CME2202

Data Organization & Management

Lecture #2: Data, Information, Knowledge, Wisdom (DIKW) Model

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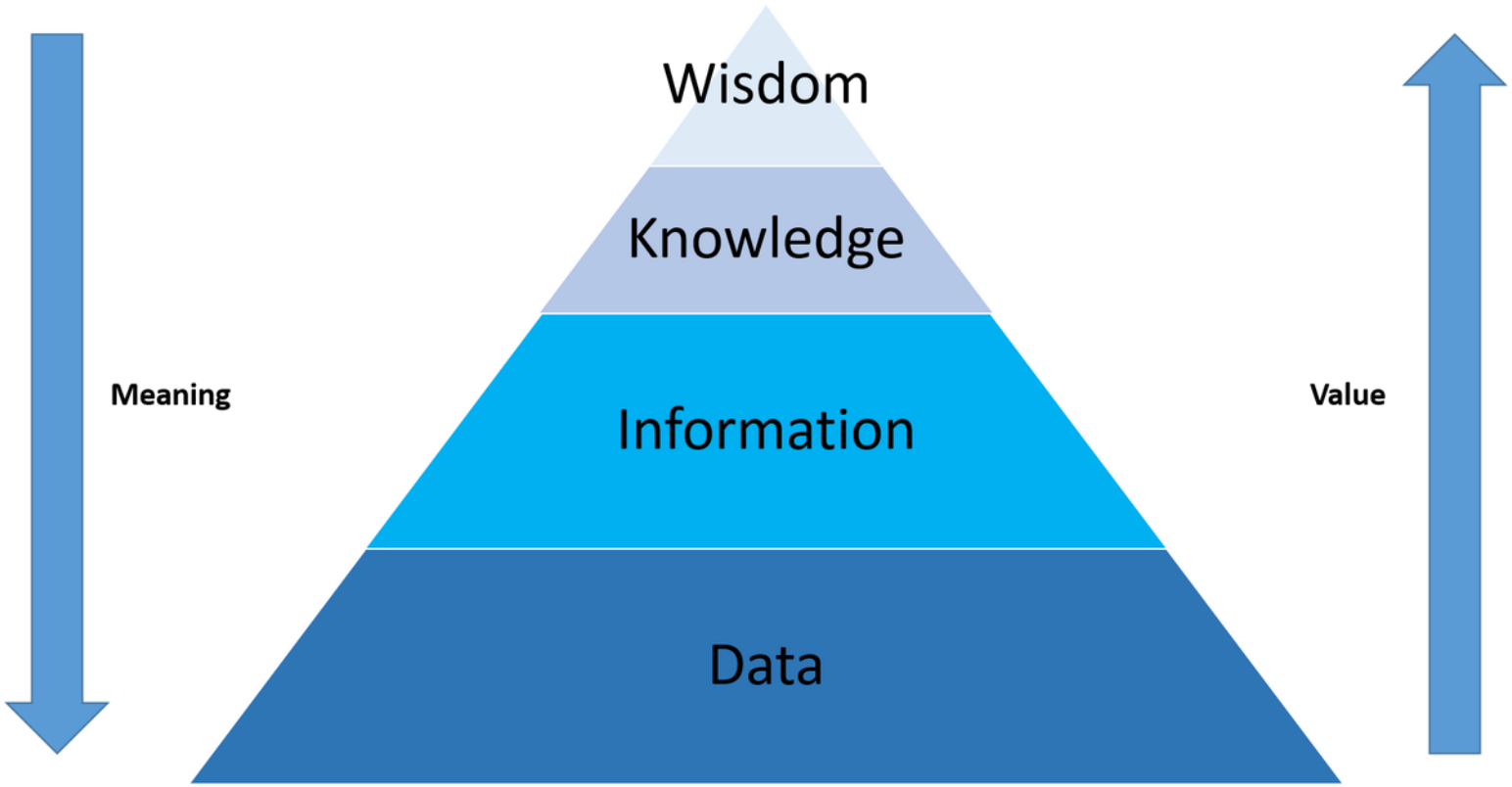
Data, Information, Knowledge, Wisdom (DIKW) Model

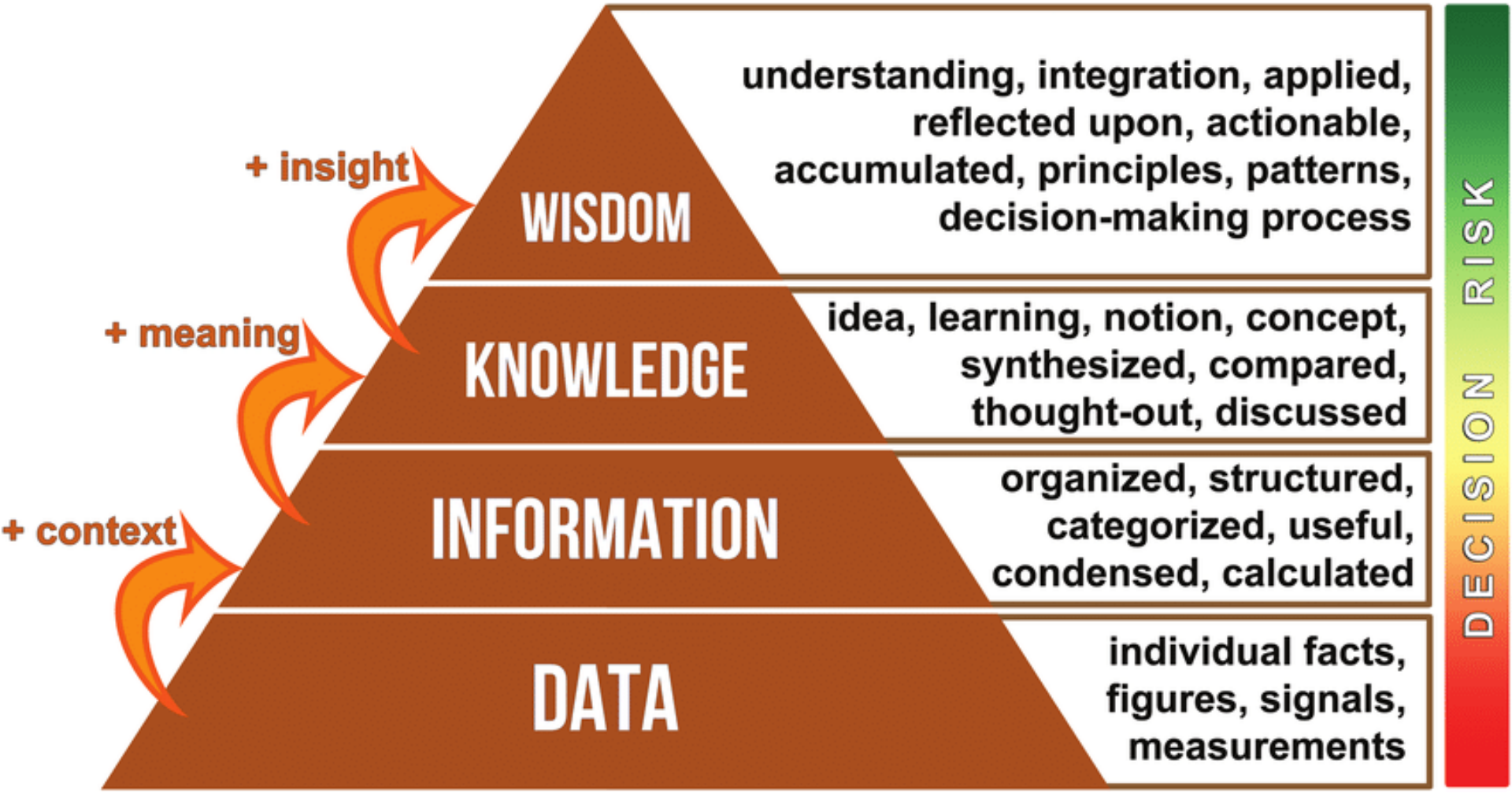


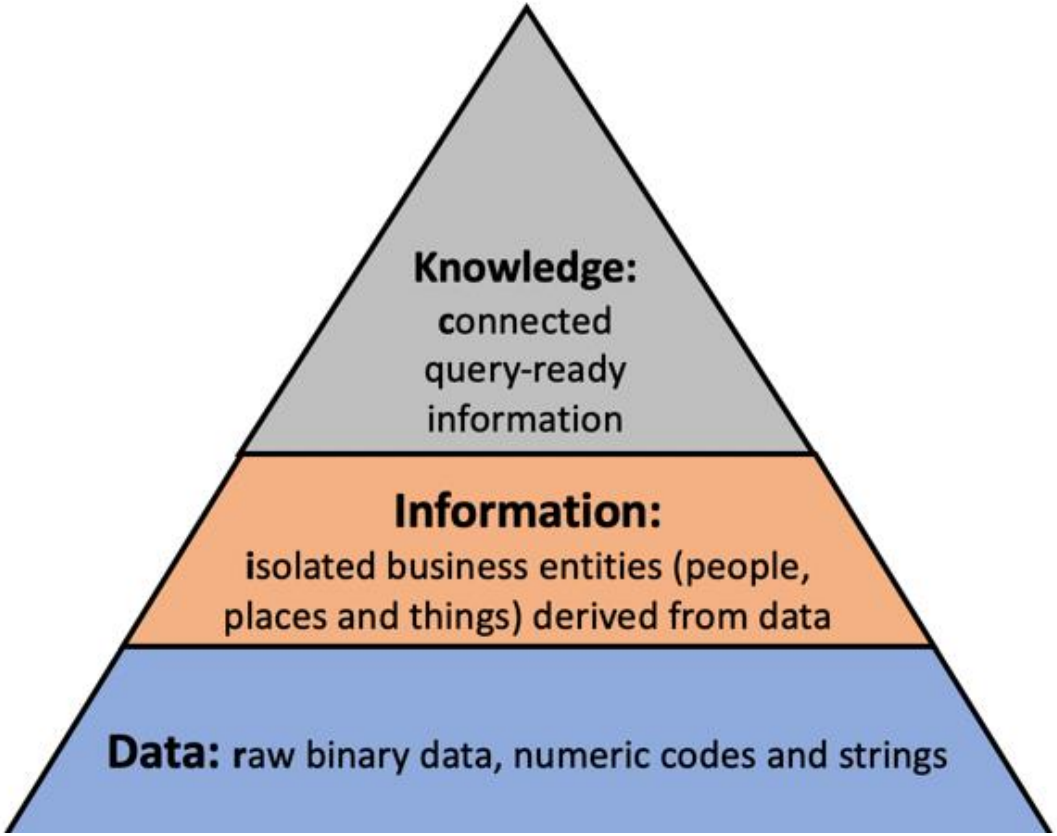
- We frequently hear the words **Data, Information** and **Knowledge** used as if they are the same thing.

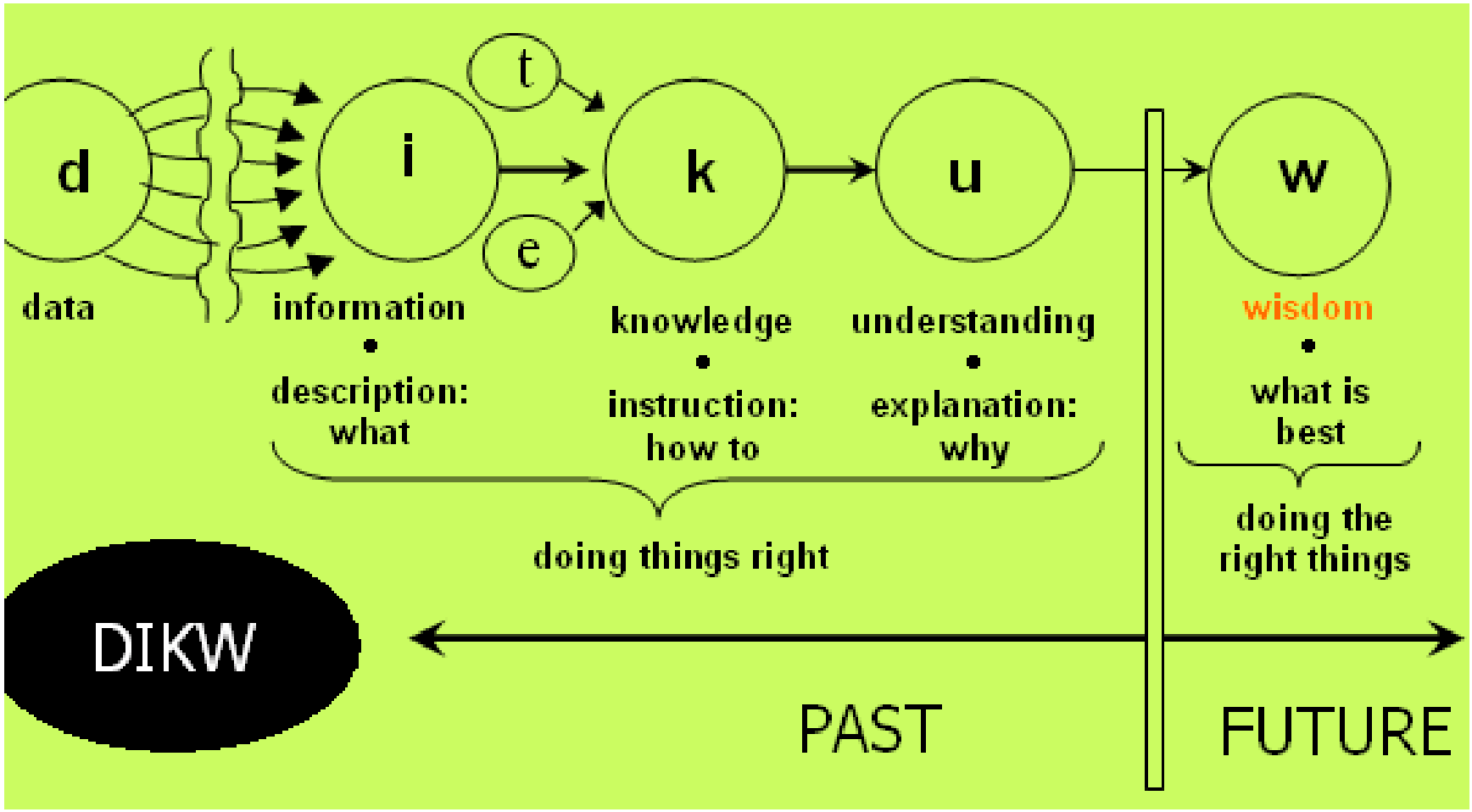
- **Data** represents unorganized and unprocessed facts.
  - Usually data is static in nature.
  - It can represent a set of discrete facts about events.
  - Data is a prerequisite to information.
  - An organization sometimes has to decide on the nature and volume of data that is required for creating the necessary information.

- **Information**
  - Information can be considered as an aggregation of data (processed data) which makes decision making easier.
  - Information has usually got some meaning and purpose.
- **Knowledge**
  - By knowledge we mean *human understanding of a subject matter that has been acquired through proper study and experience*.
  - Knowledge is usually based on learning, thinking, and proper understanding of the problem area.
  - Knowledge is not information and information is not data.
  - Data → Information → Knowledge

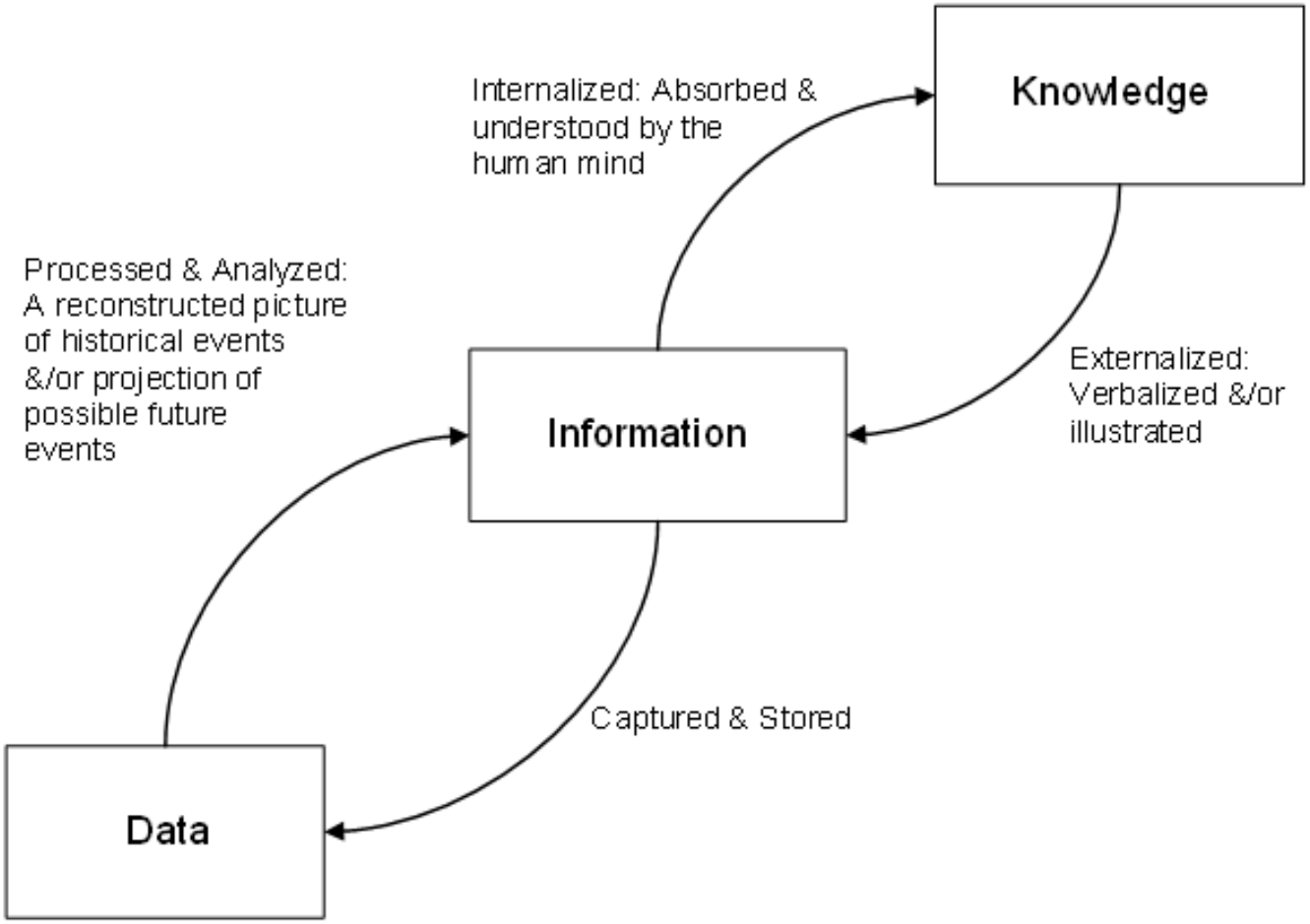
- Knowledge is derived from information in the same way information is derived from data.
- We can view it as an understanding of information based on its perceived importance or relevance to a problem area.
- It can be considered as the integration of human perceptive processes that helps them to draw meaningful conclusions.


+ insight
+ meaning
+ context
WISDOM
KNOWLEDGE
INFORMATION
DATA
understanding, integration, applied, reflected upon, actionable, accumulated, principles, patterns, decision-making process
idea, learning, notion, concept, synthesized, compared, thought-out, discussed
organized, structured, categorized, useful, condensed, calculated
individual facts, figures, signals, measurements
DECISION RISK


Knowledge:
connected
query-ready
information
Information:
isolated business entities (people,
places and things) derived from data
Data: raw binary data, numeric codes and strings


d
i
t
e
k
u
w
data
information
•
description:
what
knowledge
•
instruction:
how to
understanding
•
explanation:
why
wisdom
•
what is
best
doing things right
doing the
right things
DIKW
PAST
FUTURE

Relationships Amongst Knowledge, Information, and Data



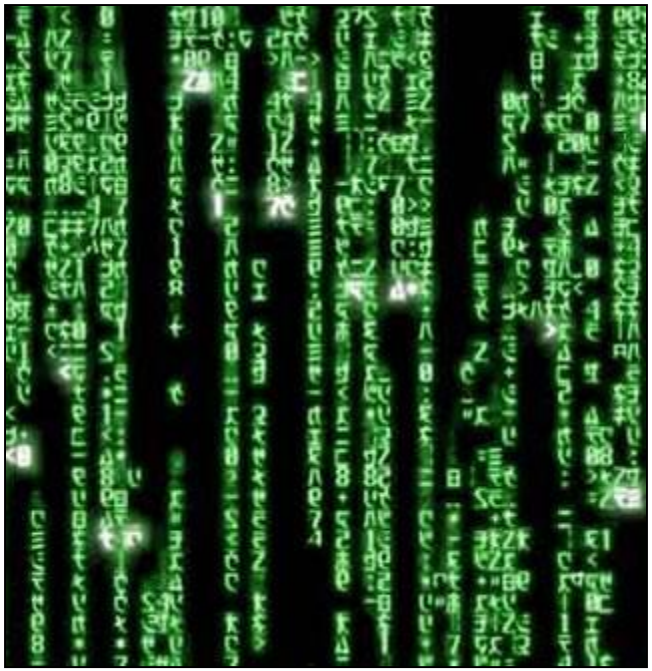
Definitions

- Data management
- Information management
- Knowledge management

Data

- Data **are** raw facts and figures that on their own have no meaning

- These can be any alphanumeric characters i.e. text, numbers, symbols



Data Examples

- Yes, Yes, No, Yes, No, Yes, No, Yes
- 42, 63, 96, 74, 56, 86
- 111192, 111234

- None of the above data sets have any meaning until they are given a **CONTEXT** and **PROCESSED** into a useable form

Data Into Information

- To achieve its aims the organisation will need to **process** data into information.
- Data needs to be turned into meaningful information and presented in its most useful format
- Data must be processed in a **context** in order to give it meaning

Information

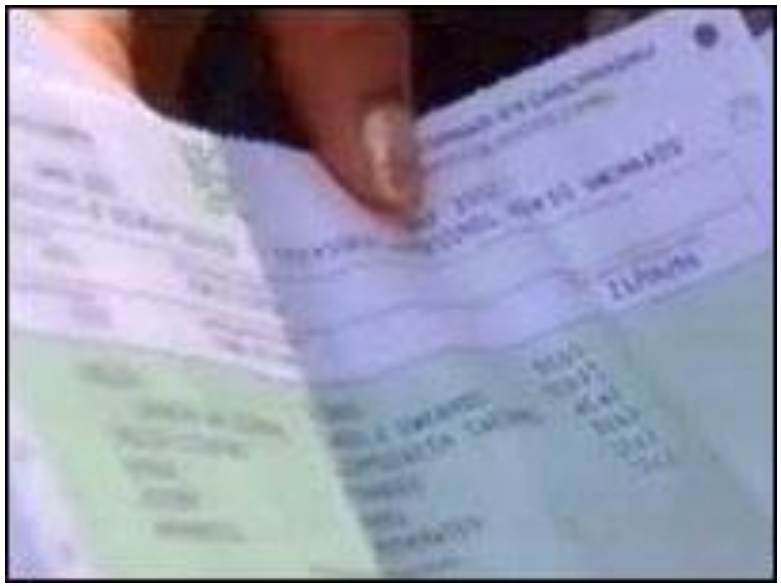
- Data that has been processed within a context to give it meaning

OR

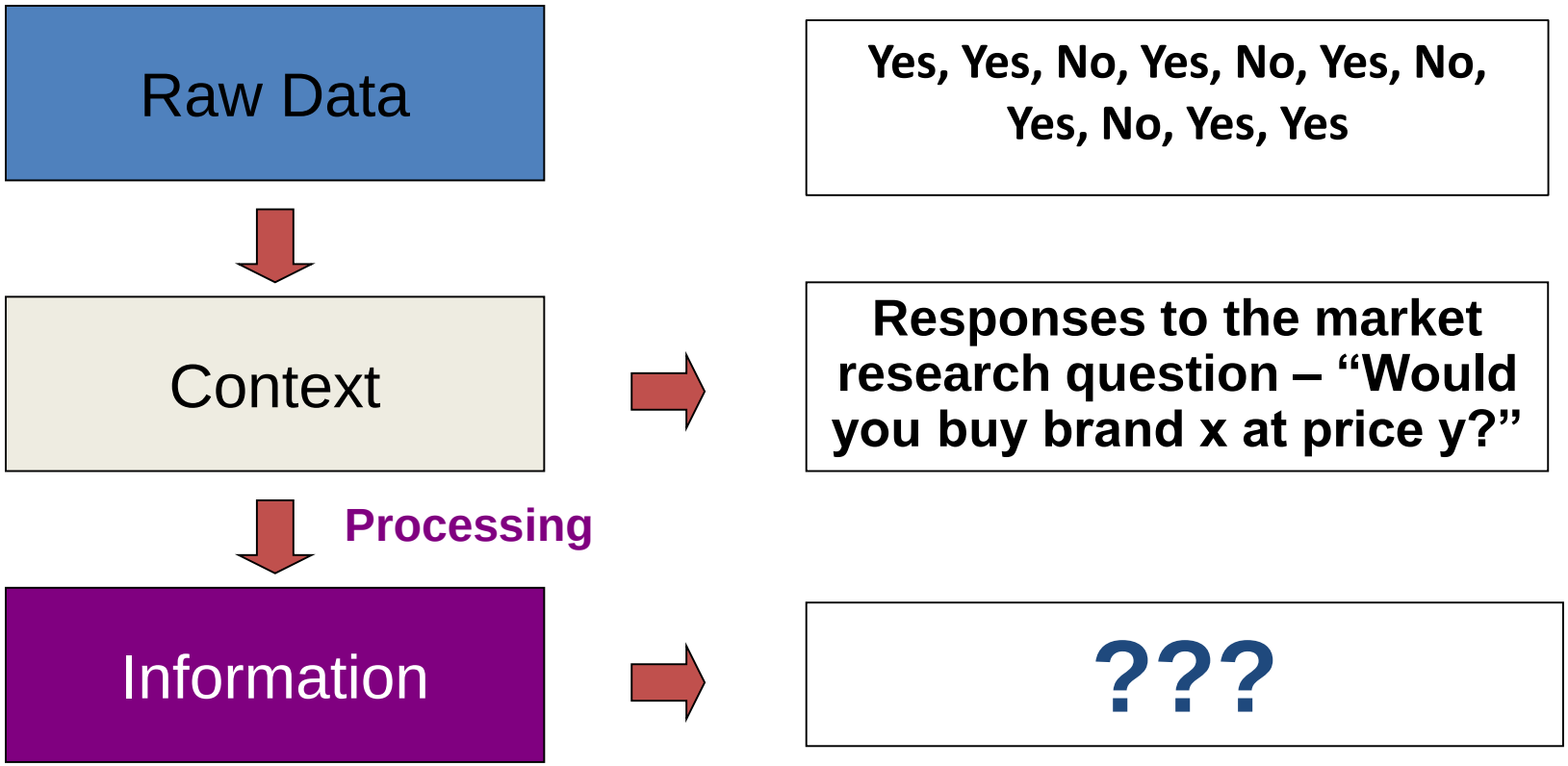
- Data that has been processed into a form that gives it meaning

Examples

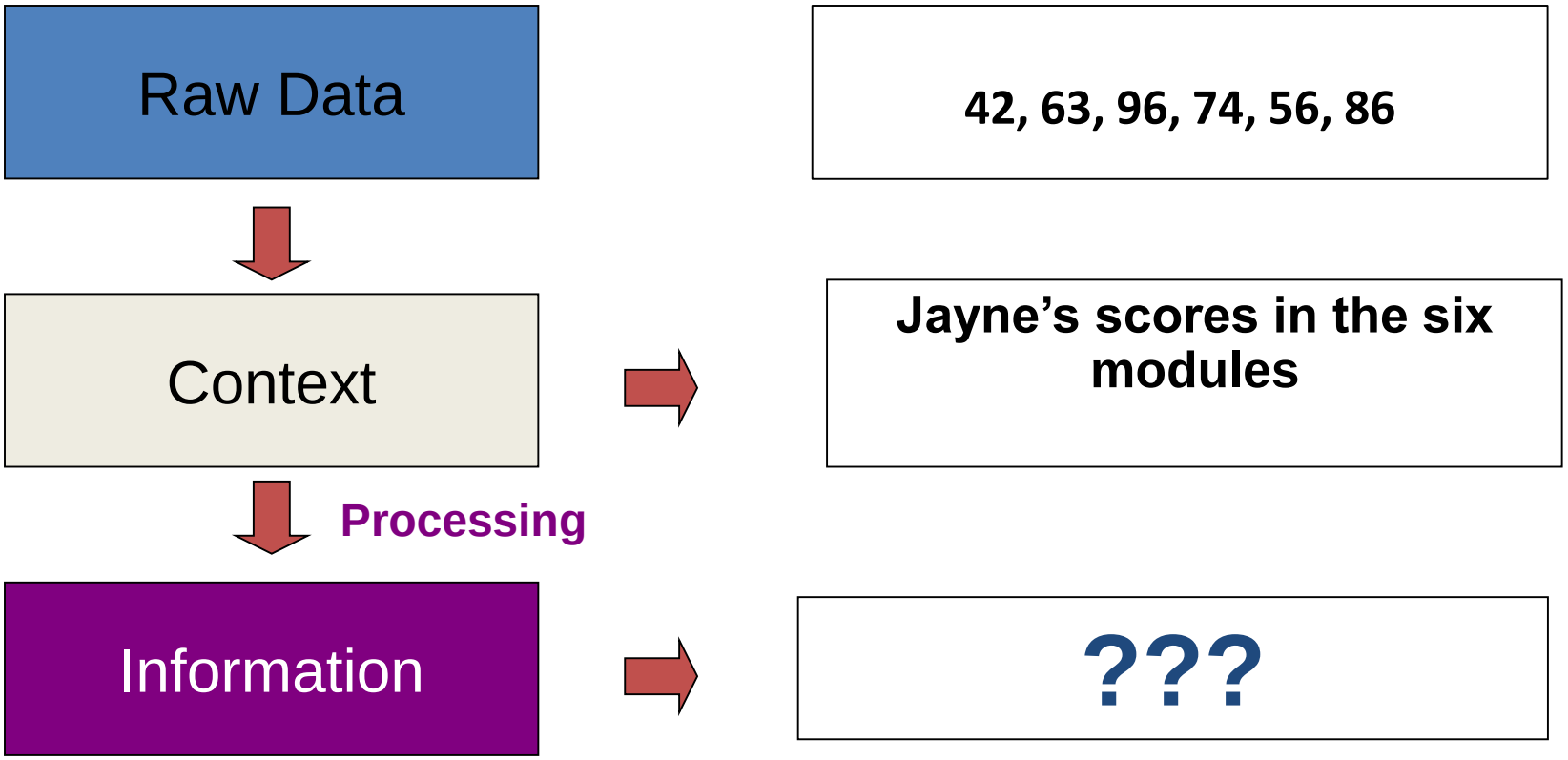
- In the next 3 examples explain how the data could be processed to give it meaning
- What information can then be derived from the data?



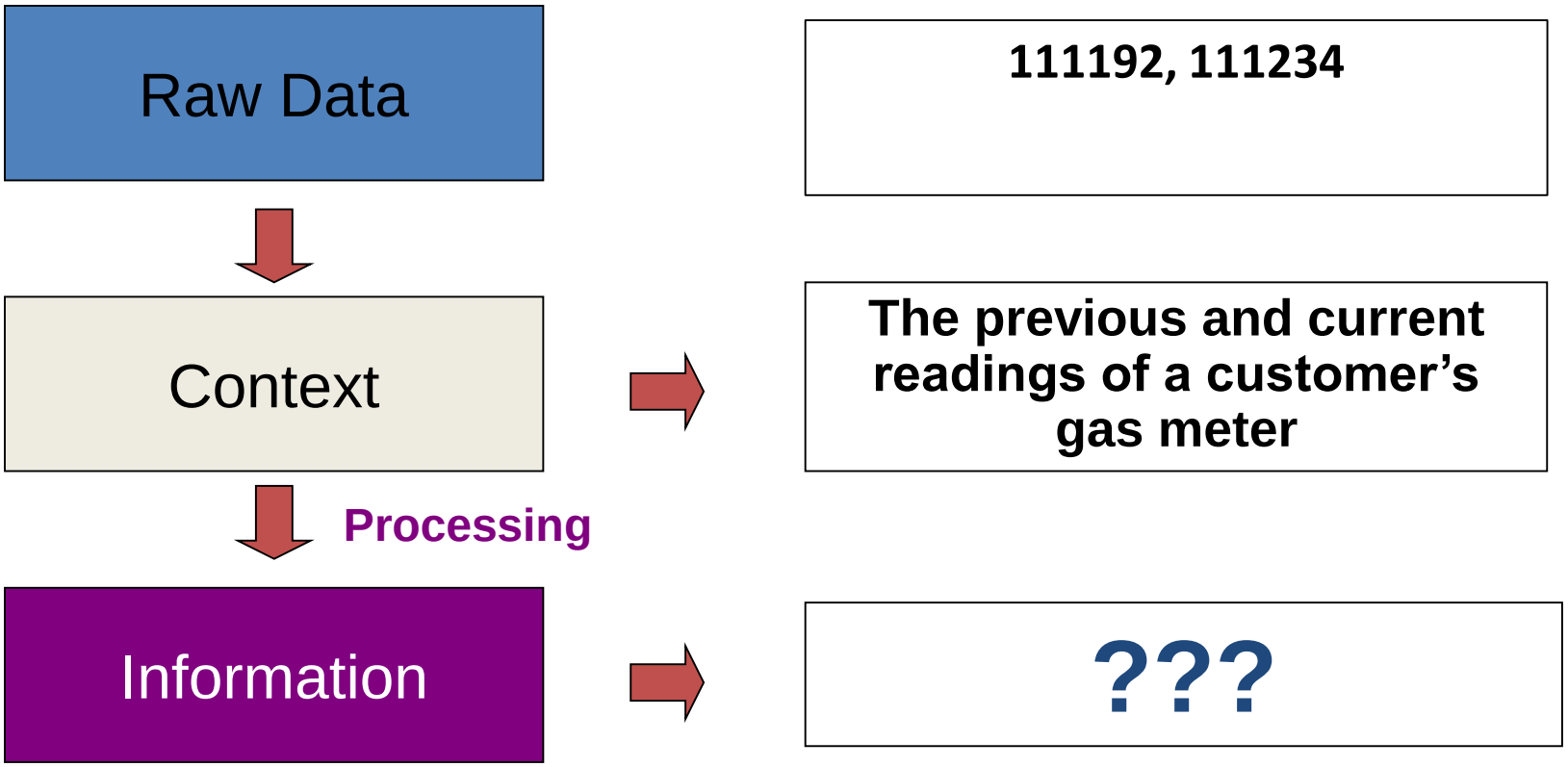
Example #1


Raw Data
Context
Processing
Information
Yes, Yes, No, Yes, No, Yes, No, Yes, No, Yes, Yes
Responses to the market research question – “Would you buy brand x at price y?”
???

Example #2


Raw Data
42, 63, 96, 74, 56, 86
Context
Jayne's scores in the six modules
Processing
Information
???

Example 3


Raw Data
111192, 111234
Context
The previous and current readings of a customer's gas meter
Processing
Information
???

Knowledge

- Knowledge is the understanding of rules needed to interpret information

"…the capability of understanding the relationship between pieces of information and what to actually do with the information"

Knowledge

- Data and information deal with facts and figures
- Knowing what to do with them requires knowledge
- **Knowledge = information + rules**
- Rules tell us the likely effect of something
- For example: you are more likely to pass your A level IF you do your coursework and revise for your exam!

Knowledge Examples

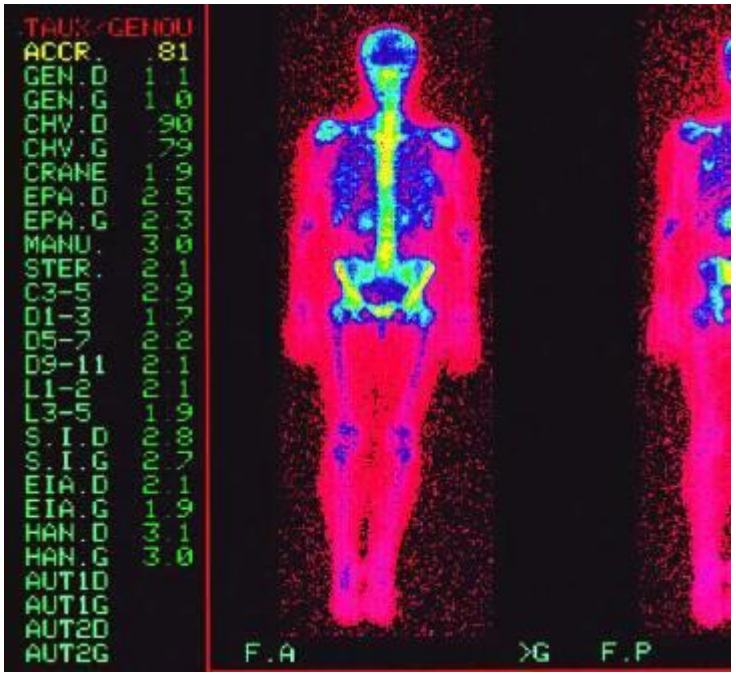
- Using the 3 previous examples:
  - A Marketing Manager could use this information to decide whether or not to raise or lower price y
  - Jayne's teacher could analyse the results to determine whether it would be worth her re-sitting a module
  - Looking at the pattern of the customer's previous gas bills may identify that the figure is abnormally low and they are fiddling the gas meter!!!

Knowledge Workers

- Knowledge workers have specialist knowledge that makes them “experts”
  - Based on formal and informal rules they have learned through training and experience
- Examples include doctors, managers, librarians, scientists…

Expert Systems

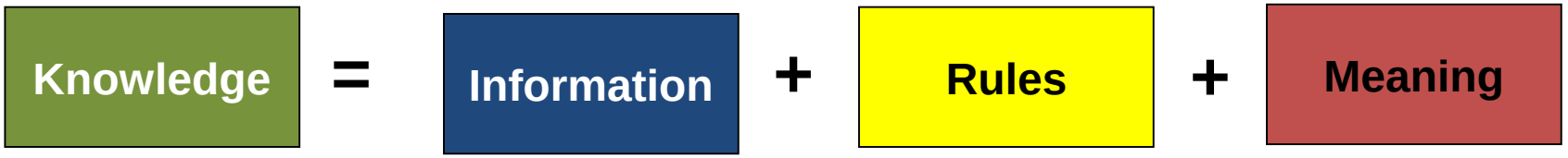
- Because many rules are based on probabilities computers can be programmed with “subject knowledge” to mimic the role of experts
- One of the most common uses of expert systems is in medicine
  - The ONCOLOG system shown here analyses patient data to provide a reference for doctors, and help for the choice, prescription and follow-up of chemotherapy

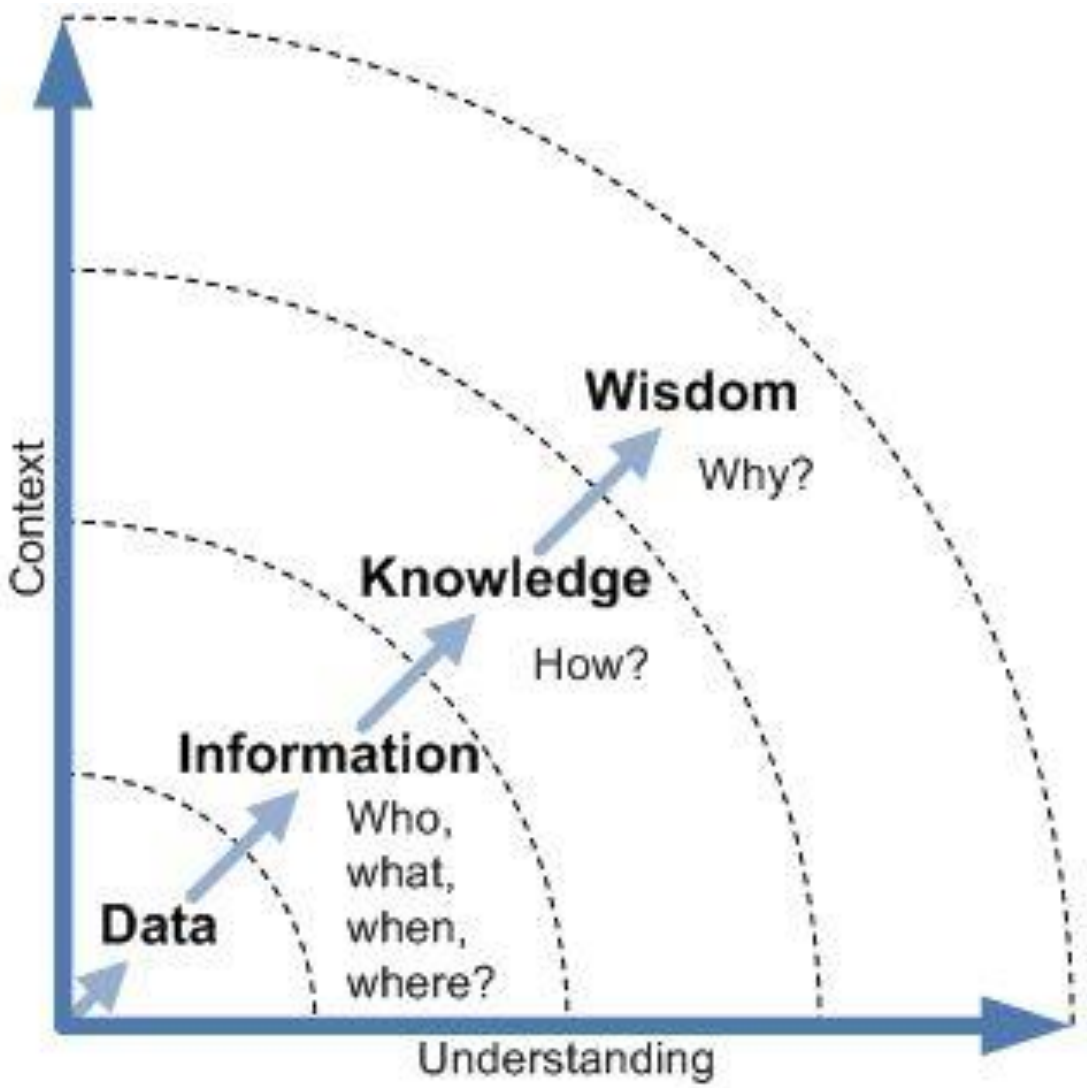


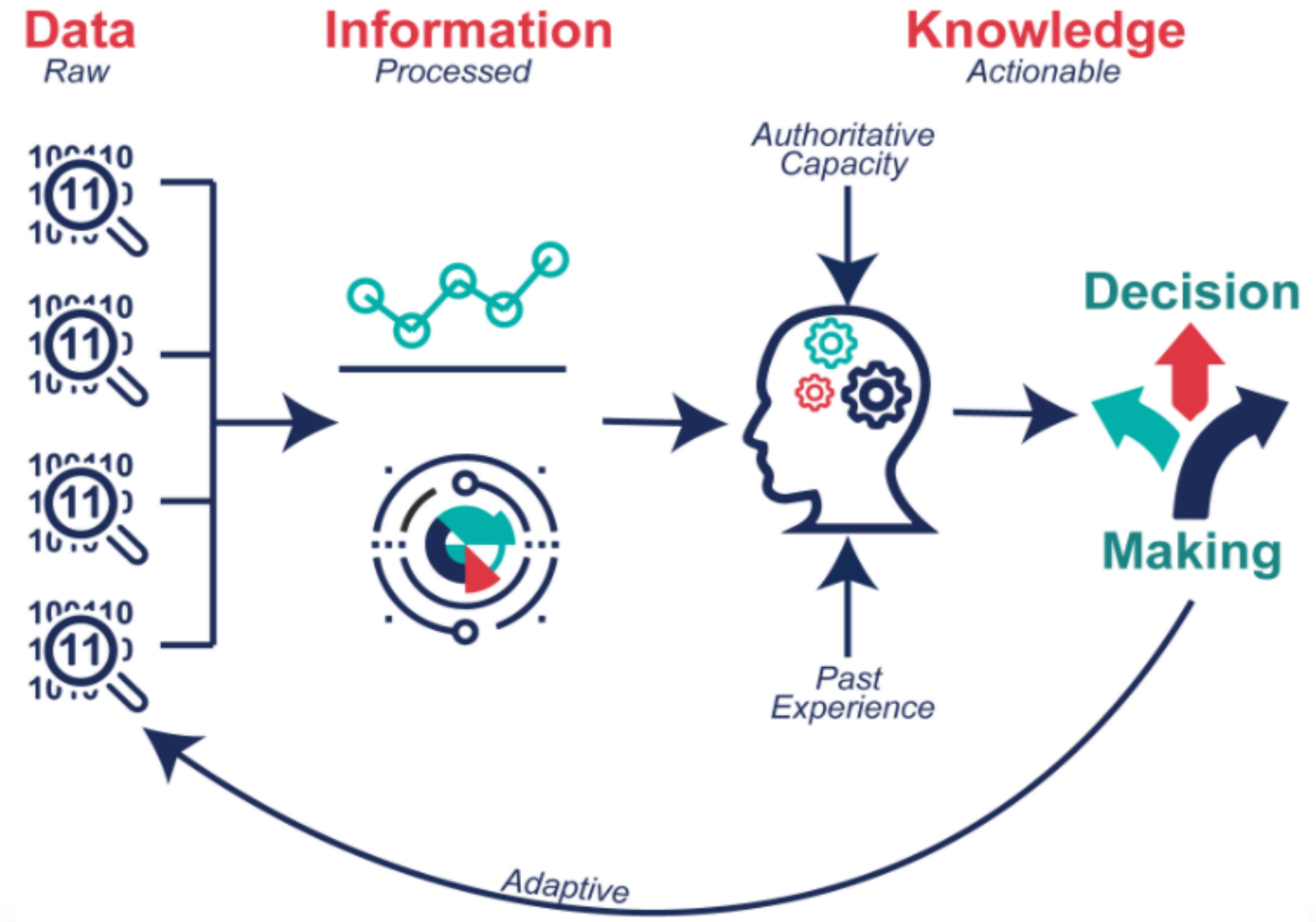
Summary

Data – raw facts and figures

Information – data that has been processed (in a context) to give it meaning




Context
Wisdom
Why?
Knowledge
How?
Information
Who,
what,
when,
where?
Data
Understanding


Data
Raw
Information
Processed
Knowledge
Actionable
Authoritative
Capacity
Decision
Making
Past
Experience
Adaptive

Data Organization & Management

"Data is stored in files"

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Data Structures vs File Structures

- Both involve

  Representation of Data

  +

  Operations for accessing data

- Difference:
  - **Data structures** deal with data in the main memory
  - **File structures** deal with the data in the secondary storage

Goal of the File structures

- Performance
  - Time
    - Minimize the number of hops in order to get desired information
    - Group related information so that we are likely to get everything we need with fewer hops.
  - Memory
    - Balance the memory size and the time
- How to improve performance
  - Use the right file structure
    - Understand the advantages disadvantages of alternative methods

Metrics used to measure efficiency and effectiveness of a File structure

- Time complexities,
- Space complexities,
- Simplicity,
- Reliability,
- Scalability,
- Pogrammability, and
- Maintainability.

Metrics used to measure efficiency and effectiveness of a File structure

- The file structures involve two domains: hardware and software.
  - Hardware - physical characteristics of the storage medium.
  - Software - data structures and algorithms to deal with these structures.
- Hardware + SW (data structures and algorithms) are used to predict the efficiency of file operations.

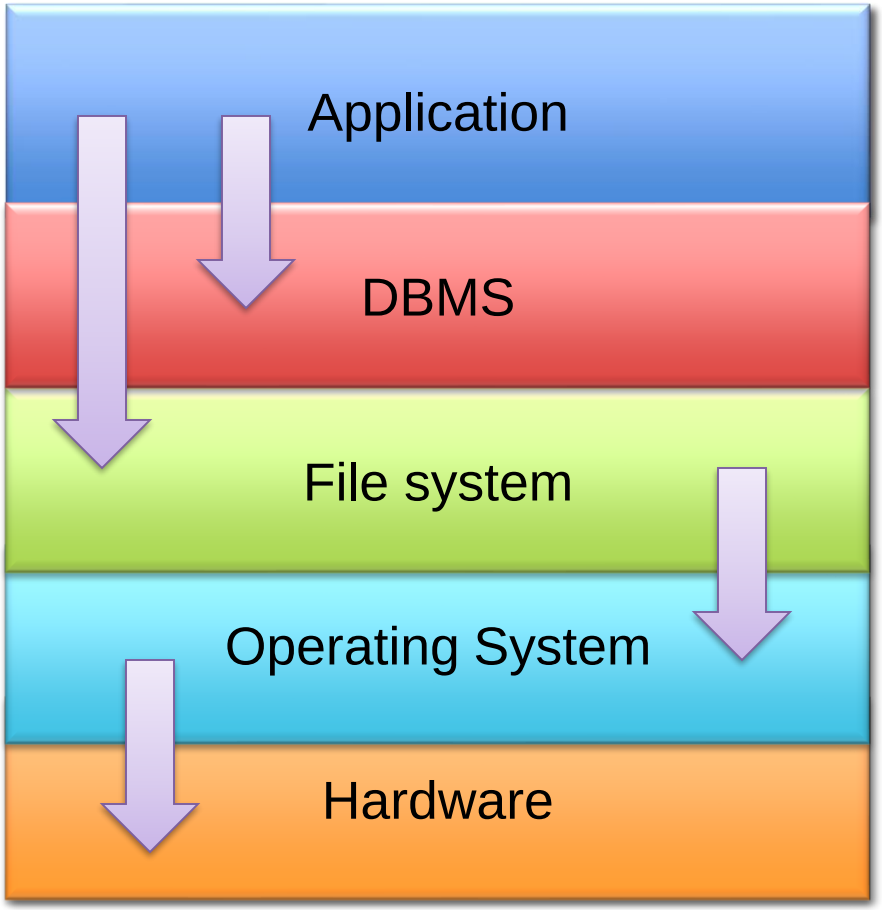
Basic File operations

- Search for a particular data in a file,
- Add a certain data item,
- Remove a certain item,
- Order the data items according to a certain criterion,
- Merge of files,
- Creation of new files from existing file(s).
- create, open, and close operations which have implications in the operating system.

Basic File Processing Operations

- Opening
- Closing
- Reading
- Writing
- Seeking
- Updating
- Compacting

Where do File System fits in Computer System?



File structures versus DBMS

- According to Alan Tharp, “file structures is used to process data in physical level, DBMS is used to manage data in a logical level”
- According to Raghu Ramakrishnan, “DBMS is a piece of software designed to make data maintenance easier, safer, and more reliable”.
- Thus, file structure is a pre-requisite to DBMSs.