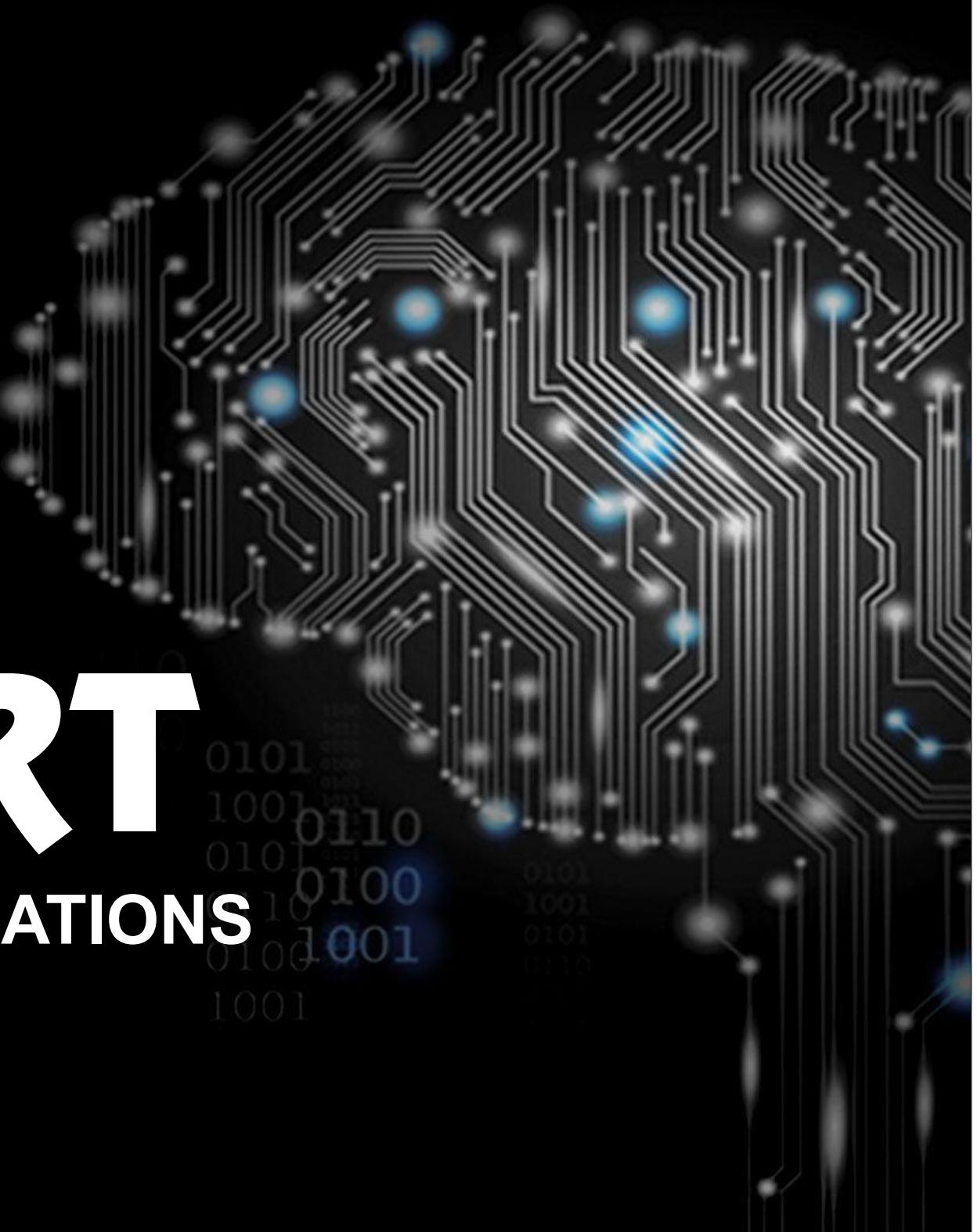


Welcome
to the
presentation
of

EXPERT

**SYSTEM & APPLICATIONS
(ES)**



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- b) Knowledge Representation

3) Expert System Architecture

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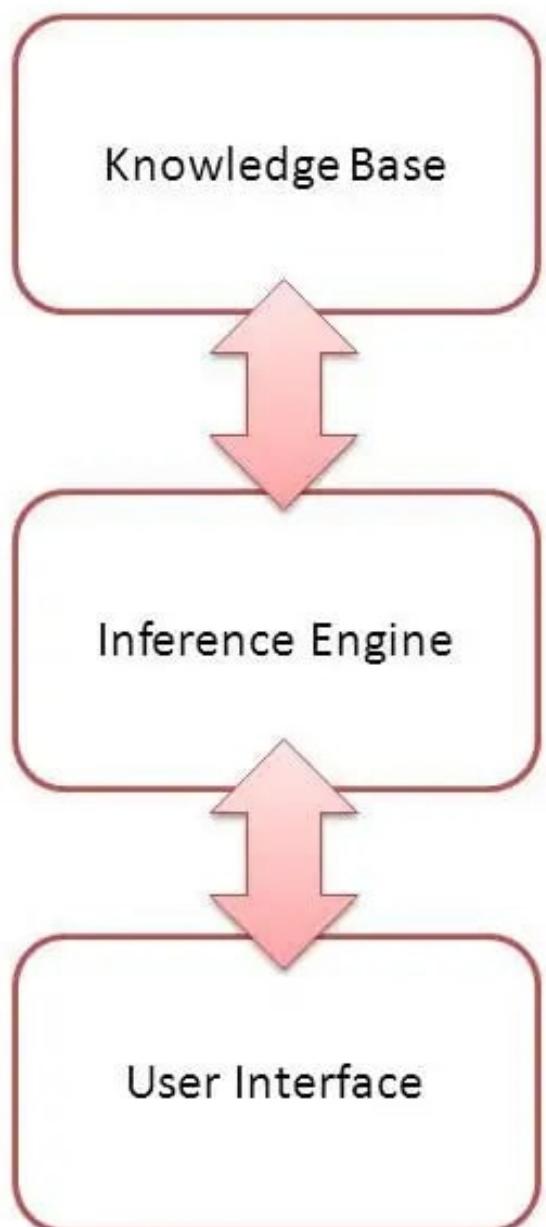


Introduction

- * Expert System is a set of programs which is designed and which responds to the User Interface as per the user requirements.
- * The ES fetch the data from the Knowledge Base.
- * The Knowledge Base contains the rules and facts which are encoded by many Domain Expert And human Experts.
- * ES are made to or used to solve the complex problems, real world problems, and also to perform clinical Experiments and many more.

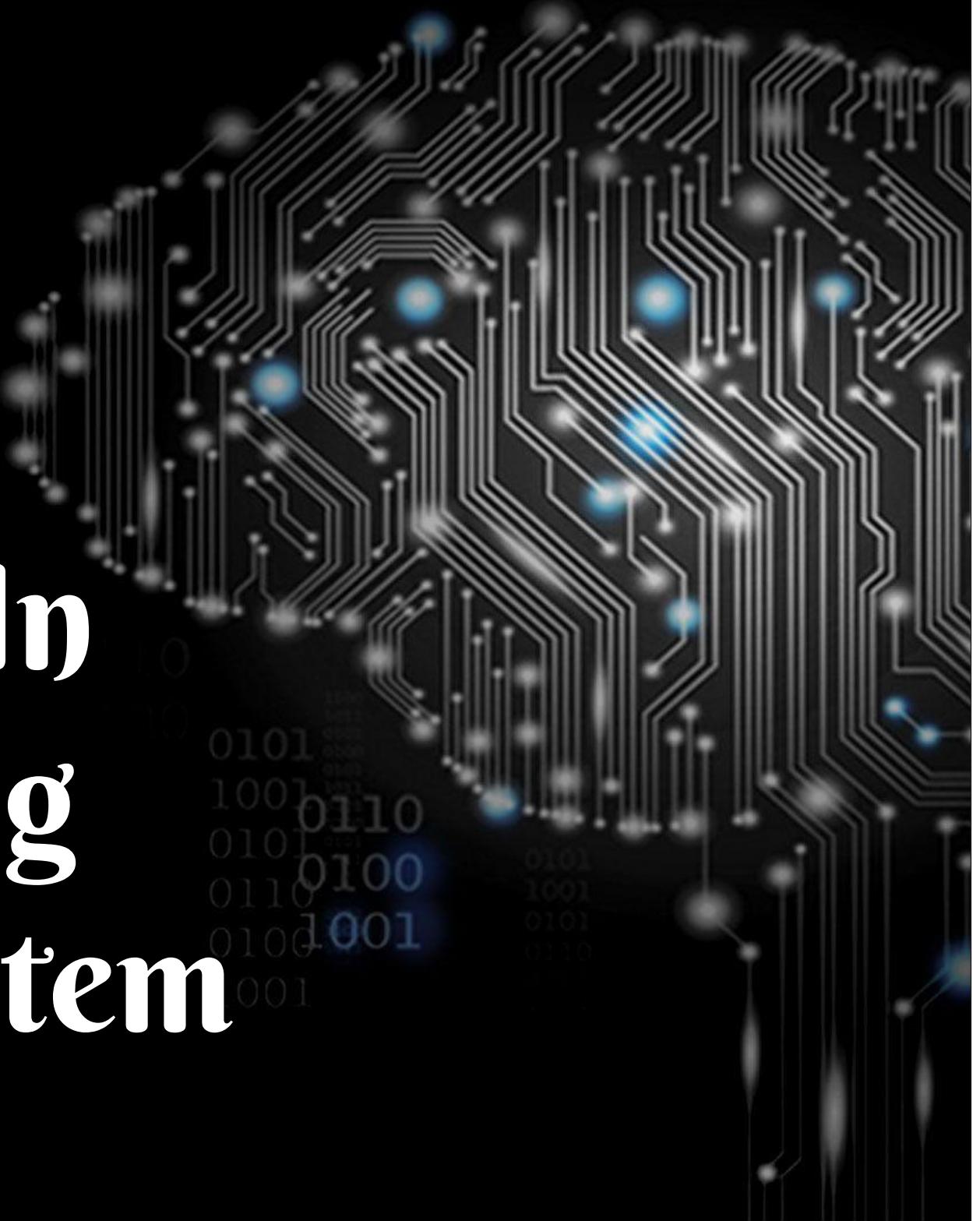


An Expert System

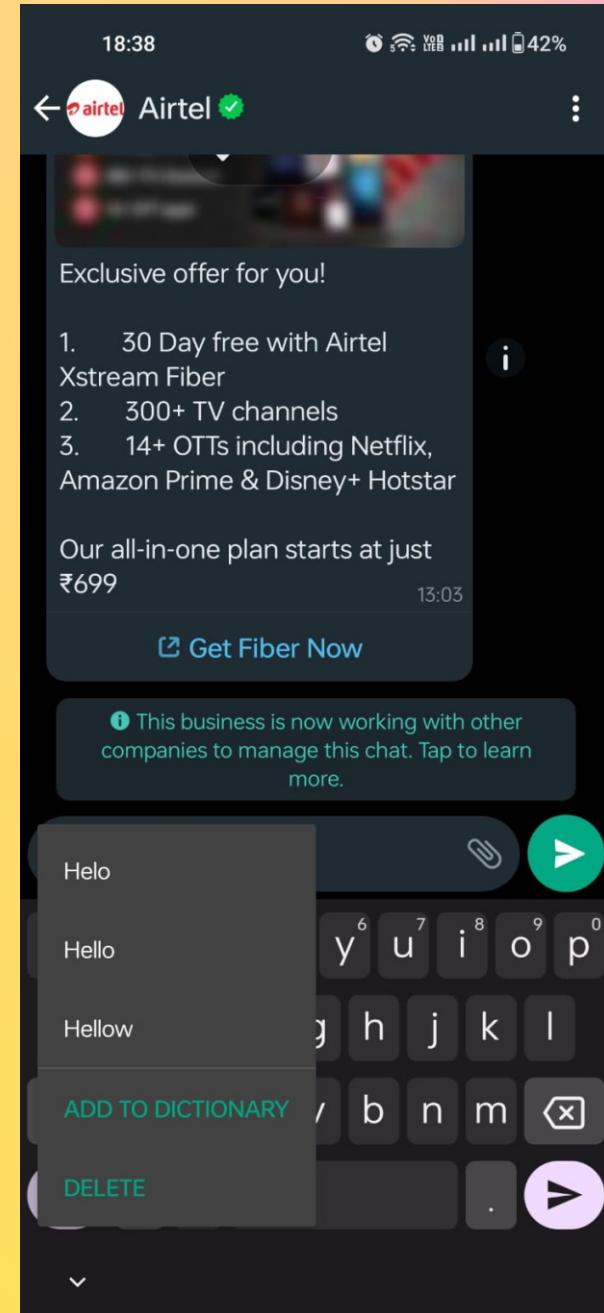
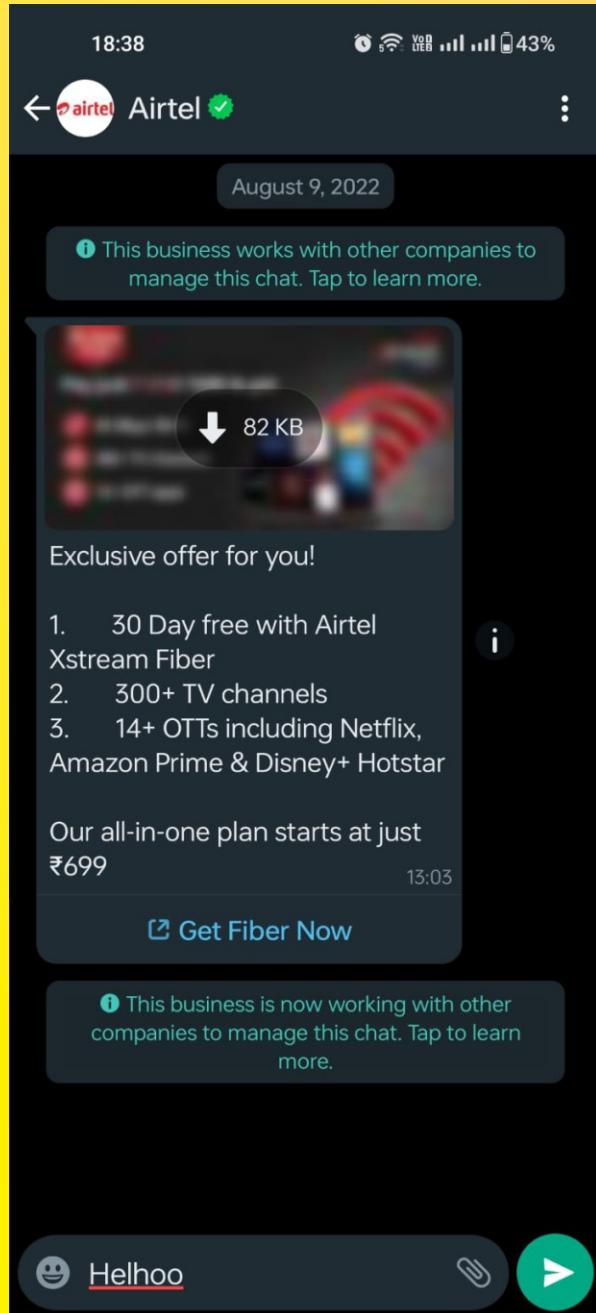


- A huge organised set of knowledge about a particular subject. It contains facts and judgemental knowledge which gives it the ability to guess like a human
- A set of rules on which to make decisions (using the if-then structure). The Inference engine does reasoning by manipulating the knowledge base
- The user interface presents questions and information to the operator and also receives answers from the operator

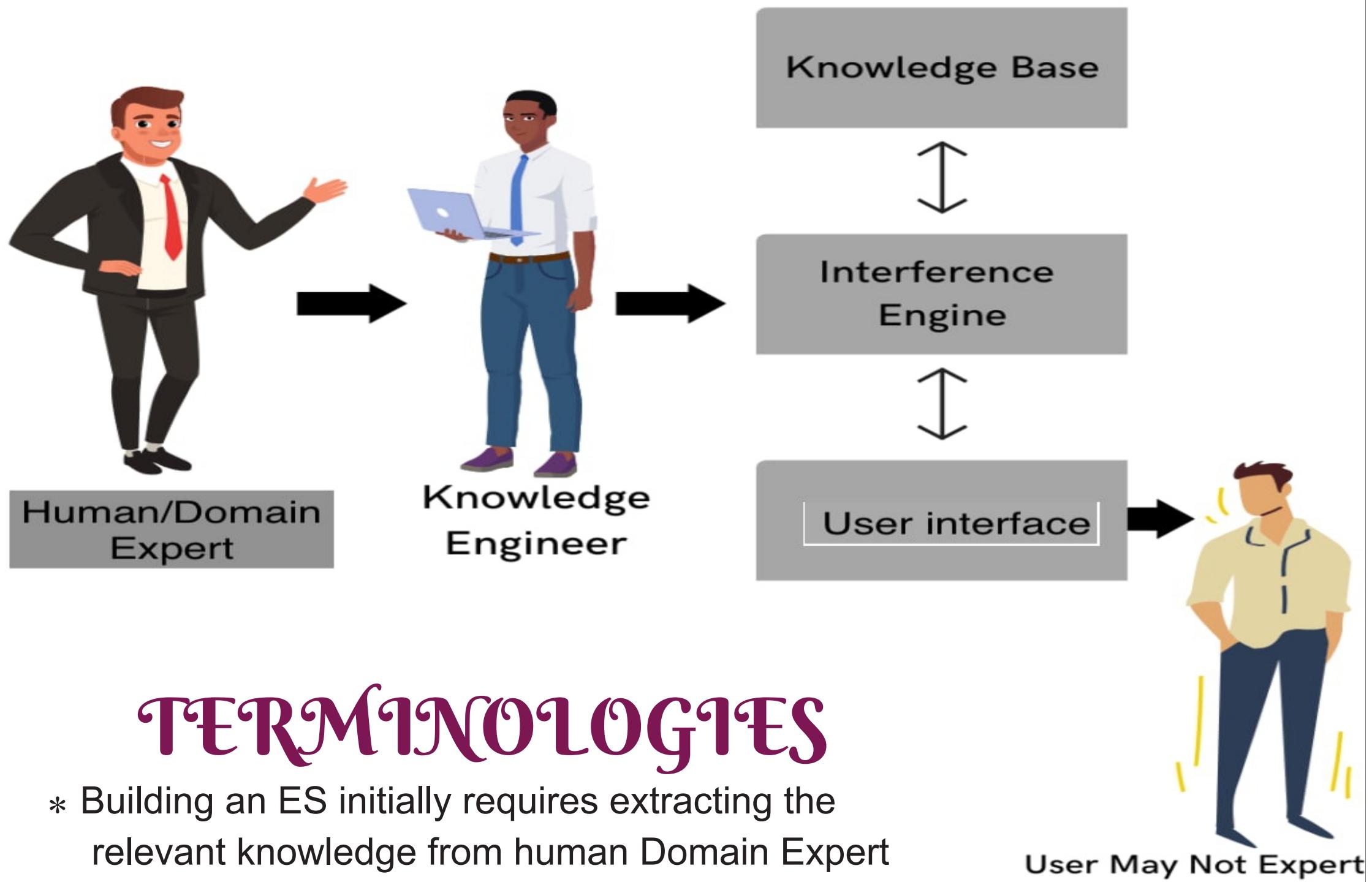
Phases In Building Expert System



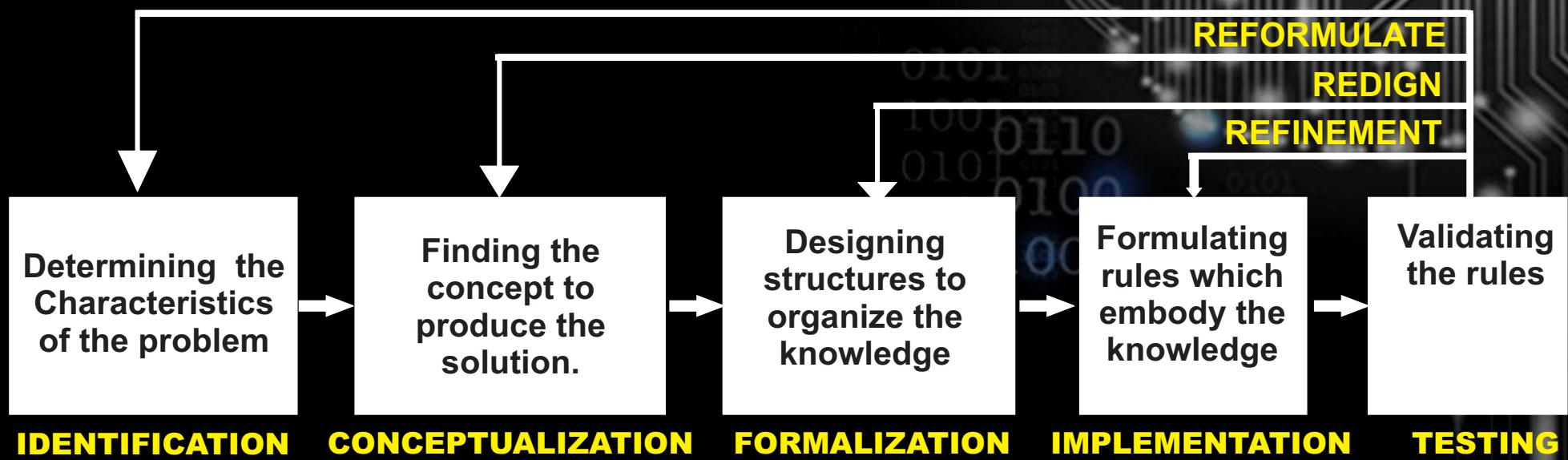
Expert System Example illustrations



Expert System



Five Phases



Knowledge Engineering

- * The Whole process of building an ES is often refers to Knowledge Engineering

Responsibilities of Knowledge Engineering

- * Ensuring that the Computer has all the Knowledge needed to solve the problem
- * Choosing one or more forms to represent the required Knowledge
- * Ensuring that the Computer can use the Knowledge Efficiently by selecting some of the reasoning methods



- * The job of the Knowledge Engineer involves close Collaboration with the Domain Experts and the End users.
- * The Development of ES would remain incomplete if it did not involve collaboration with the end users
- * The Domain Knowledge Consisting of both formal, Textbook knowledge and experimental Knowledge entered into the program piece by piece
- * The Development of ES would remain incomplete if it did not involve close collaboration with the end user

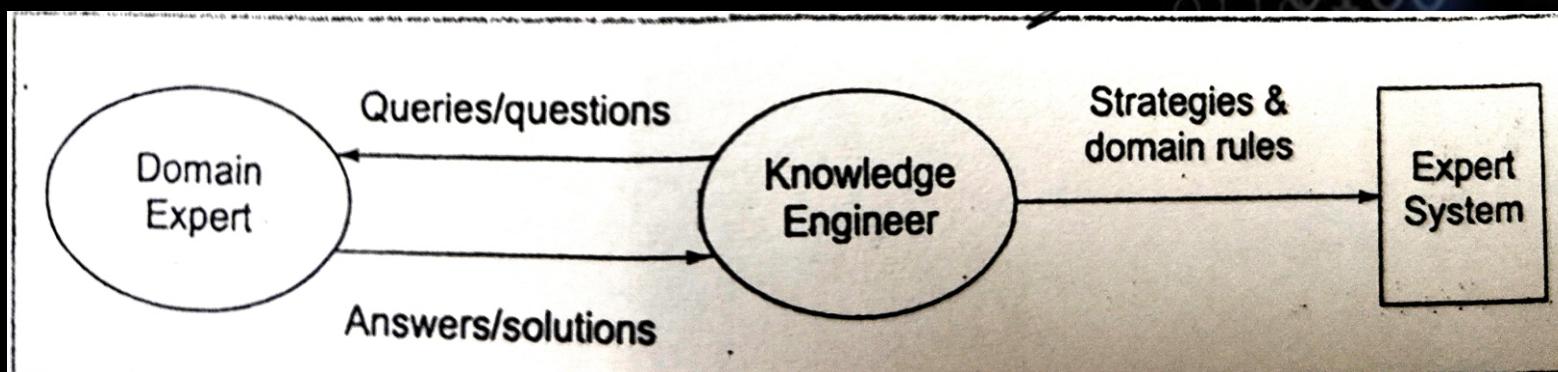
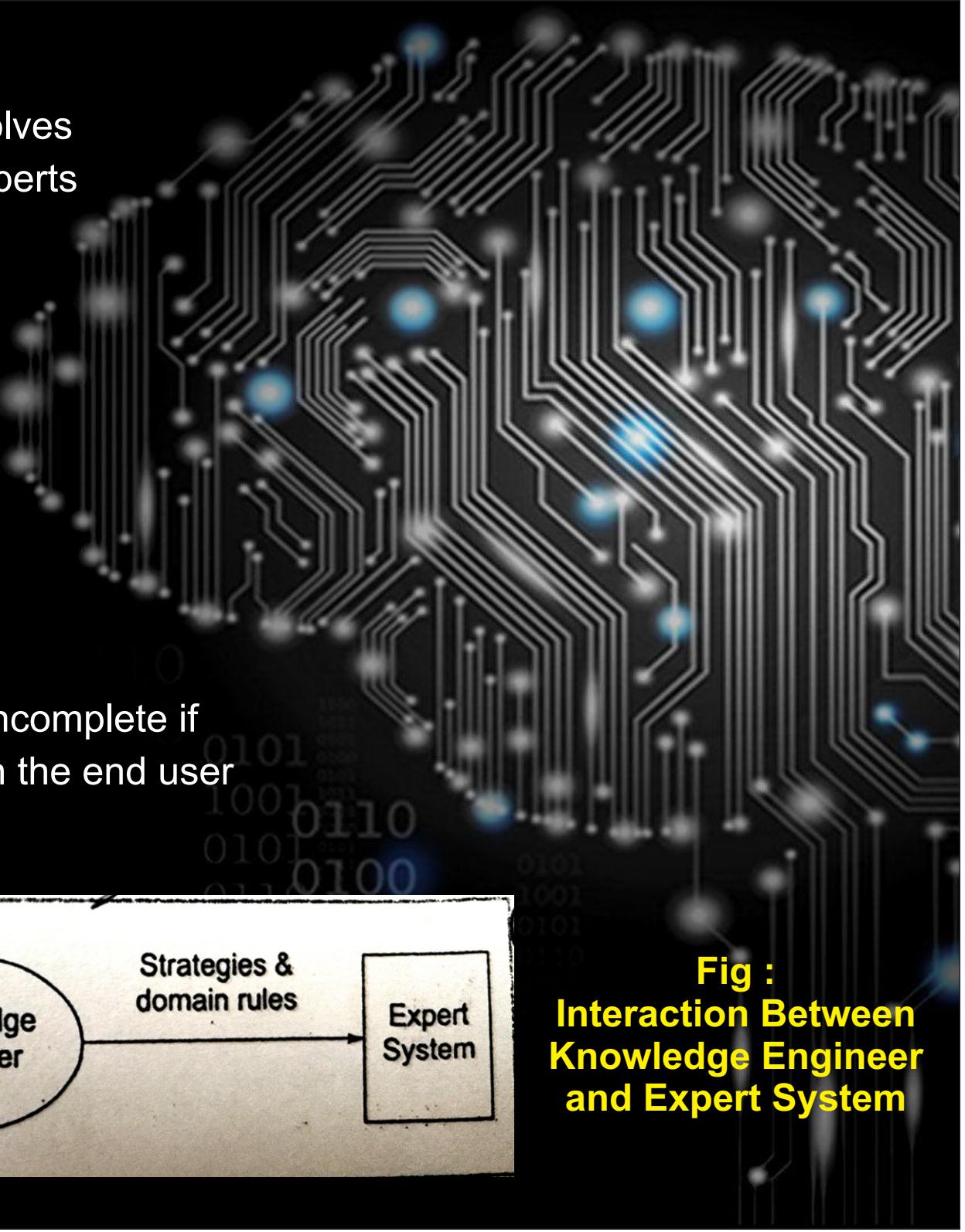


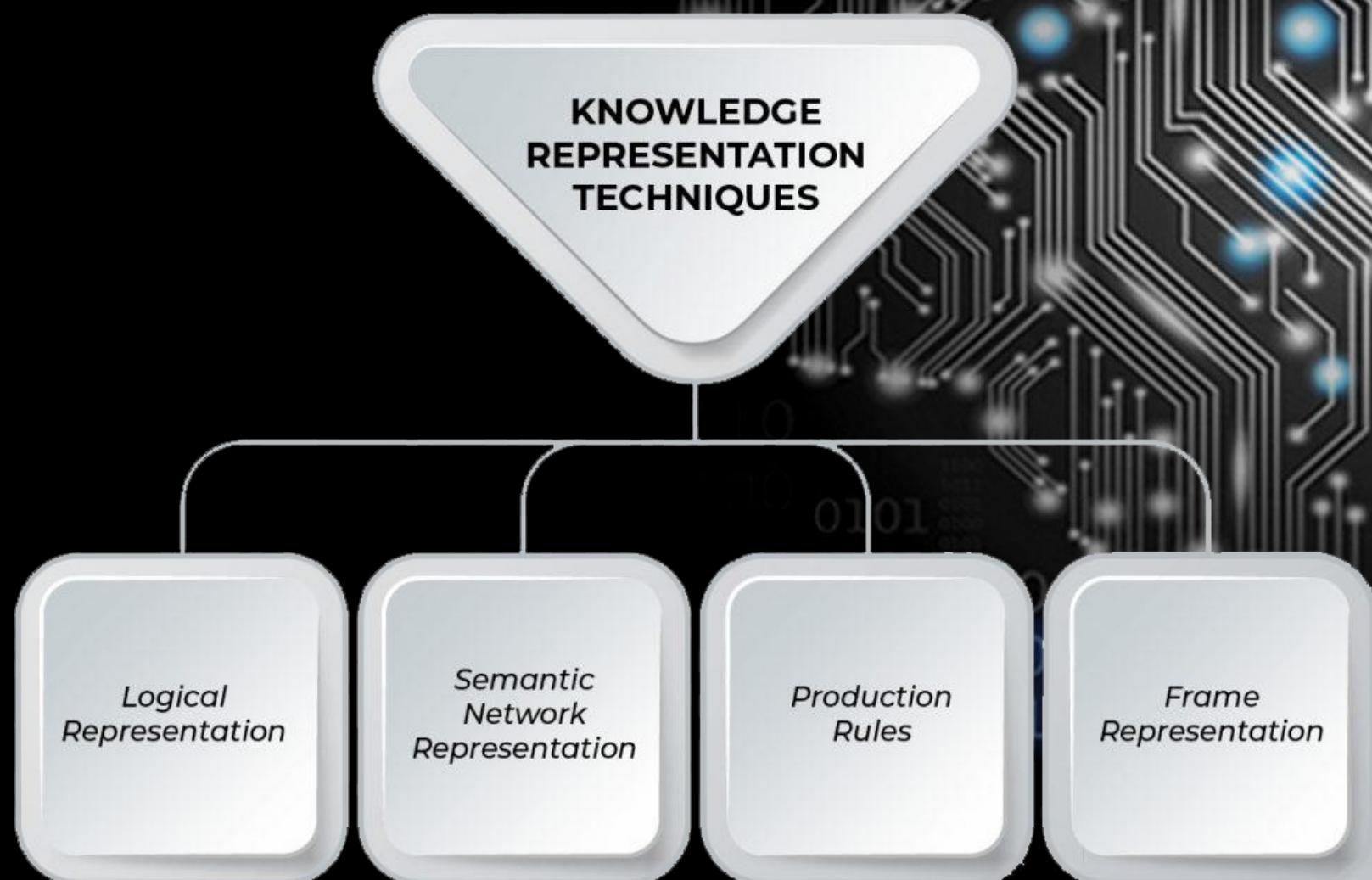
Fig :
**Interaction Between
Knowledge Engineer
and Expert System**



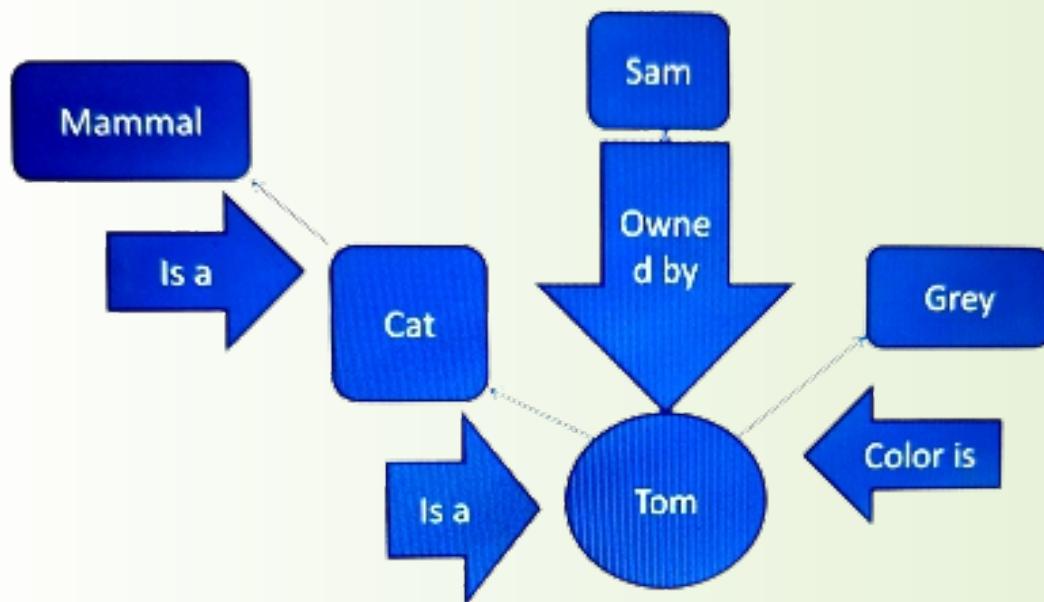
Knowledge Representation

- * The most common Knowledge Representation scheme for ES consists of production rules or simply rules, they are of the form if then.
 - * Expert System in which Knowledge is represented in the form of rules are called rule based systems.
 - * Another widely used representation in ES is called the unit (also Known as Frame, Semantic net)

Four Types of Representation



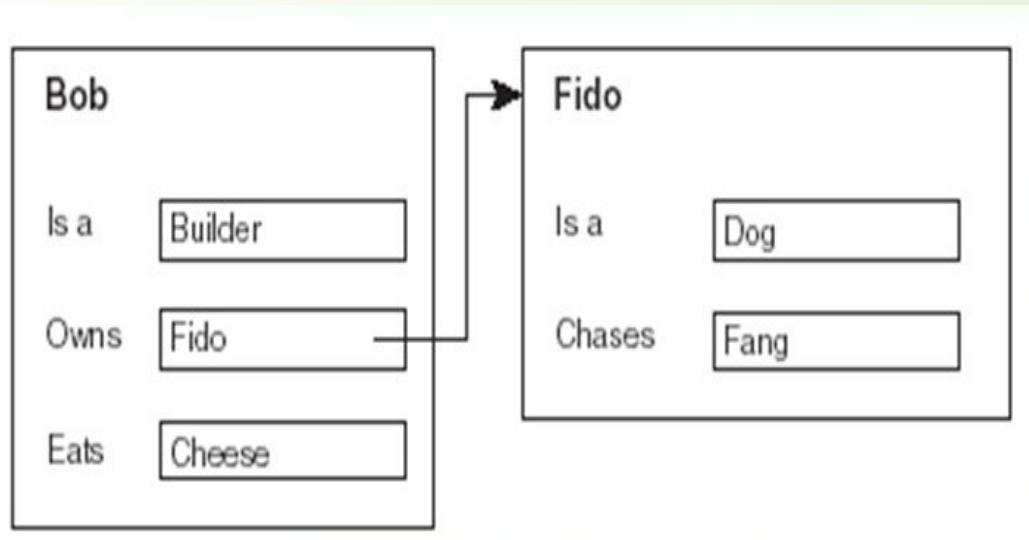
AI researchers continue to Explore and add to the current list of Knowledge Representations Technique and reasoning methods



Semantic Network

- * This representation Knowledge in the form of graphical network.

Ex. Tom is / a cat / grey in color / Mammal / owned by sam

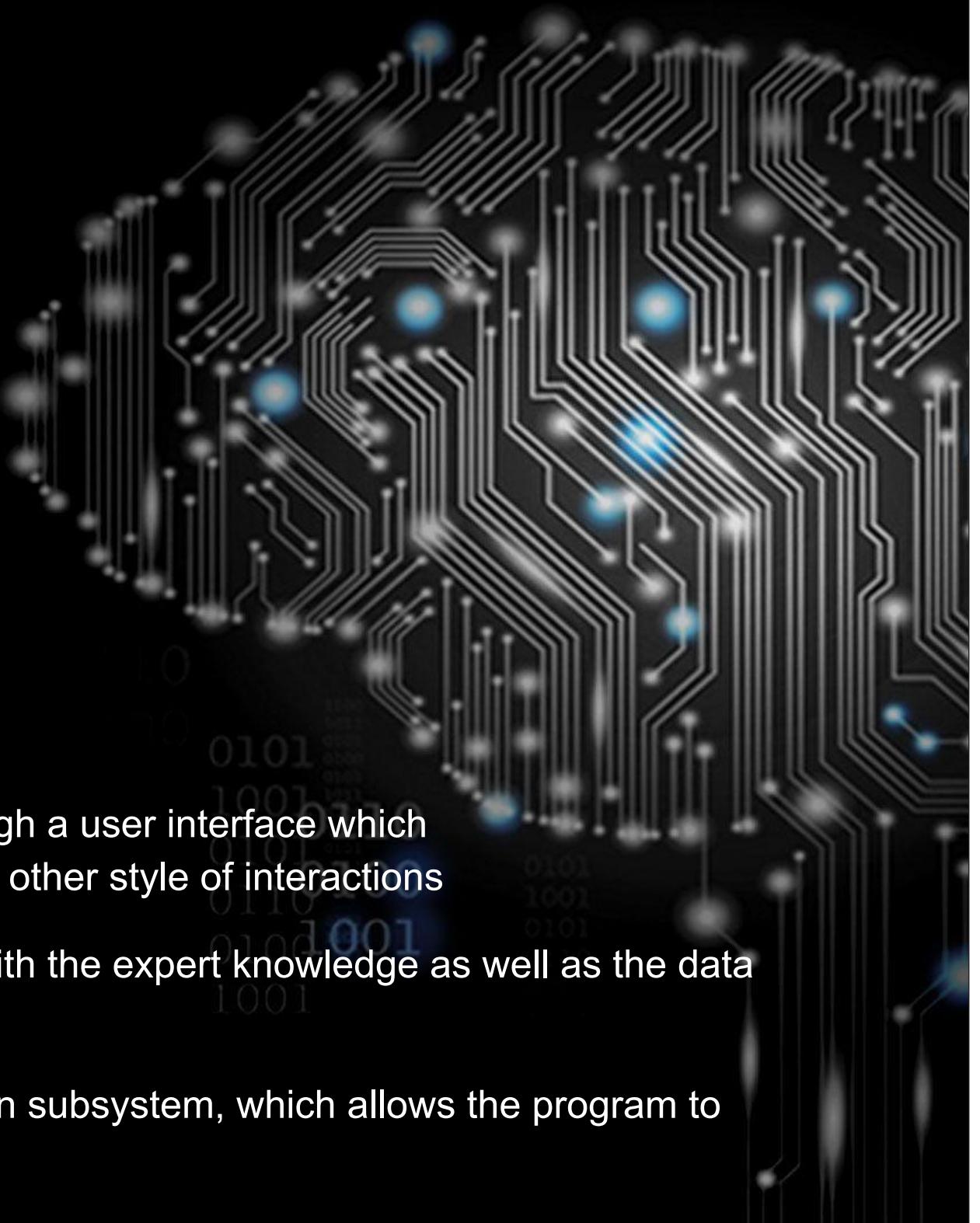


Frame Representation

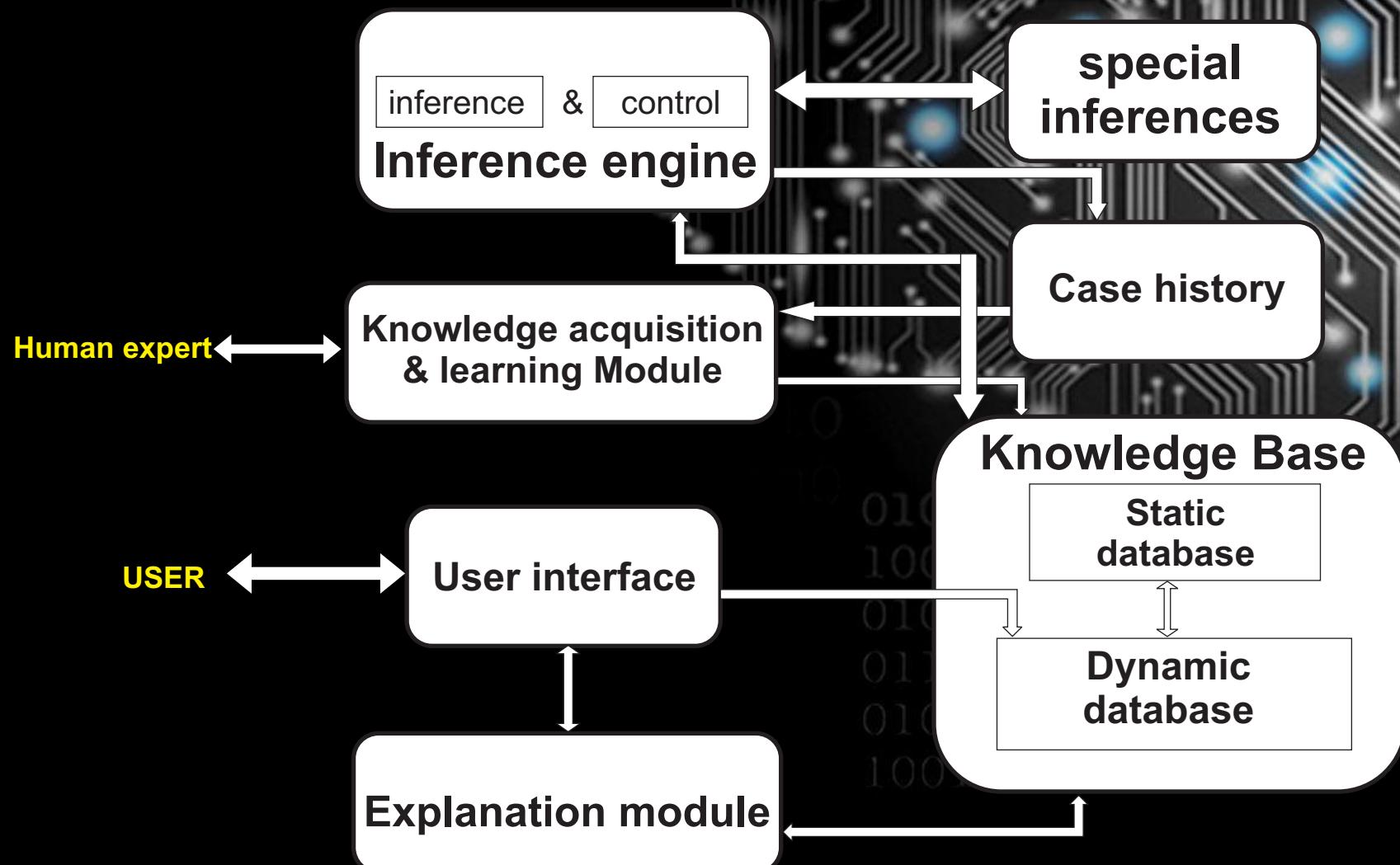
- * Frames are record like structures that consists of a collection of slots or attributes and the corresponding slot value .
- * Slots have names and values called FACETS

EXPERT SYSTEM ARCHITECTURE

- * The user interacts with the system through a user interface which may use menus natural language or any other style of interactions
- * An inference engine is used to reason with the expert knowledge as well as the data specific to the problem being solved
- * All expert systems possess an explanation subsystem, which allows the program to explain its reasoning to the user



EXPERT SYSTEM ARCHITECTURE



Two Ways of thinking about Knowledge

Dynamic Knowledge

vs

Static Knowledge



Dynamic knowledge lives in people's minds and experience and is continually updated but can be hard to reference

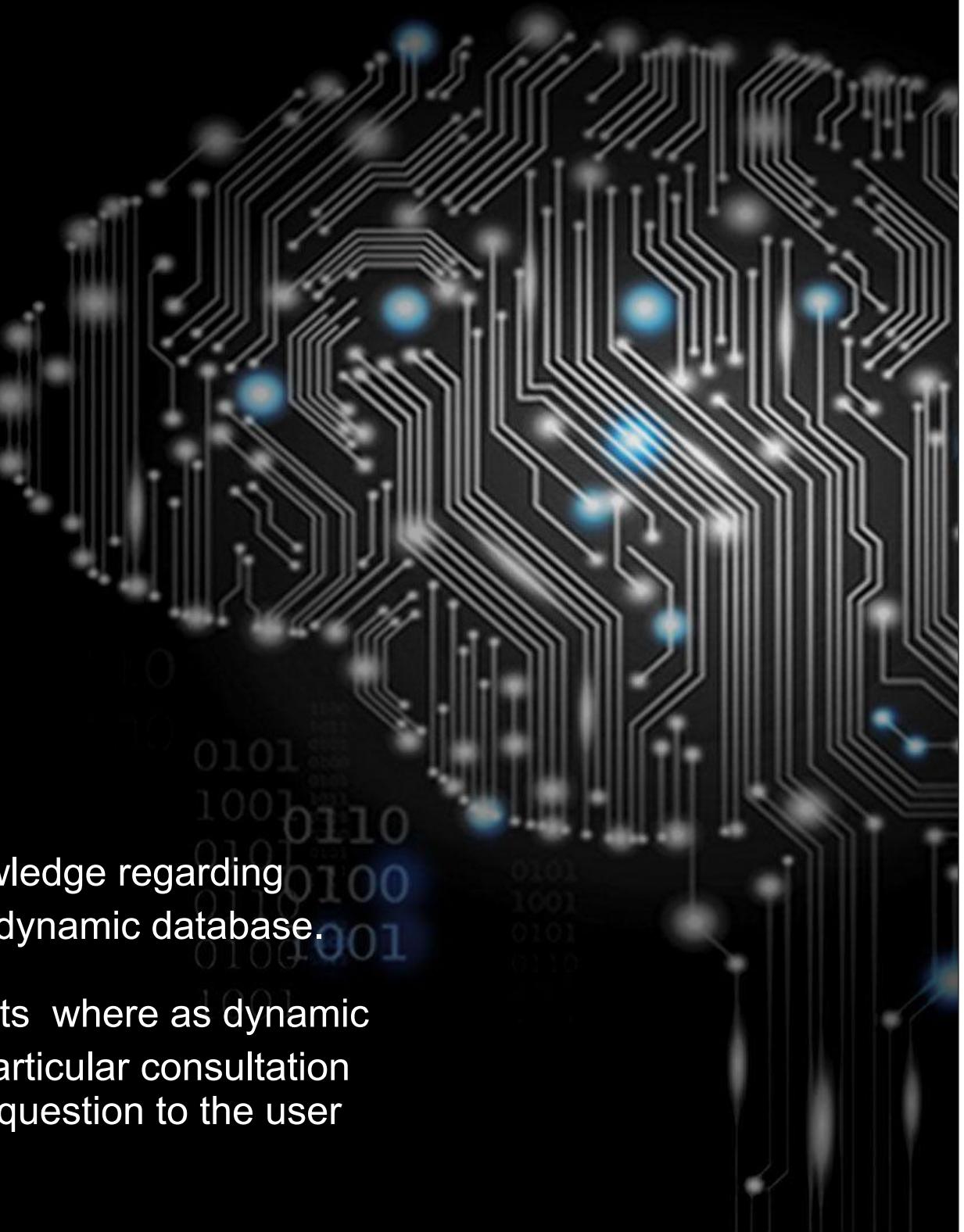


Static knowledge lives in documents and products that can be referenced but can become disconnected from practice.



Knowledge Acquisition

- * A knowledge acquisition module allows the system to acquire more knowledge regarding the problem domain from expert



Knowledge Base

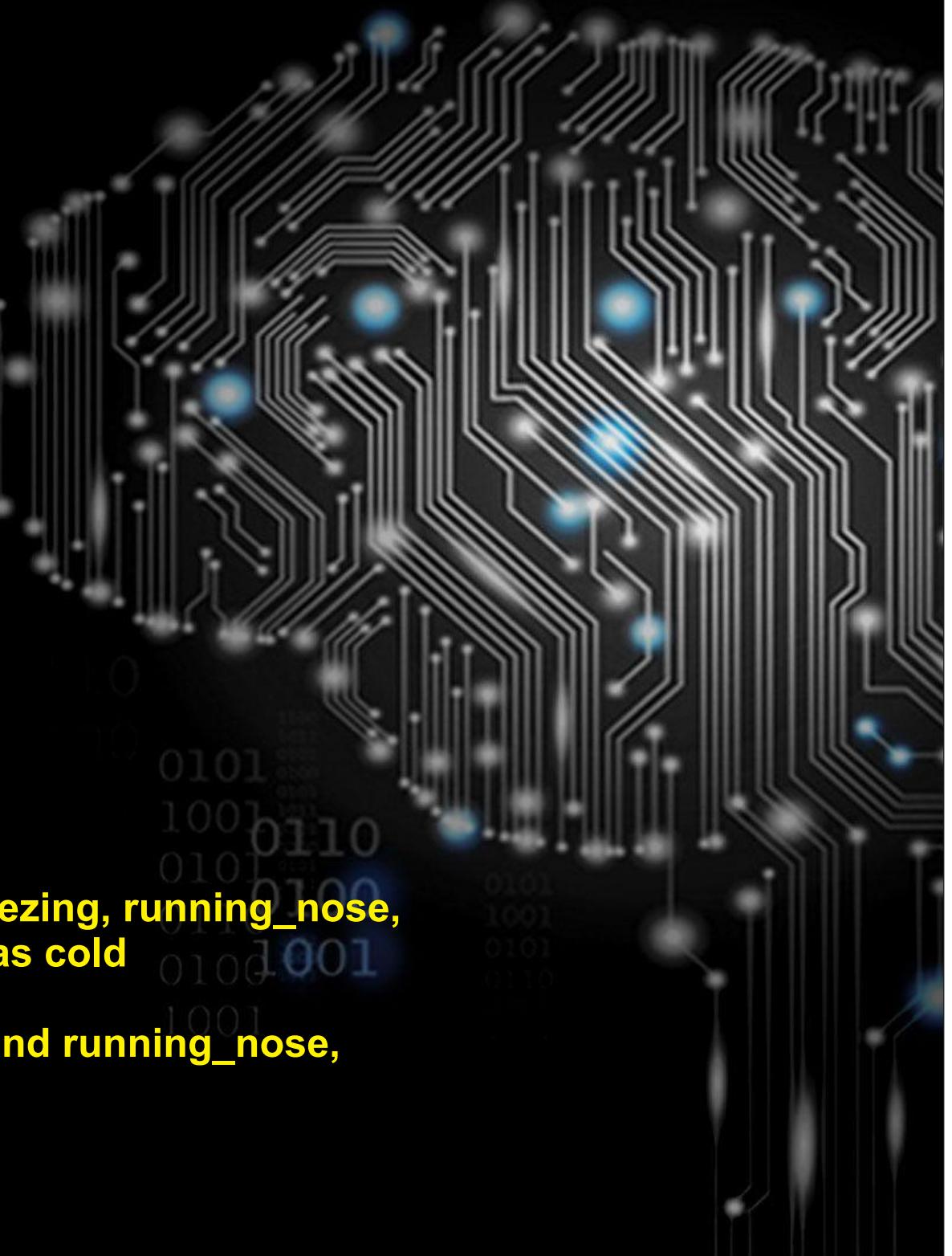
- * Knowledge base of an es consists of knowledge regarding problem domain in the form of static and dynamic database.
- * Static knowledge consists of rules and facts where as dynamic knowledge consists of facts related to a particular consultation of the system collected by asking various question to the user who is consulting the ES.

Inference Engine

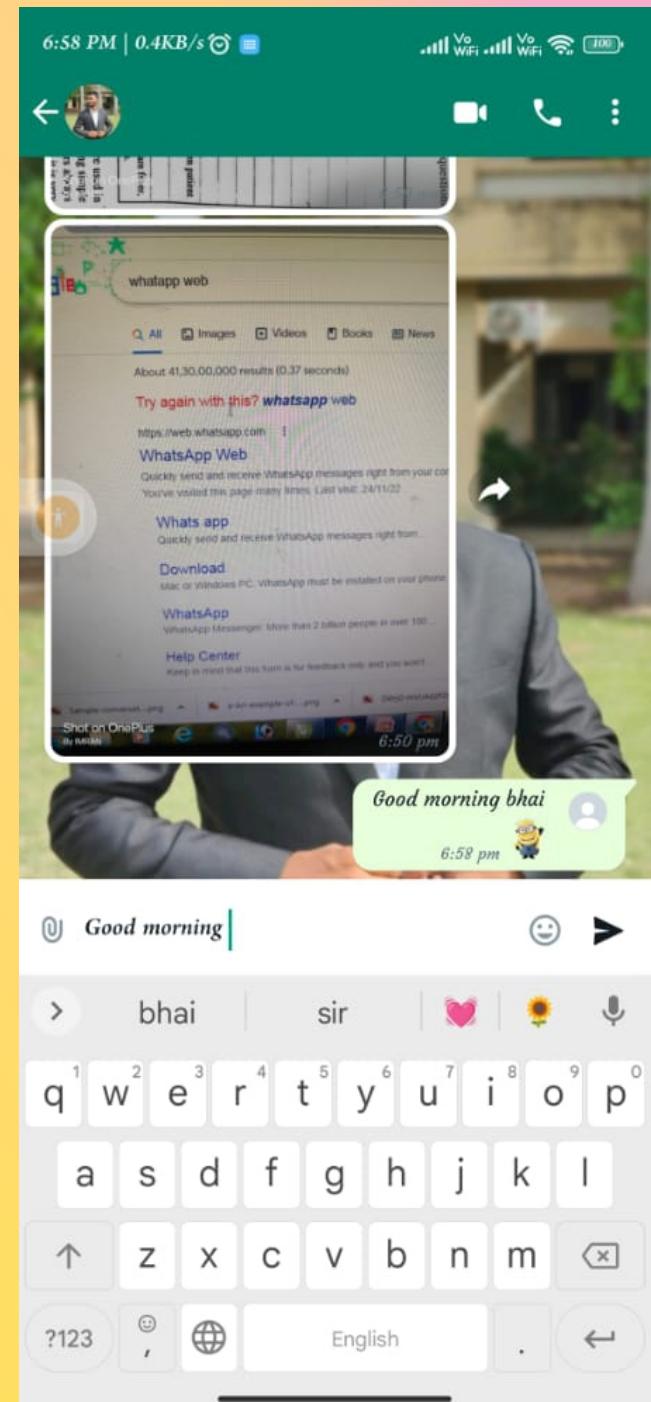
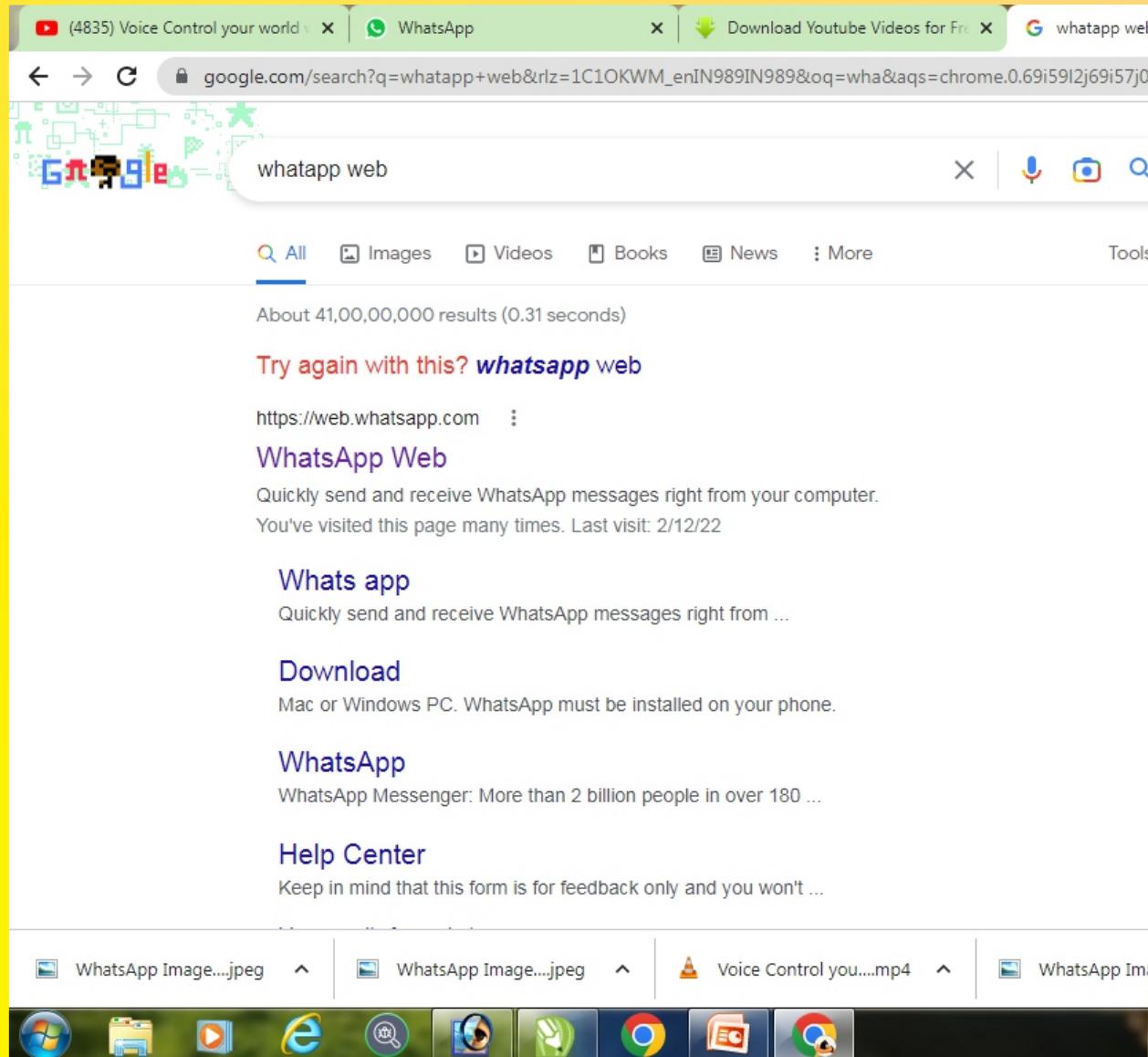
- * The term inference refers to the process of searching through knowledge base and deriving new knowledge.
- * An inference rules may be defined as a statement that has two parts, an if clause and a then clause.
- * There are mainly two types of reasoning mechanism that use inference rules: backward chaining and forward chaining.

Rule 1 : If Symptoms are headache, sneezing, running_nose, and sore_throat, then Patient has cold

Rule 2 : If Symptoms are fever, cough, and running_nose, then Patient has measles.



Examples for Inference Engine



Case History

- * Case history stores the files created by inference engine using the dynamic database.
- * Different cases with solutions are stored in case Base system (CBS)and these cases are use for solving the problem using case base reasoning(CBR).

Special Interface

- * Special interfaces may be use in ES for performing specialized activities such as handling uncertainty in knowledge.
- * The set methods for using uncertain knowledge in combination with uncertain in the reasoning process in called reasoning with uncertainty.

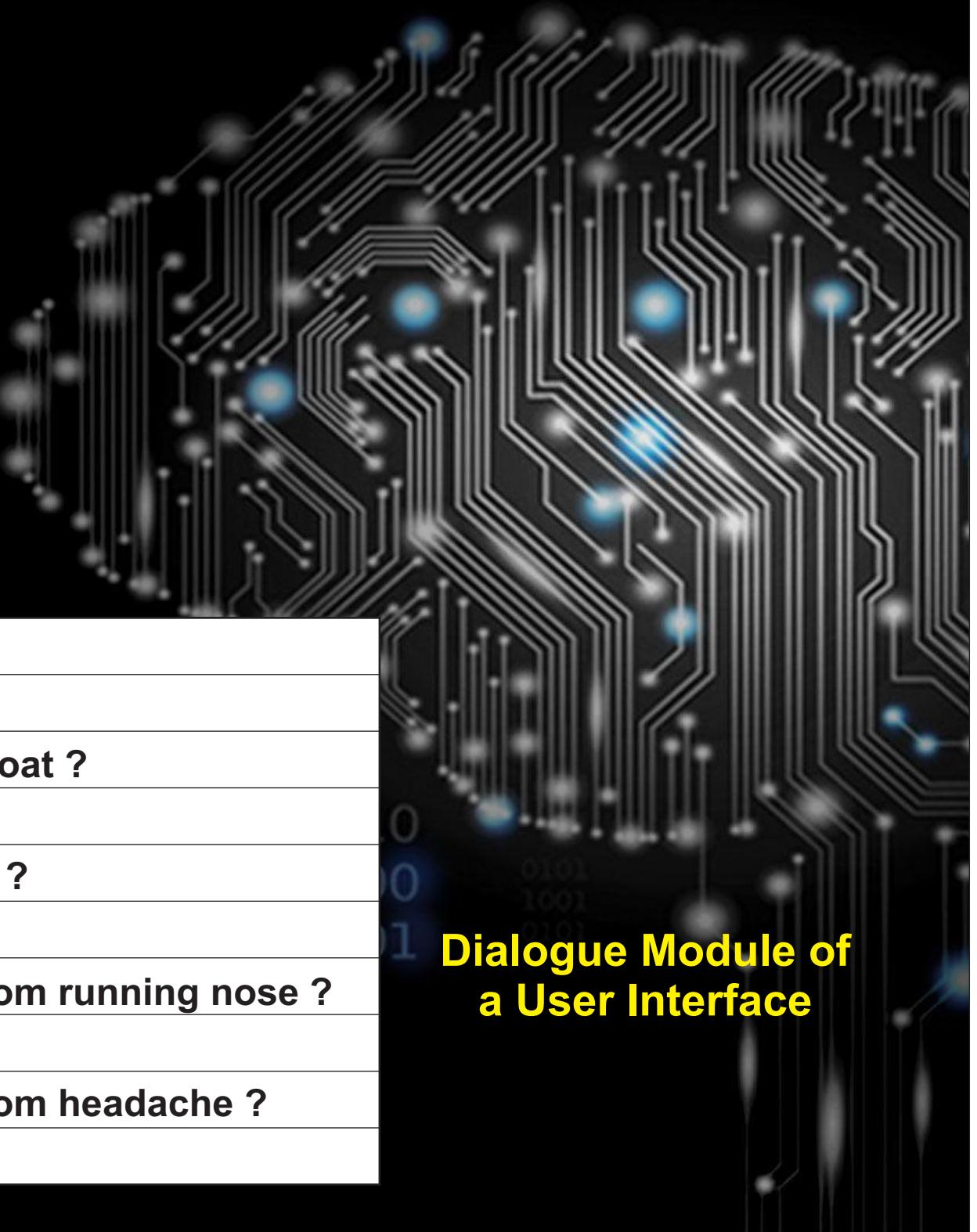


User Interface

- * User interface of an Es allows user to communicate with the system in an interactive manner and helps the system in creating working knowledge for the problem that has to be solved.
- * The end-user usually sees an ES through an interactive dialogue module.

SYSTEM	Do you have fever ?
USER	Yes
SYSTEM	Do you have Sore throat ?
USER	NO
SYSTEM	Do you have Cough ?
USER	Yes
SYSTEM	Are you suffering from running nose ?
USER	Yes
SYSTEM	Are you suffering from headache ?
USER	No

**Dialogue Module of
a User Interface**



Explanation Module

- * Most of the Es has explanation facilities that enable users to query the system about why its asked some question and how it reaches some conclusion; these modules are called how and why.

INVOKE	Why / How modules
SYSTEM	Do you have running nose ?
USER	Yes
SYSTEM	I am trying to prove you have Cold. Do you have headache ?
USER	Yes
SYSTEM	Do you have Sore throat ?
USER	NO
SYSTEM	Then you do not have cold. Do you have fever ?
USER	Yes
SYSTEM	Now I am Looking at the Possibility of measles. Do you hvae Cough ?
USER	Yes
SYSTEM	I can infer measles using the rule “ If Symptoms are headache, sneezing, running_nose, and sore_throat, then Patient has cold ”
USER	How ?
SYSTEM	Since you have fever , running_nose, and cough and thee is a rule “ If Symptoms are headache, sneezing, running_nose, and sore_throat, then Patient has cold ” . So, measles is concluded for you.

Expert System

vs

Traditional System

- * The basic difference between an ES and a traditional system is that an ES manipulates knowledge, whereas a traditional system manipulates data
- * The use of words such as if , then, might, probably etc. Indicate that there is some uncertainty involved in the statement .
- * Further, conventional programs are designed to always produce correct answers, whereas expert systems are designed to behave like human experts and may sometimes produce incorrect results



Characteristics of Expert System



No emotion

High Efficiency

Expertise in a domain

No Memory limitation

Regular updates improve the performance

High Security

Considers all facts

Advantages & Disadvantages

Advantages:

- Consistent answers for repetitive decisions.
- Cheaper than using a human expert.
- Can consult a larger pool of knowledge compared to a human expert.
- Available 24/7
- The computer doesn't forget information.

Disadvantages:

- No common sense
- Can make absurd errors (if the data is incorrectly input) – e.g. if a persons weight and age were swapped around.
- Not able to provide a creative response.
- Not able to realise when no answer is available to a problem.
- Relies on the rules and knowledge base being correct.

Language for ES Development

- * The basic hypothesis of Ai is that intelligent behavior of can be described as symbol manipulation and can be modeled with the symbol processing capabilities of the computer.
- * Special programming languages were invented in the late 1950s and they facilitate symbol manipulation.
- * The most prominent of them is called LISP (List Processing) which is based on Lambda Calculus .
- * Another AI programming language, known as Prolog (Programming in Logic), was invented in the early 1970s.
- * Now- a-days, object-oriented languages(c++,java, etc) and even C are used for developing ES.



THANK you

By :

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