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University of Dublin
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CSU22041: Information Management I

An Introduction to the module
2020-2021

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Some Core Concepts

ORGANISATION

How data represented/associated

METADATA

Data about what the data is

ACCESS

How get at the data efficiently

What is the difference between Data, Information and Knowledge?

Data:

- Raw; building blocks of information
- Unprocessed information

90 **Rehab** **Smith**

Information:

- Data associated together to convey some meaning
- Basic Unit of Communication

Heart Beats per minute **Surname** **Location**

Knowledge:

- Interrelating and "understanding"information

Normal- If Male and HBPM <=70 >=50

Patient with a heart condition

Gym

More Context

So, what software do you know that manages data?

All applications

- File formats inherently organise data for particular applications: .xls, .doc, .mp4, .jpg, .eps, .exe etc.

Specialist data management applications

Your applications!

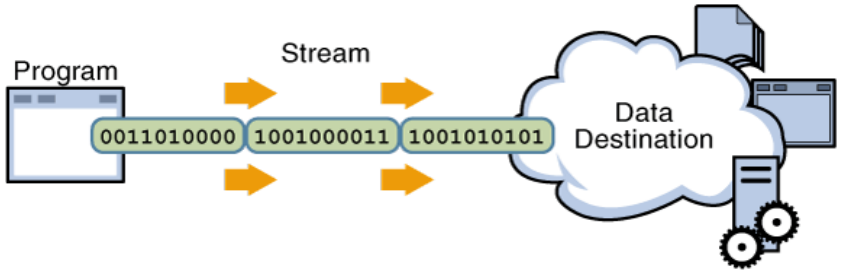
Maintaining structure in your own data file

Files just represent data as a series of bytes and will lose the structure that you might have imposed either logically or physically (e.g. as an object/field or record) unless you do something about it

Take an example:

```
Public class Movie {
    // members
    String title; int movieId; String genre;

    // constructor
    public Movie (String t, int i, String g) {
        title = t; movieId = i; genre=g;
    }};
```



So how can we encode the structure we want in the file itself?

Maintaining structure in your own data file

There are many ways of adding structure to files, for example

- Choose a special character/delimiter that will not appear as a legitimate character within the information field and then insert that character into the file after writing each field… called delimited-text field
- Use a fixed length for each information field (the size depending on field in question) and pad out when length of actual data value is less than the fixed length… called fixed-length field
- Write the length of the value (in bytes) of the information field followed by the value in exactly that number of bytes… called length-based field
- Write the name of the information field and then value both represented as delimited-text fields… called identified field

Turning Data into Information

Two distinct approaches

1. Deliberately associate data together to turn into information… to serve a range of known information needs and carefully manage. Let's call this Structured approach.

   e.g. excel, databases, datawarehouses

2. Bring loosely managed data together to serve a specific information need, using information retrieval techniques. Let's call this Unstructured approach.

   e.g. search engines

Representation: Structured vs Unstructured

Name	Gender	Salary	Date of Birth
String	**Char**	**Int**	**Date**
Kima Greggs	F	$25,000	11/03/1978
Jimmy McNulty	M	$20,000	18/07/1976
Cedric Daniels	M	$50,000	23/10/1973

"James Joyce was born in Dublin in 1882. His works include Ulysses and Finnegans Wake. He died in 1941 in Switzerland."

Nature of Querying: Structured vs Unstructured

Use Artificial Language

Known Data Types

Exact Criteria

SQL (or Xquery)

```
SELECT Name
FROM Character
WHERE Salary
BETWEEN 40000 AND
 60000
```

Keyword based, increasingly phrase based

Google Ireland top search terms of 2019

- Rugby World Cup
- Gay Byrne
- Storm Lorenzo
- Game of Thrones
- Brendan Grace
- Cameron Boyce
- EU election results
- Shane Lowry
- Joker
- Luke Perry

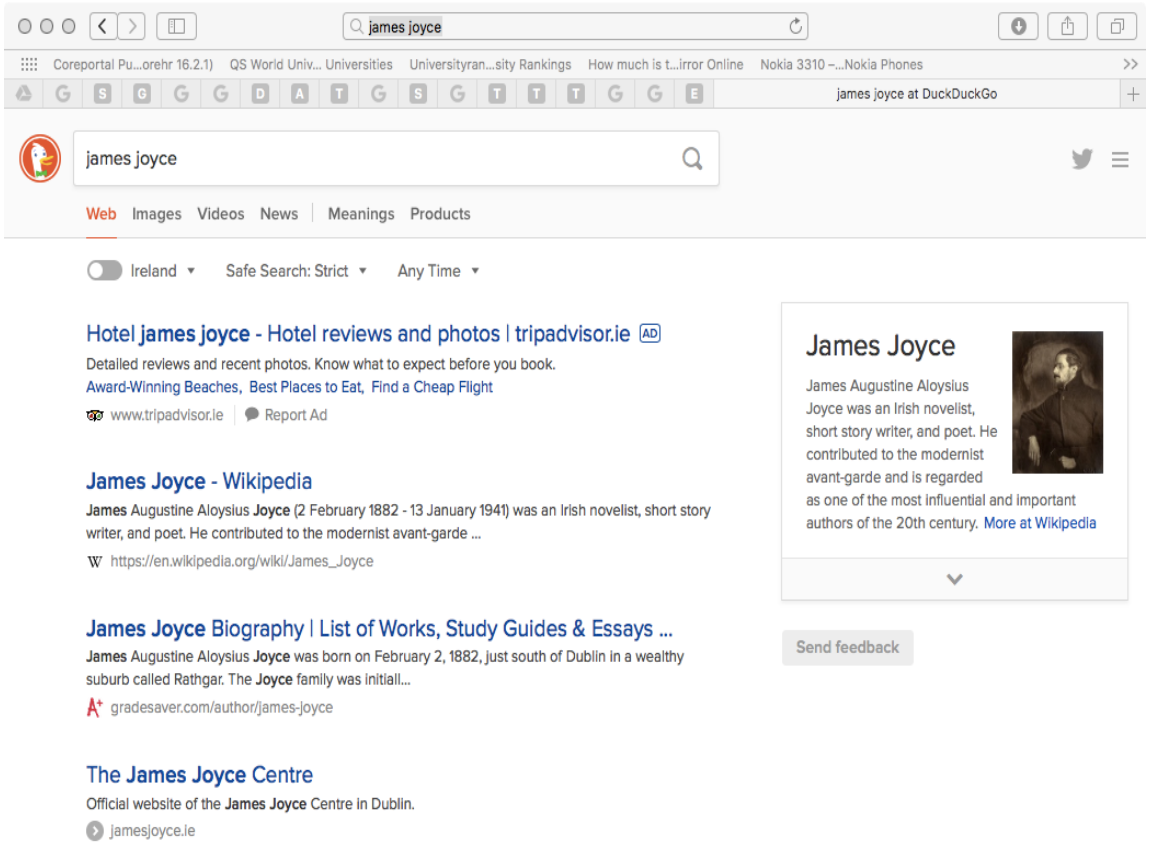
Nature of Results: Structured vs Unstructured

Structured

Definitive Results

Returns the Complete Set of Data that meets search criteria

No estimation of Relevancy



Structured Approach Specialist Software: Databases (DBs)

A combination of software and hardware

Optimised to reduce data to storage transfer

Optimised to provide Transactional/ACID properties upon the data

- **A**tomic, **C**onsistent, **I**solated, **D**urable

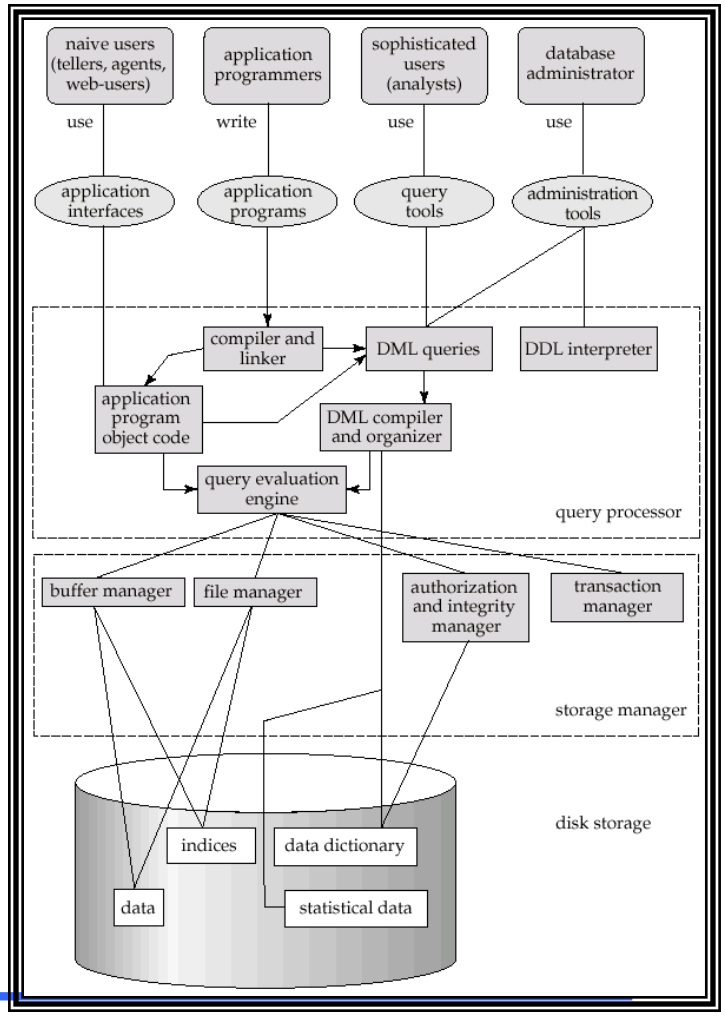
(Check the ACID terms out)

Designed to be administered and secure

Different Models

- Relational (by far the most popular)
- Networked (coming back in interest)
- Hierarchical (original model)
- Object-oriented

Primarily for operational purposes



Structured Approach Specialist Software: DataWarehouses (DWs)

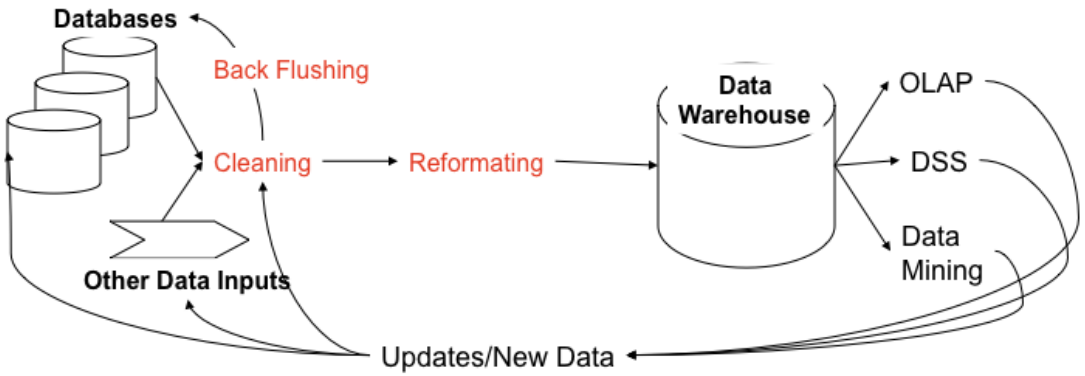
Data Warehouse is a subject oriented, integrated, nonvolatile, time-variant collection of data in support of management's decisions

Data Warehouse is a repository of data which is:

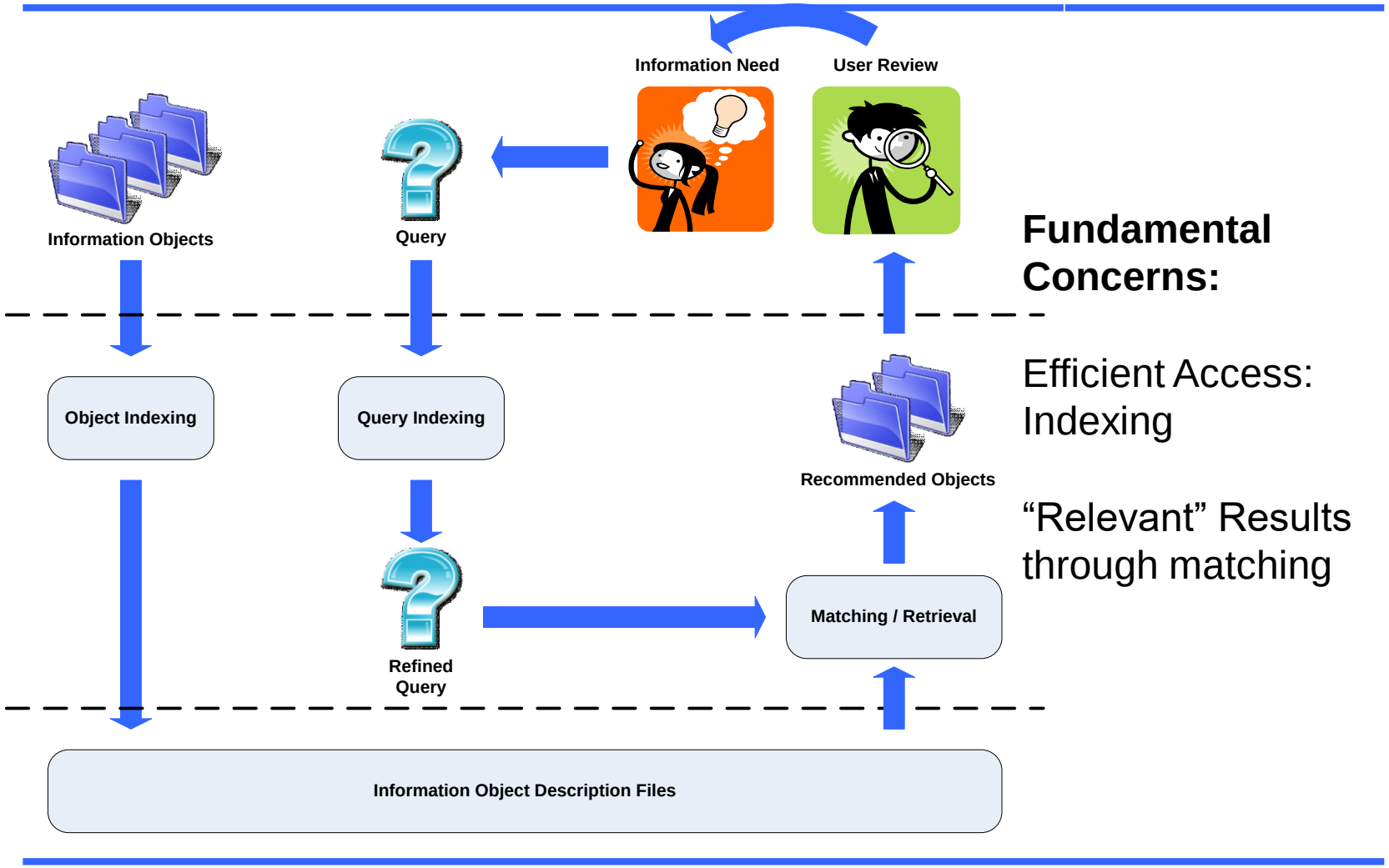
- Separate from operational systems and populated by data from these systems
- Provides a trend view of data
- Available entirely for the task of making data available to be interrogated by business users
- **Timestamped** and associated with defined periods of time, that is calendar periods or fiscal reporting periods
- Subject oriented around the high-level entities of the enterprise
- Accessible to users who have a limited knowledge of computer systems or data structures

Used for

- Data Mining
- Decision Support
- OLAP



Unstructured Approach: Information Retrieval



Fundamental Concerns:

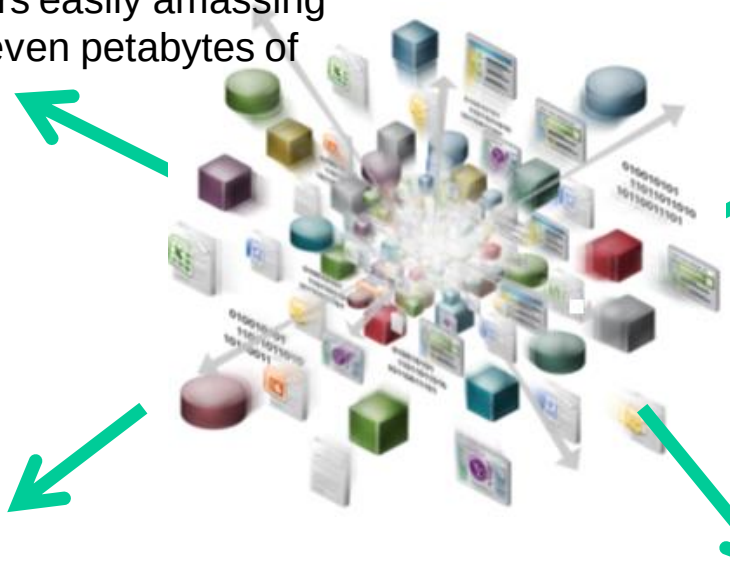
Efficient Access: Indexing

"Relevant" Results through matching

Common Challenges managing data for Enterprises and Individuals

Volume

Awash with data, consumers easily amassing terabytes and enterprises even petabytes of information.



Velocity

Often time-sensitive, data must be processed as it is streaming in order to maximize its value

Validity

Data protection – consent and compliance;
Data privacy – what data an individual willing to share;
Data ethics – consideration of ethical issues when processing data.

Variety

Data extends beyond structured data, including semi-structured and unstructured data of all varieties: text, audio, video, click streams, log files and more.

Solution Trend for Velocity: "Big Data"

Desire to examine and derive new insights from information about:

enterprise (organisation, customers, suppliers and partners

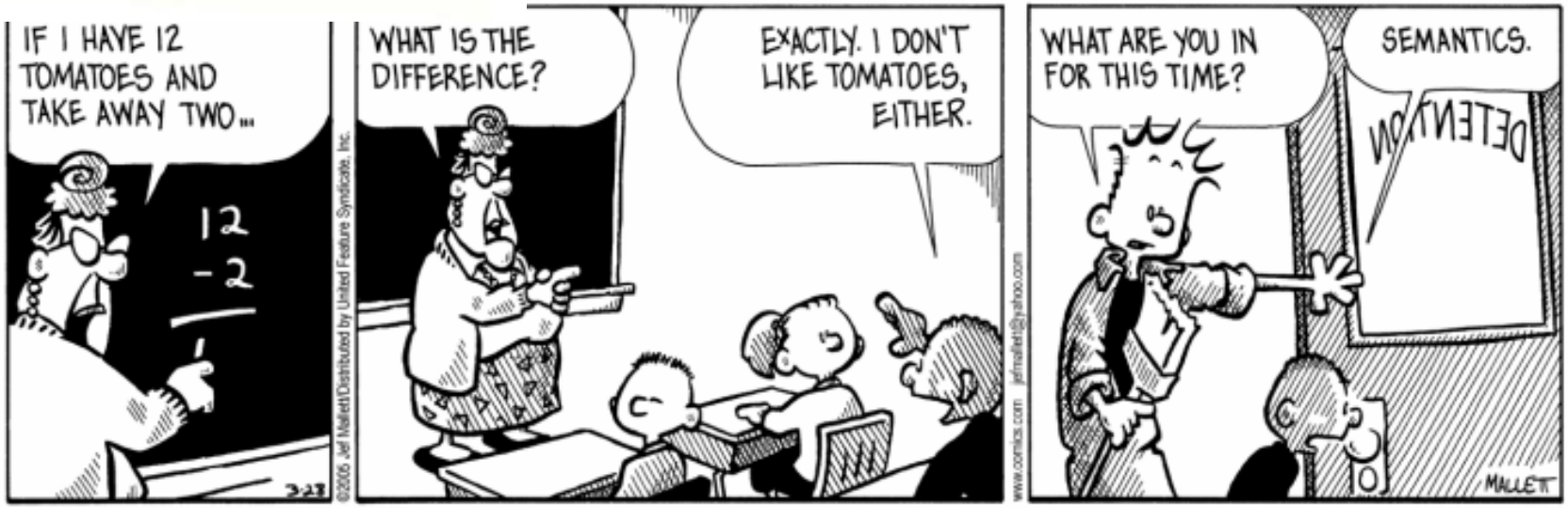
individuals (personsalisation, recommendations etc.)

Realtime analytic techniques and technologies increasingly key, **requires rapid data access**

"Now! ... *That* should clear up a few things around here!"

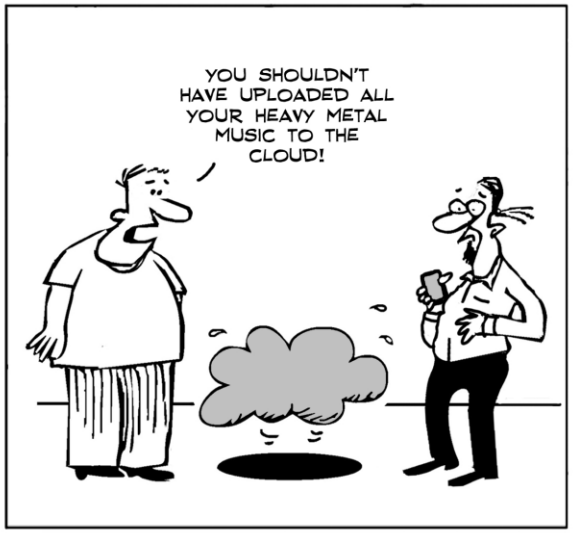
Solution Trend for coping with Variety:

Natural Language Processing (NLP)
and
Semantic Web Technologies



Solution Trend for coping with Volume: “The Cloud”

Desire to “out source” information management and technologies to massively distributed computing resources



Solution Trend for Validity: Data Protection, Data Privacy

Protection

In Europe GDPR (General Data Protection Regulations)

– challenges

explicit gathering and lifecycle management consent- (check out Risk based approach, Notice and Choice based approach)

- Automatic compliance checking

Privacy

Raising awareness and providing tools for users to understand the “convenience vs privacy” tradeoff

Validity: data processing concern

Solution Trend for Validity: Data Ethics

Ethics

- Conversation just beginning on the ethics of processing data
- Being taken seriously at corporate level (e.g. IBM)
- Efforts ongoing to provide stakeholders to address ethics early in development lifecycle
  - Check out http://ethicscanvas.org