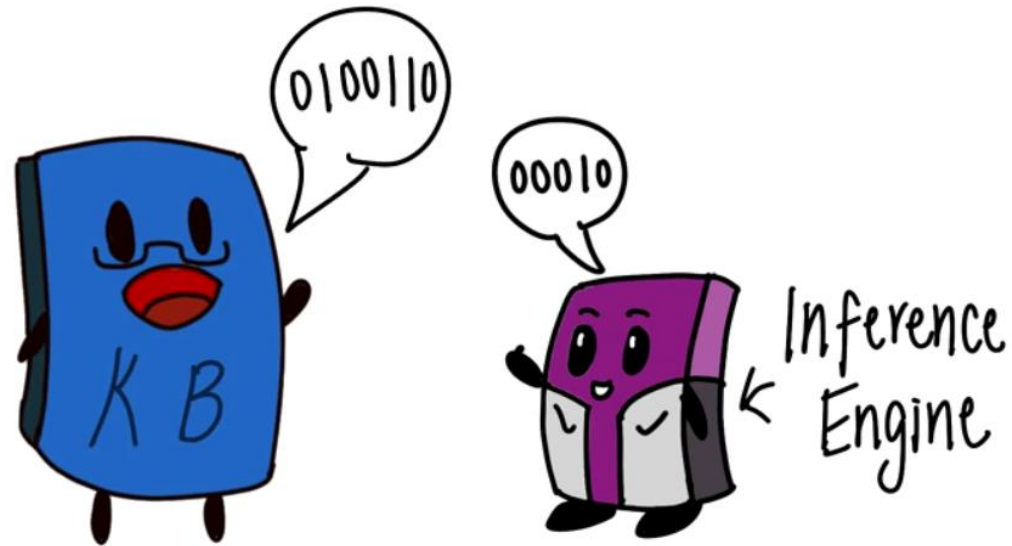
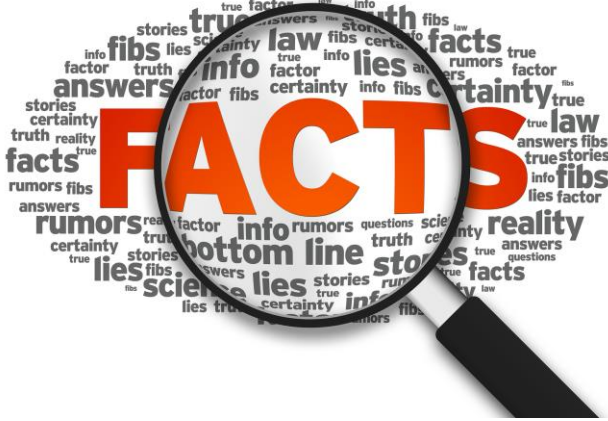


20IS603 Architecture of Intelligent Systems

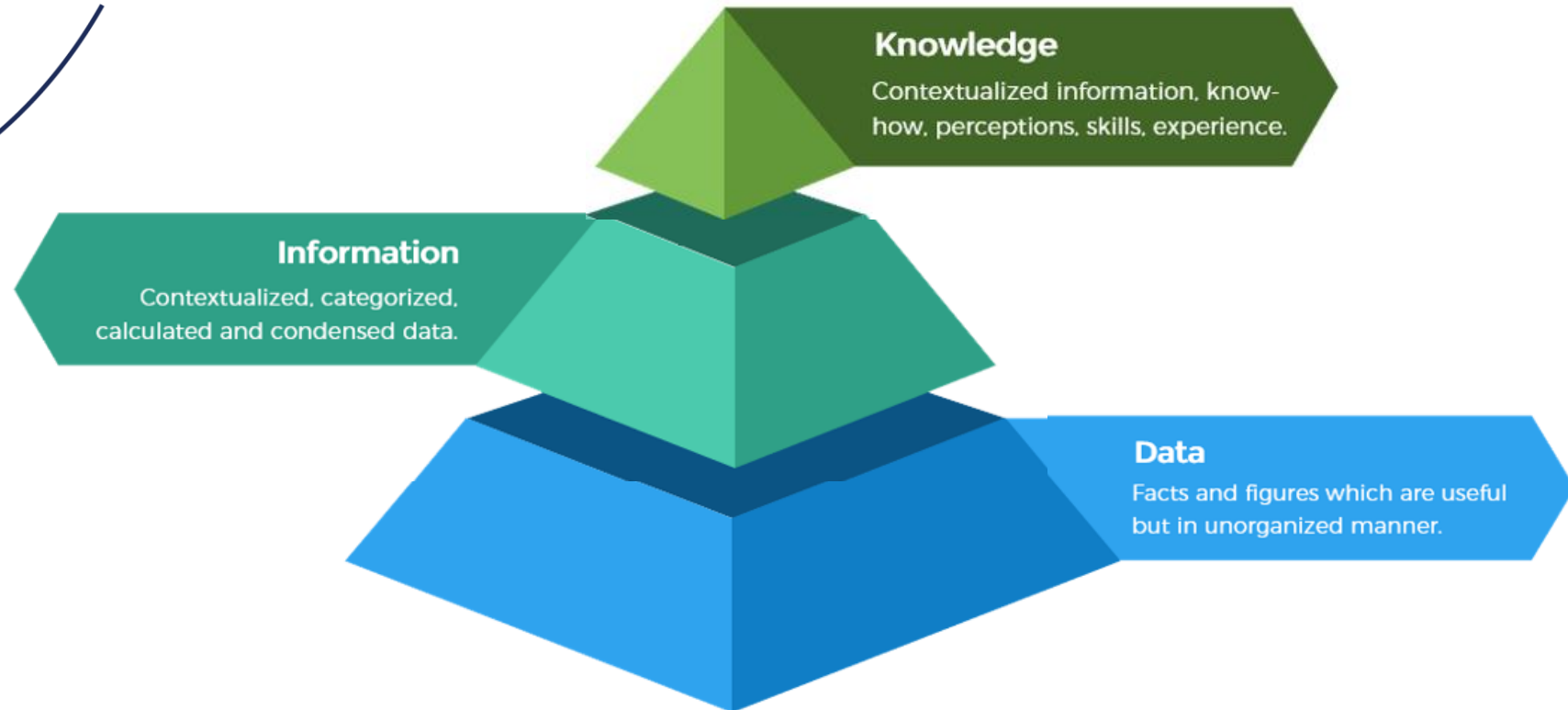
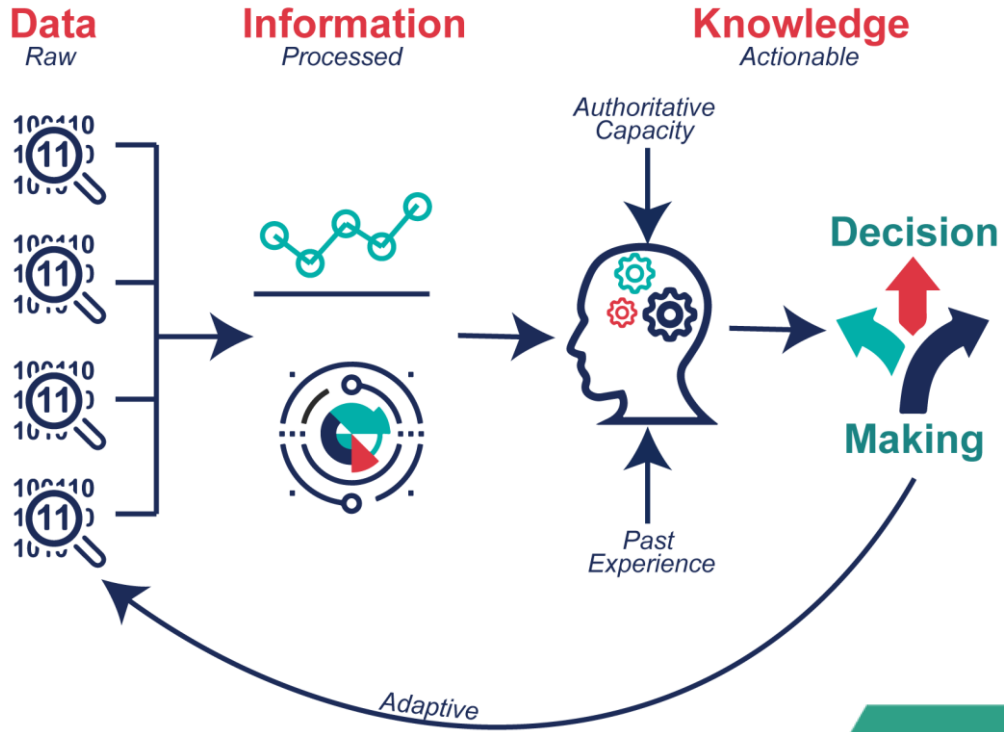


Knowledge based systems

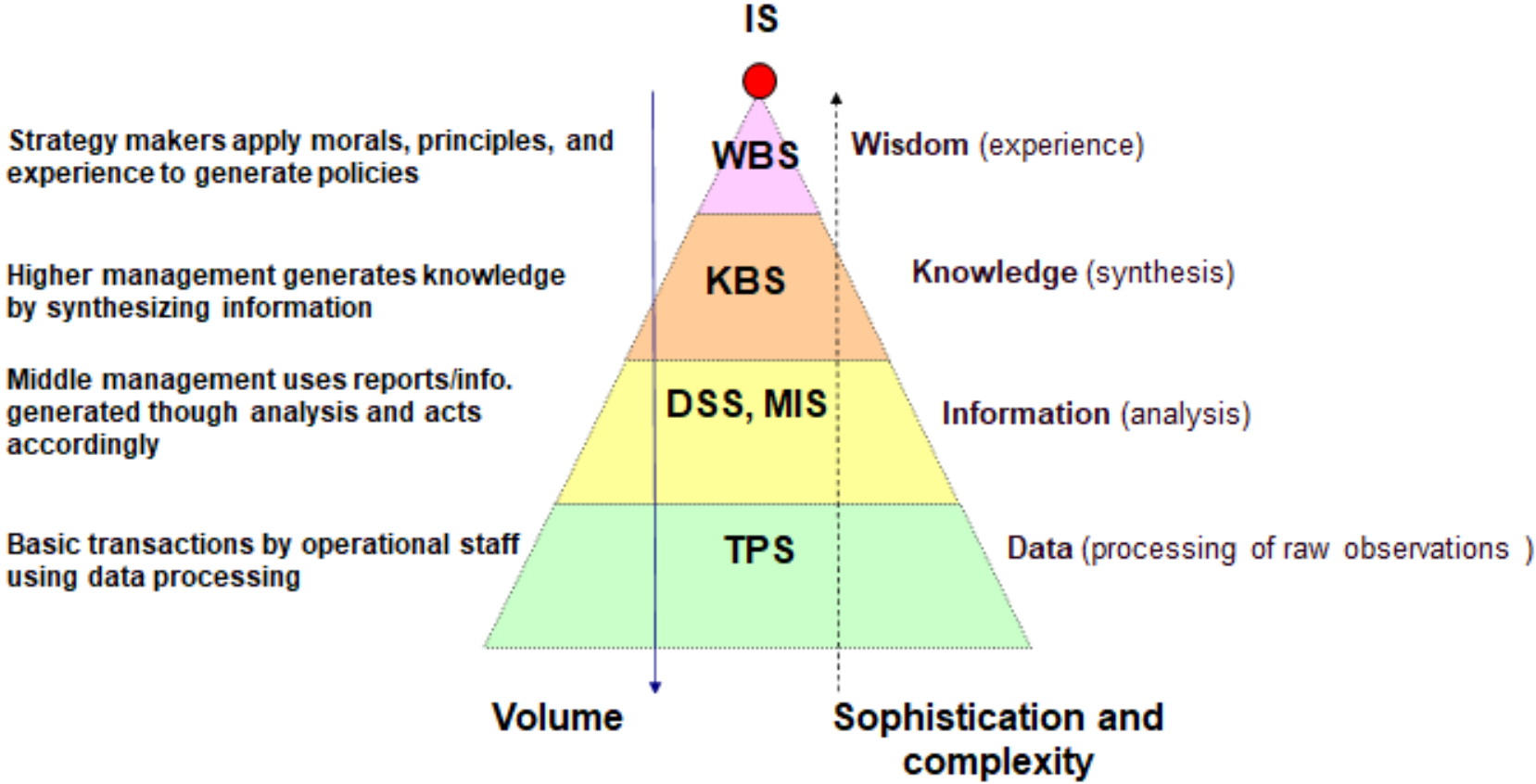
Knowledge



Knowledge



Data Pyramid and Computer-Based Systems

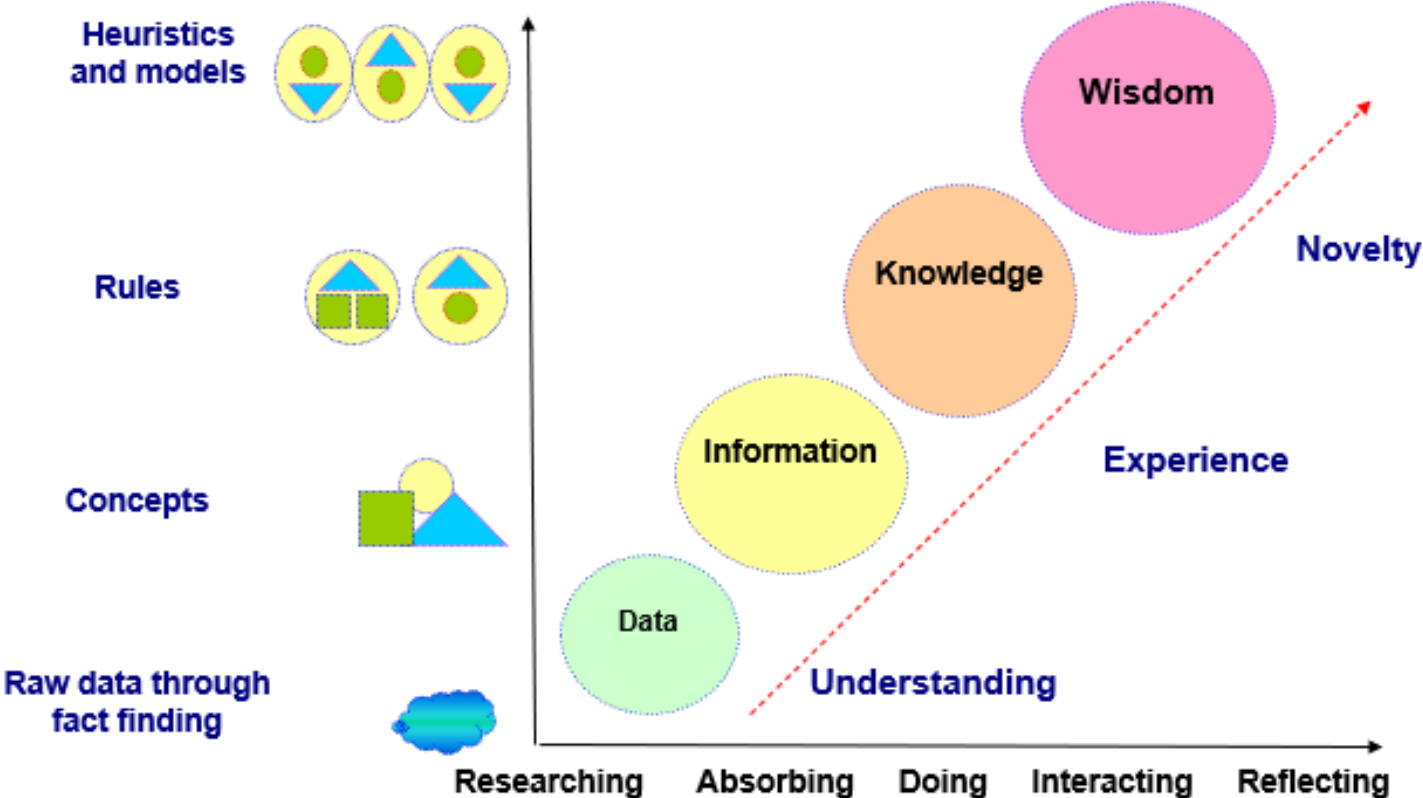


Data pyramid: Managerial perspectives

Knowledge representation

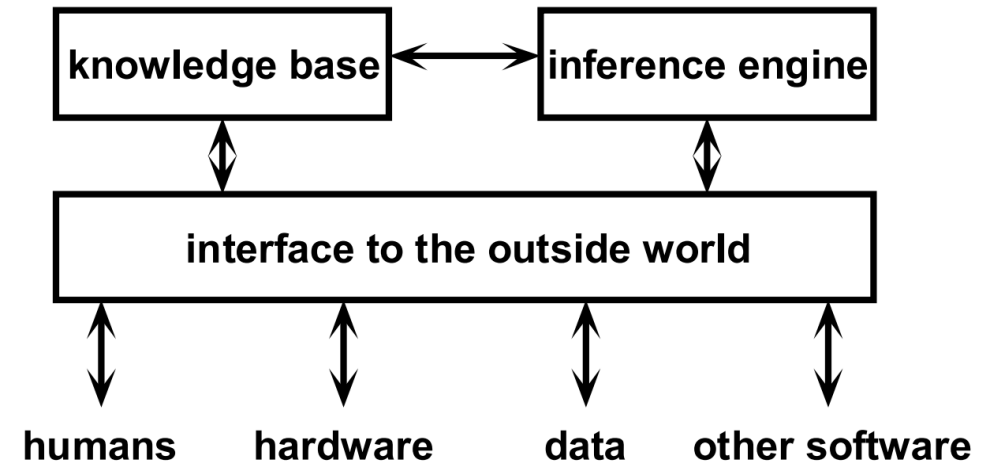
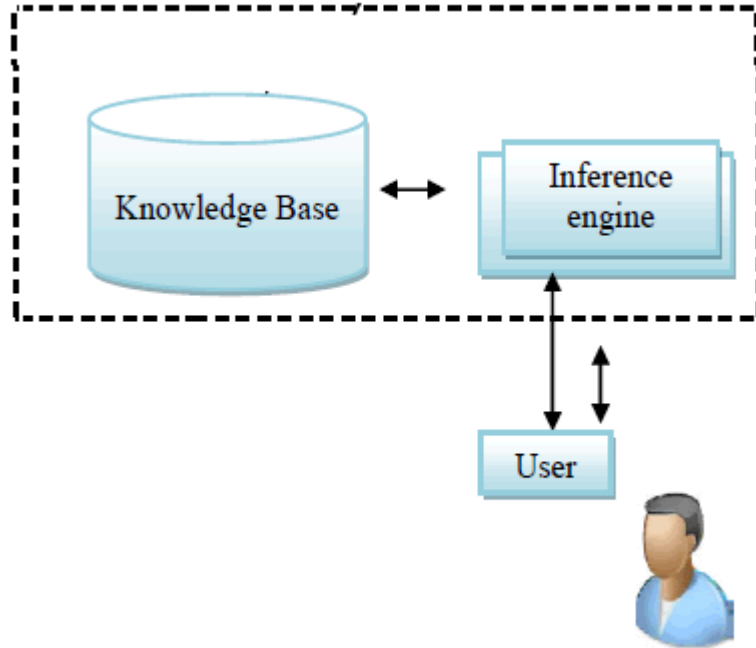
- Declarative knowledge
 - passive knowledge expressed as statements of facts about the world
- Procedural knowledge
 - compiled knowledge related to the performance of some task
- Heuristic knowledge
 - used by humans to solve complex problems
- Meta-knowledge
 - Knowledge about knowledge
- Extensional
 - explicit, detailed, and long
- Intentional
 - implicit, short, and compact

Data Pyramid and Computer-Based Systems

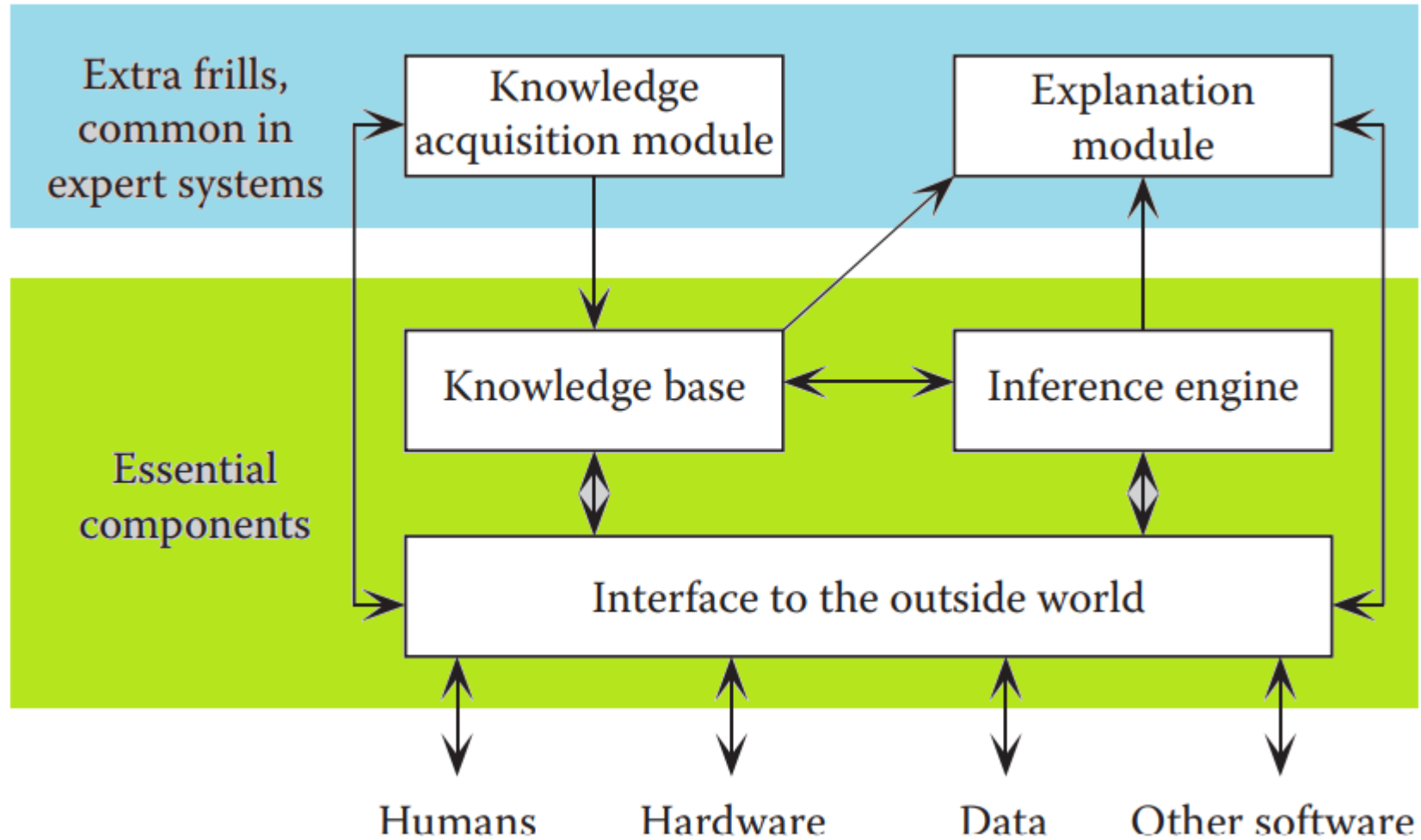


Convergence from data to intelligence

Knowledge-Based Systems



Knowledge-Based Systems



Knowledge base

- An easily accessible **data storage hub** that contains information
- Logically provides information to the users
- Knowledge is defined as **value derived from information**, which derives its value from data
- **Rules and facts** are the most straightforward means of representing knowledge in a knowledge base
- Knowledge is represented **explicitly** in the knowledge base – thus can be altered
- Production rule

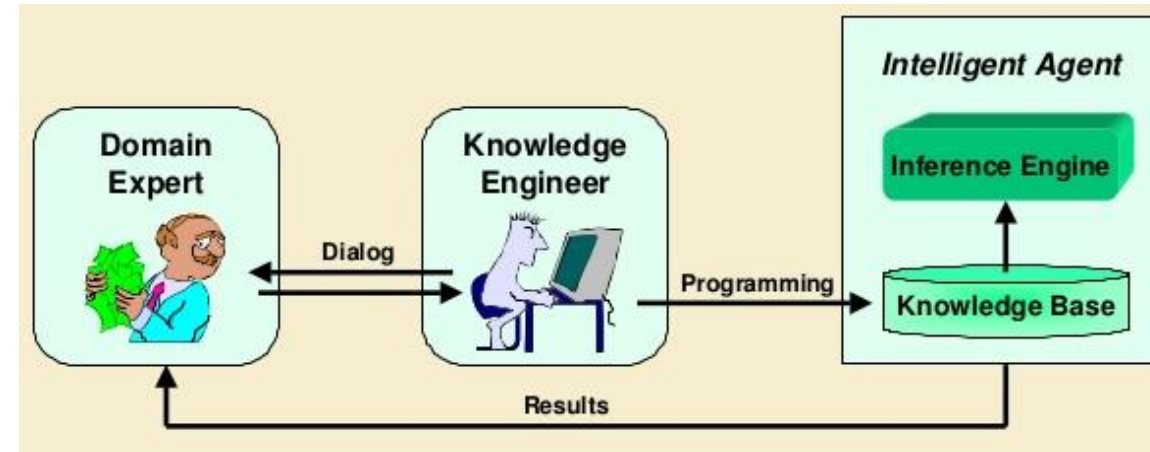
if <condition> then <conclusion>

KNOWLEDGE
BASE



Knowledge Acquisition

- The knowledge is teased out of a domain expert
 - **Knowledge engineer** - extracts the knowledge from the expert and encodes it in the knowledge base
- The builder of the KBS is a domain expert
 - **Domain expert becomes a knowledge engineer**, or the knowledge engineer becomes a domain expert
- The system learns automatically from examples
 - System **generate its own knowledge base** from a set of examples



KBS Comparison

Conventional program

- Process data and **use algorithms, a series of well-defined operations** to solve general numerical problems
- **Do not separate knowledge** from the control structure to process this knowledge
- **Do not explain how a particular result was obtained** and why input data was needed

Human Expert

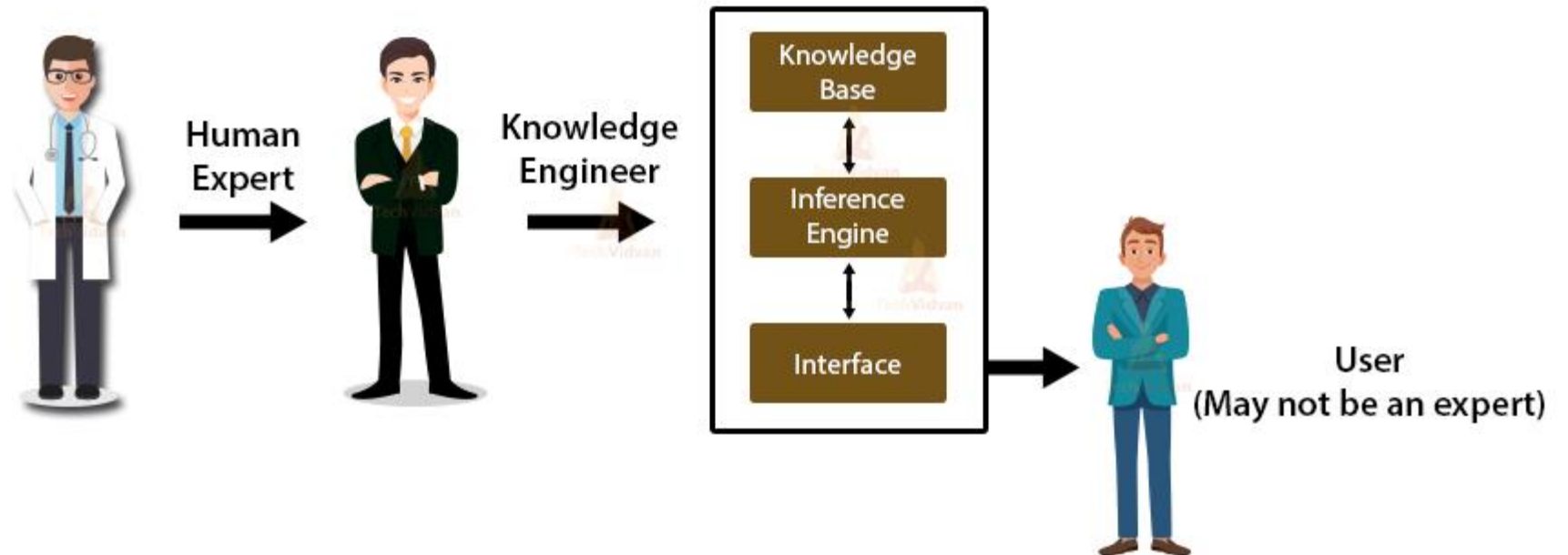
- Use knowledge in the form of rules of thumb or heuristics to solve problems
- In a human brain knowledge exists in a compiled form
- Capable of explaining a line of reasoning and providing the details

KBS

- Process knowledge expressed in the form of **rules and facts** to solve problems in a narrow domain
- Provide a **clear separation of knowledge** from its processing
- Trace the rules fired during a problem-solving session and **explain how a particular conclusion was reached** and why specific data was needed

Expert Systems

- Type of KBS designed to embody expertise in a particular specialized domain
- Expert's knowledge about solving specific problem is called **knowledge domain** of the expert.
- The user will enter into a dialogue in which he or she describes the problem and the expert system offers advice, suggestions, or recommendations.
- An **expert system shell** is an expert system with an empty knowledge base



Development of Expert Systems

- Process of building an expert system is called **knowledge engineering**
- Knowledge engineering refers to **acquisition of knowledge** from human expert or other source and its coding in the expert system
- Explanation facility – explain its reasoning
- Allows systems to learn by example – **rule induction** – creates rules from tables of data.
- Practical limitation – **causal knowledge** – no understanding of causes and effects in a system
- Should be designed with **deep knowledge rather than shallow knowledge** based on empirical and heuristic knowledge.
- **Cognition** – human problem solving – expressed as IF... THEN type

Characteristics of Expert Systems

- High performance
- Domain Specificity
- Understandable
- Reliable
- Highly Responsive
- Linked with Metaknowledge
- Use symbolic representations
- Explaining capability