, KRL, KQML, DAML, OWL (Web Ontology Language)
- ES shells
  - an ES development tool/environment where the user provides the knowledge base
  - CLIPS, JESS, Mycin, Babylon, G2, ...

ES Advantages

- economical
  - lower cost per user
- availability
  - accessible anytime, almost anywhere
- response time
  - often faster than human experts
- reliability
  - can be greater than that of human experts
  - no distraction, fatigue(tiredness), emotional involvement, ...
- explanation
  - reasoning steps that lead to a particular conclusion
- intellectual property
  - can’t walk out of the door

ES Problems

- limited knowledge
  - “shallow” knowledge
    - no “deep” understanding of the concepts and their relationships
  - no “common-sense” knowledge
  - no knowledge from possibly relevant related domains
  - “closed world”
    - the ES knows only what it has been explicitly “told”
    - it doesn’t know what it doesn’t know
- mechanical reasoning
  - may not have or select the most appropriate method for a particular problem
  - some “easy” problems are computationally very expensive
- lack of trust
  - users may not want to leave critical decisions to machines

Artificial Intelligence

- An effort to develop computer based systems that behaves as humans
- Systems would be able to learn
  - Natural languages
  - Accomplish coordinated physical task