GENERAL ASSEMBLY

INTRO TO DATA SCIENCE

LECTURE 3: DATA FORMAT, ACCESS & TRANSFORMATION

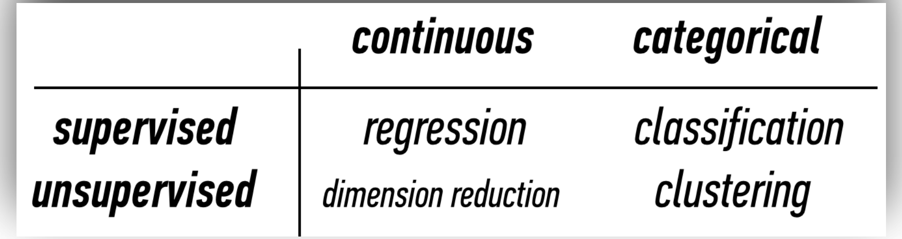
RECAP

LAST TIME:

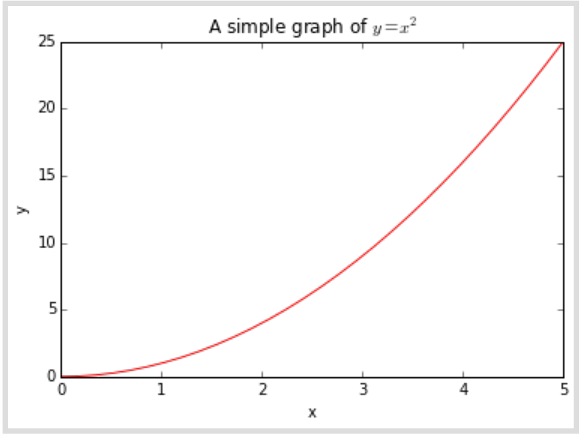
I. WHAT IS MACHINE LEARNING?
II. MACHINE LEARNING PROBLEMS

EXERCISES:
III. I-PYTHON NOTEBOOK INTRO

QUESTIONS?



	continuous	*categorical*
supervised	*regression*	*classification*
unsupervised	*dimension reduction*	*clustering*



AGENDA

I. APIS AND JSON

II. INTRO TO RELATIONAL DATABASE

III. VISUALIZATION

EXERCISES:

IV. PANDAS

V. MINING TWITTER VIA API

WHERE DOES THE DATA COME FROM?

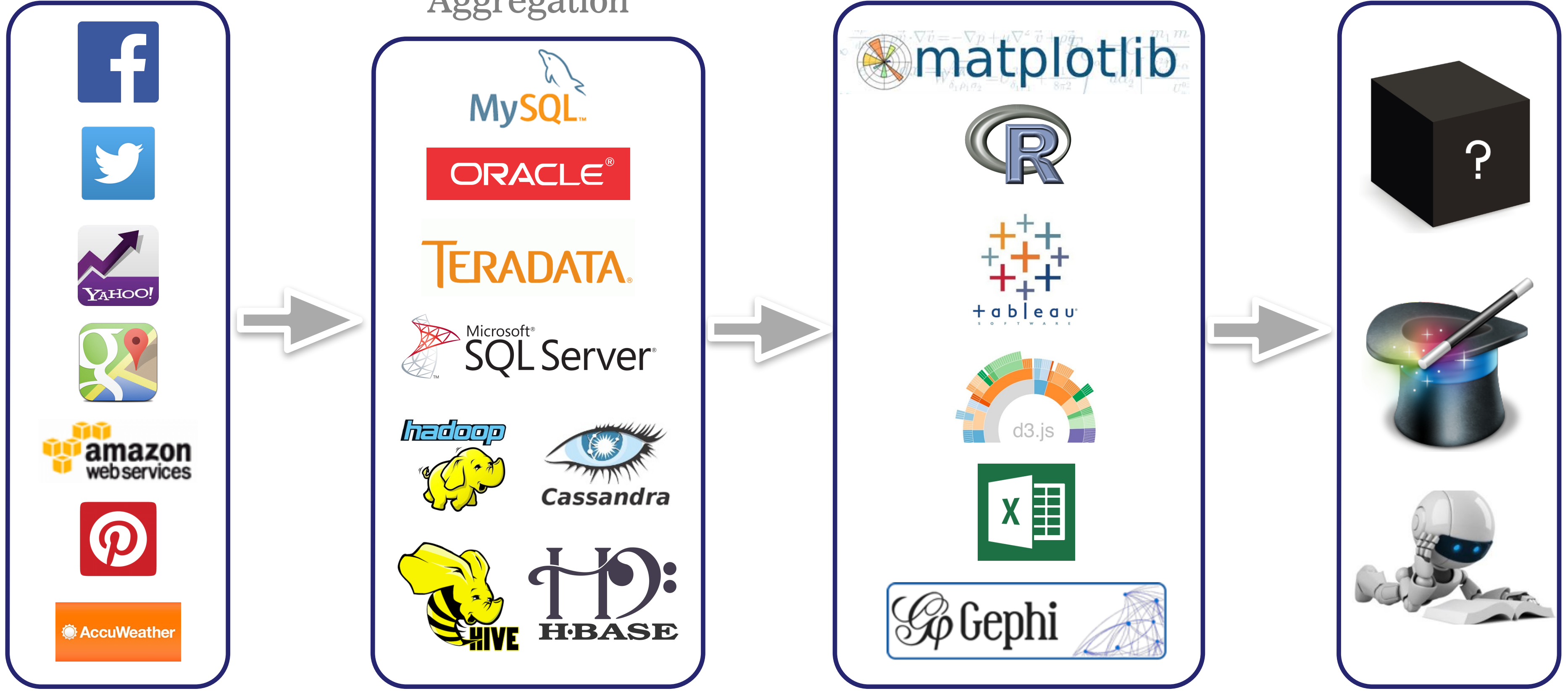
DATA FLOW

Data Retrieval

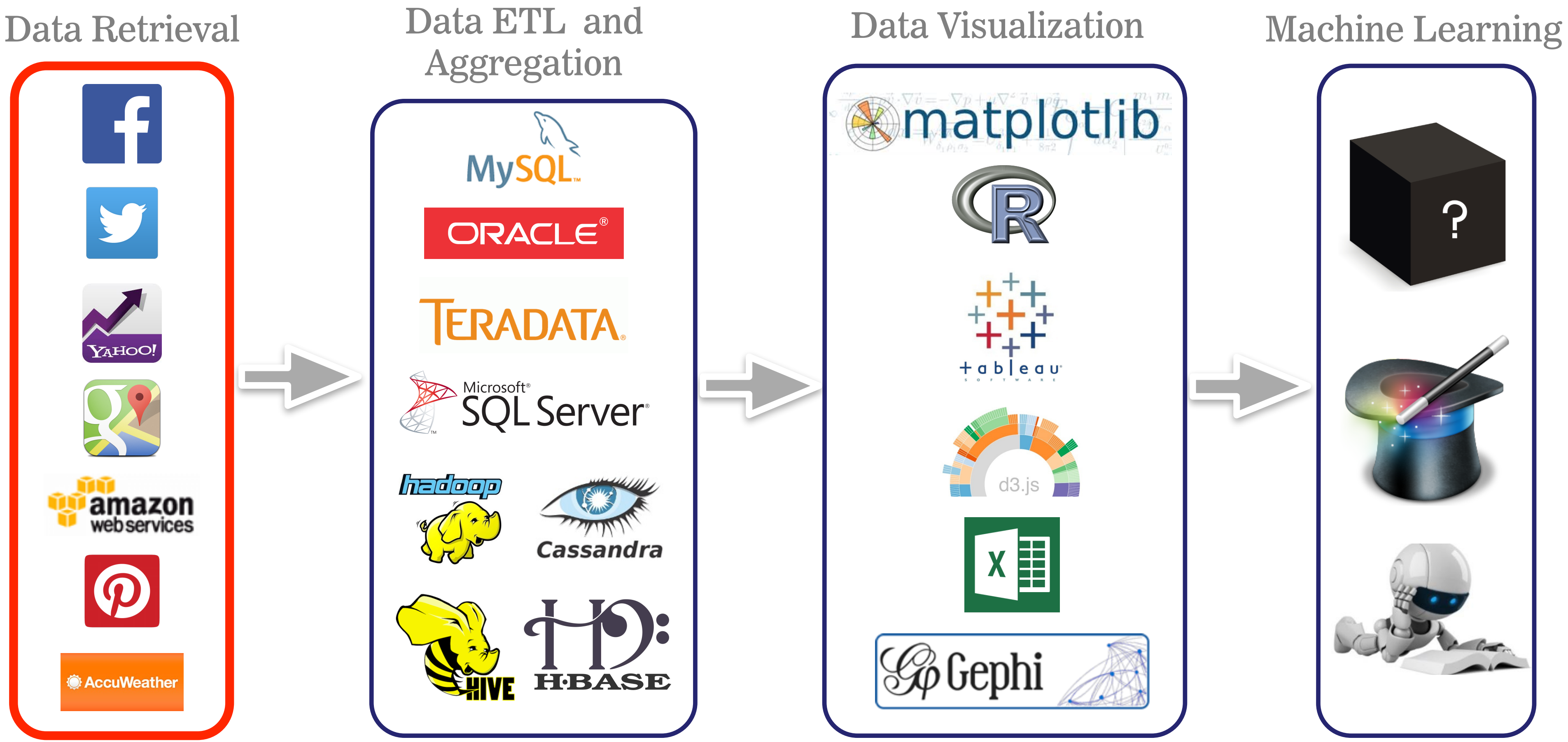
Data ETL and Aggregation

Data Visualization

Machine Learning



DATA FLOW


Data Retrieval
Data ETL and Aggregation
Data Visualization
Machine Learning
YAHOO!
amazon web services
AccuWeather
MySQL
ORACLE
TERADATA
Microsoft SQL Server
hadoop
Cassandra
HIVE
HBASE
matplotlib
R
tableau
d3.js
X
Gephi
?

I. APIS AND JSON

JSON (JavaScript Object Notation) is:

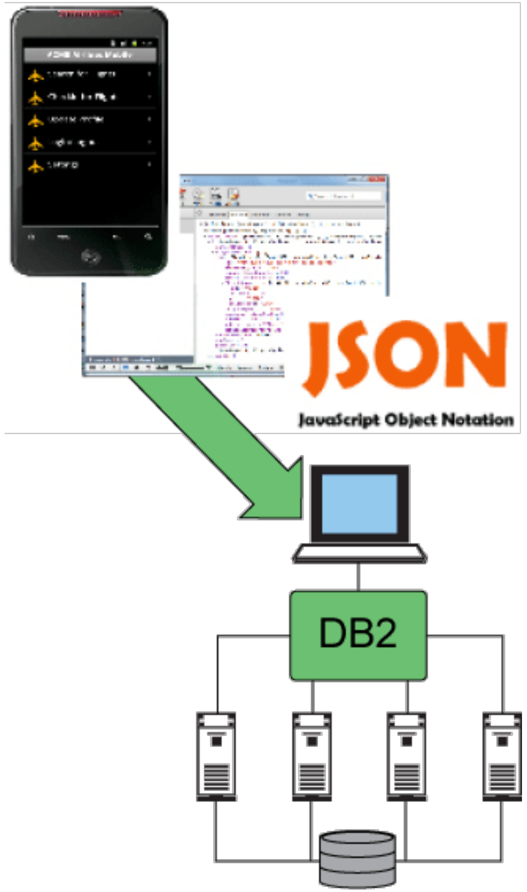
a lightweight data-interchange format

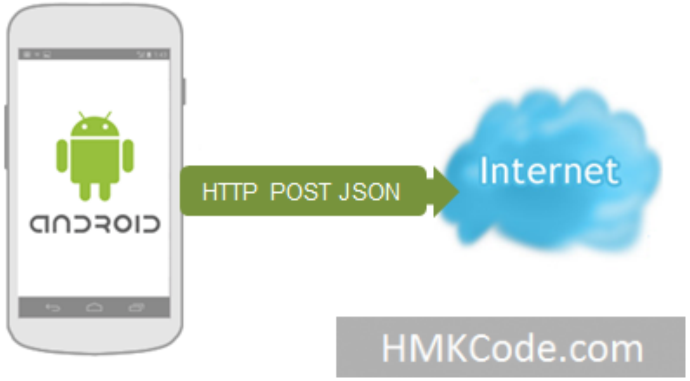
a string

JSON can be passed

between applications

easy for machines to parse and generate





JSON are passed through applications

as strings

and converted into native objects per language.

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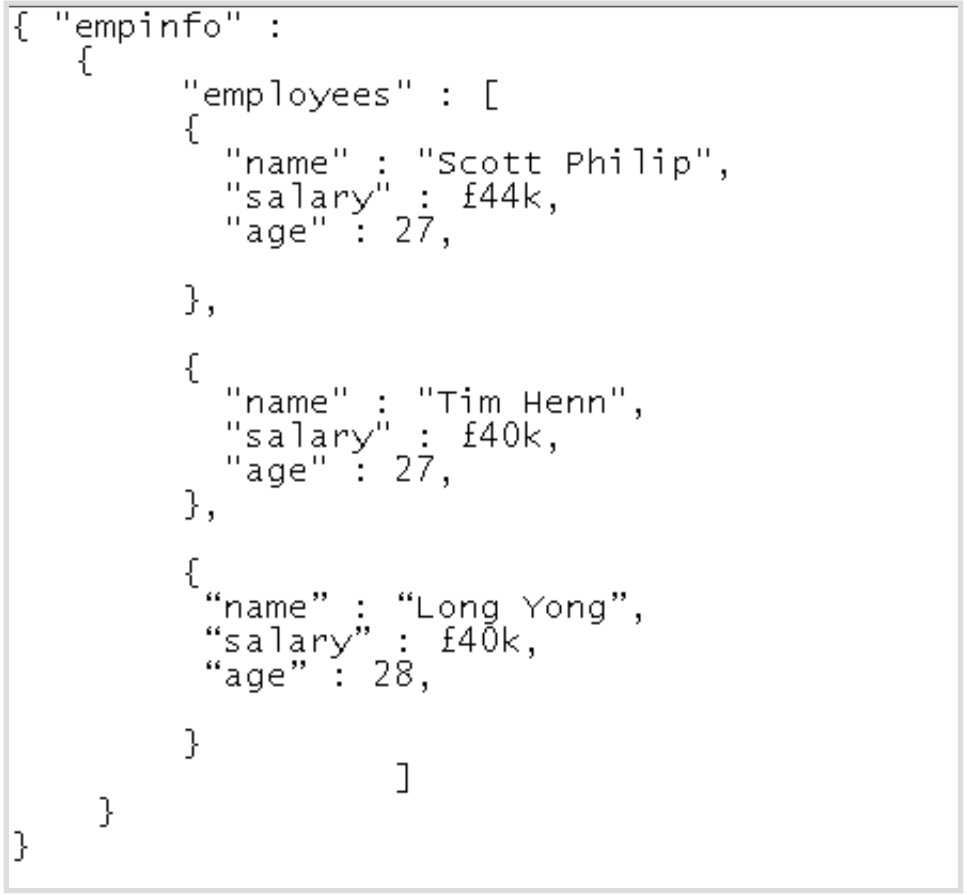


```
{ "empinfo" :
    {
          "employees" : [
          {
            "name" : "Scott Philip",
            "salary" : £44k,
            "age" : 27,

          },

          {
            "name" : "Tim Henn",
            "salary" : £40k,
            "age" : 27,
          },

          {
           “name” : “Long Yong”,
           “salary” : £40k,
           “age” : 28,

          }
                       ]
     }
}
```

JSON STRING ——> PYTHON OBJECT

```
import json
py_object = [ { 'a':'A', 'b':(2, 4), 'c':3.0 } ]
json_string = json.dumps(py_object)
print ‘JSON:’, json_string
```

```
JSON: [{"a": "A", "c": 3.0, "b": [2, 4]}]
```

PYTHON OBJECT ——> JSON STRING

```
decoded = json.loads(json_string)
```

PYTHON JSON LIBRARY

https://docs.python.org/2/library/json.html

PYTHON CSV LIBRARY

https://docs.python.org/2/library/csv.html

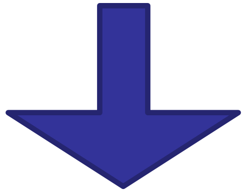
APIs (Application Programming Interface) allow people to interact with the structures of an application

- get
- put
- delete
- update
- …

Best practices for APIs are to use RESTful principles.

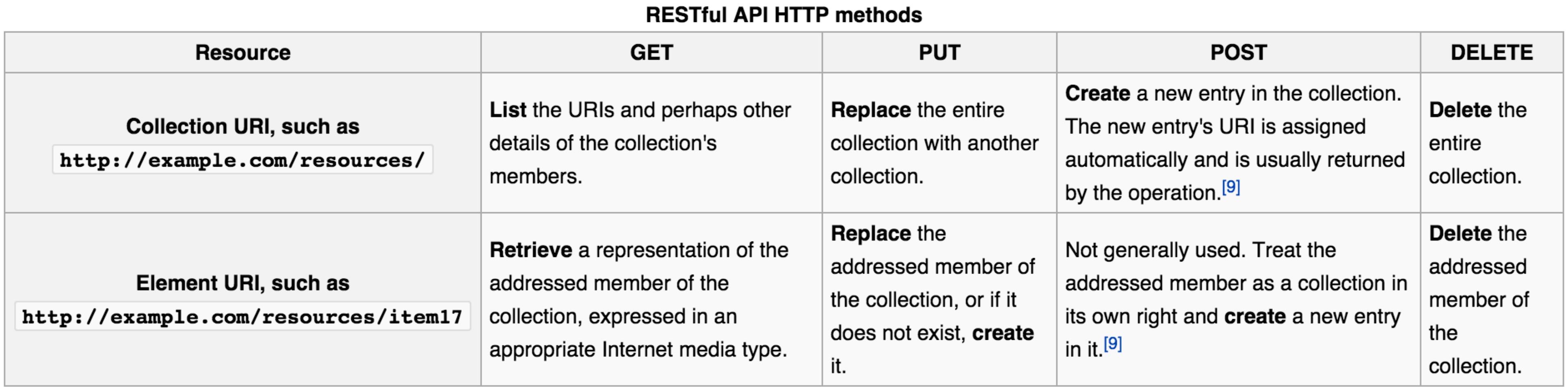
API

Best practices for APIs are to use RESTful principles.



Representational State Transfer (REST)

RESTFUL EXAMPLE



RESTful API HTTP methods

Resource	GET	PUT	POST	DELETE
Collection URI, such as `http://example.com/resources/`	**List** the URIs and perhaps other details of the collection's members.	**Replace** the entire collection with another collection.	**Create** a new entry in the collection. The new entry's URI is assigned automatically and is usually returned by the operation.[9]	**Delete** the entire collection.
Element URI, such as `http://example.com/resources/item17`	**Retrieve** a representation of the addressed member of the collection, expressed in an appropriate Internet media type.	**Replace** the addressed member of the collection, or if it does not exist, **create** it.	Not generally used. Treat the addressed member as a collection in its own right and **create** a new entry in it.[9]	**Delete** the addressed member of the collection.

http://en.wikipedia.org/wiki/Representational_state_transfer

- The Base URL
- An interactive media type (usually JSON)
- Operations (GET, PUT, POST, DELETE)
- Driven by http requests

TWITTER REST API

https://dev.twitter.com/rest/public

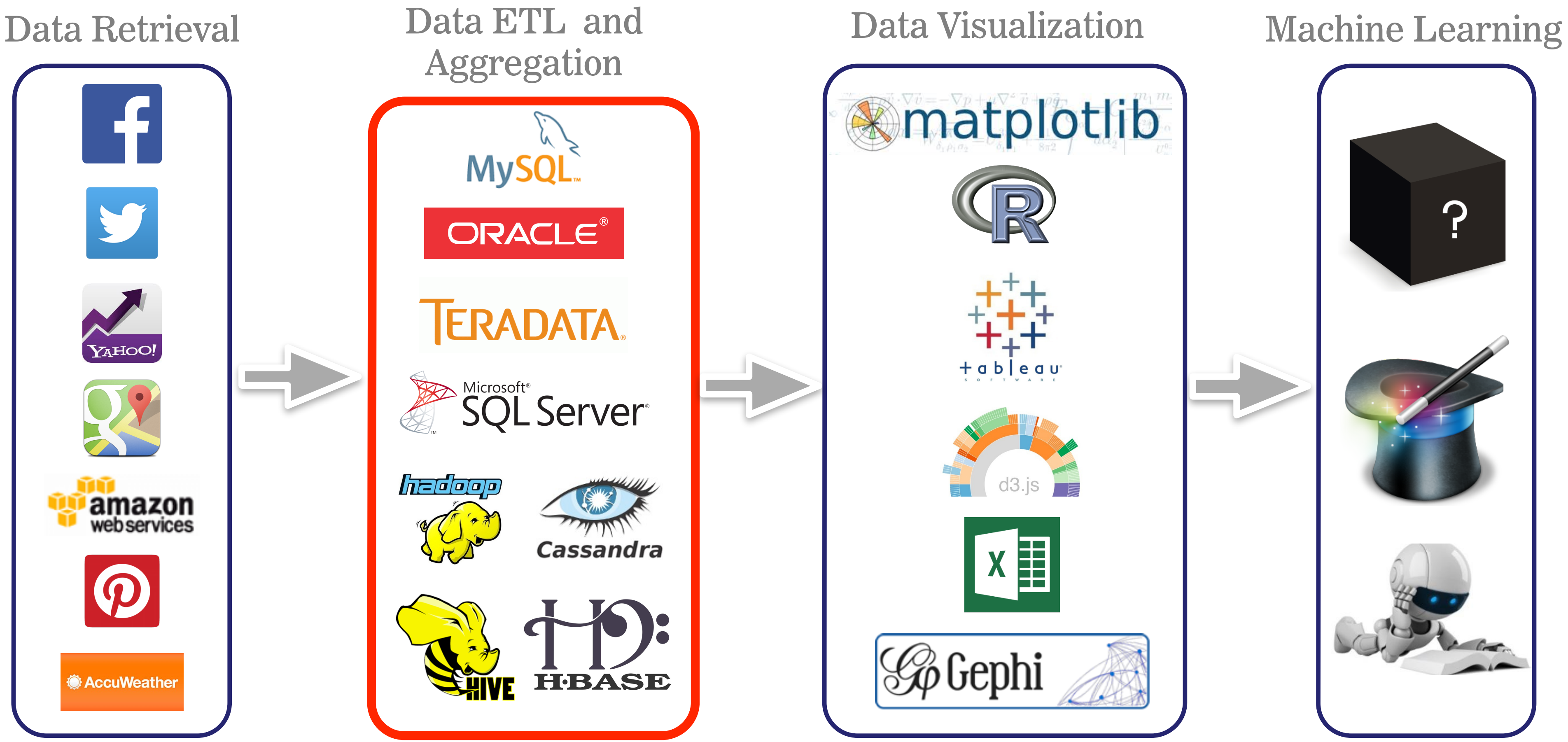
LINKEDIN REST API

https://developer.linkedin.com/docs/signin-with-linkedin

AWESOME PUBLIC DATASETS

https://github.com/caesar0301/awesome-public-datasets

DATA FLOW


Data Retrieval
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amazon web services
AccuWeather
MySQL
ORACLE
TERADATA
Microsoft SQL Server
hadoop
Cassandra
HIVE
HBASE
matplotlib
R
tableau
d3.js
X
Gephi
?

II. INTRO TO RELATIONAL DATABASE

What is ETL?

- **E**xtract data
- **T**ransform data
- **L**oad data

Databases are a **structured** data source optimized for efficient **retrieval** **and** **storage**

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retrieval **:** the ability to read data out

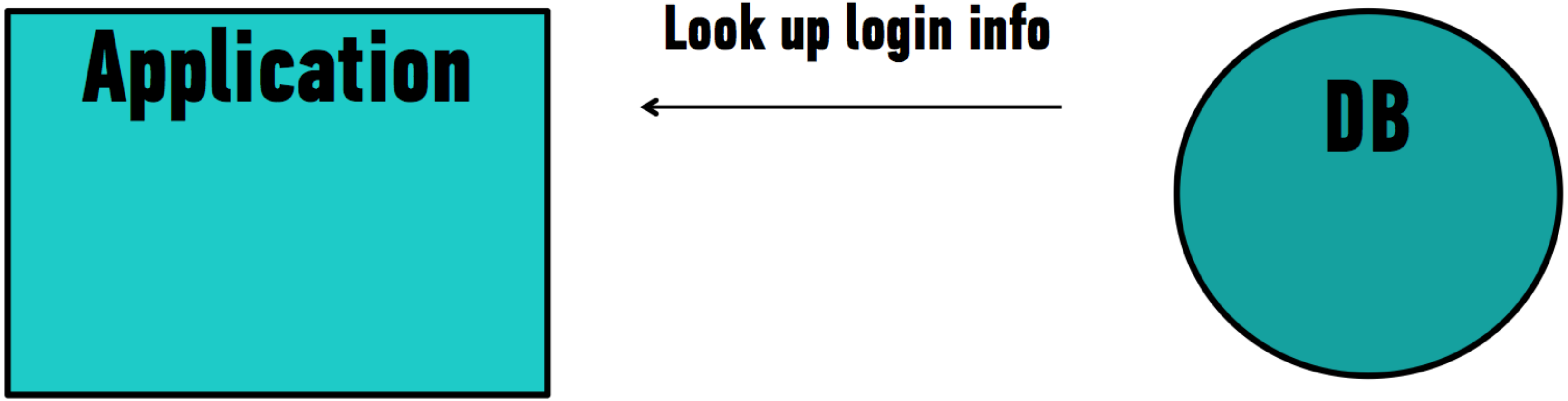
Databases are a **structured** data source optimized for efficient **retrieval and storage**

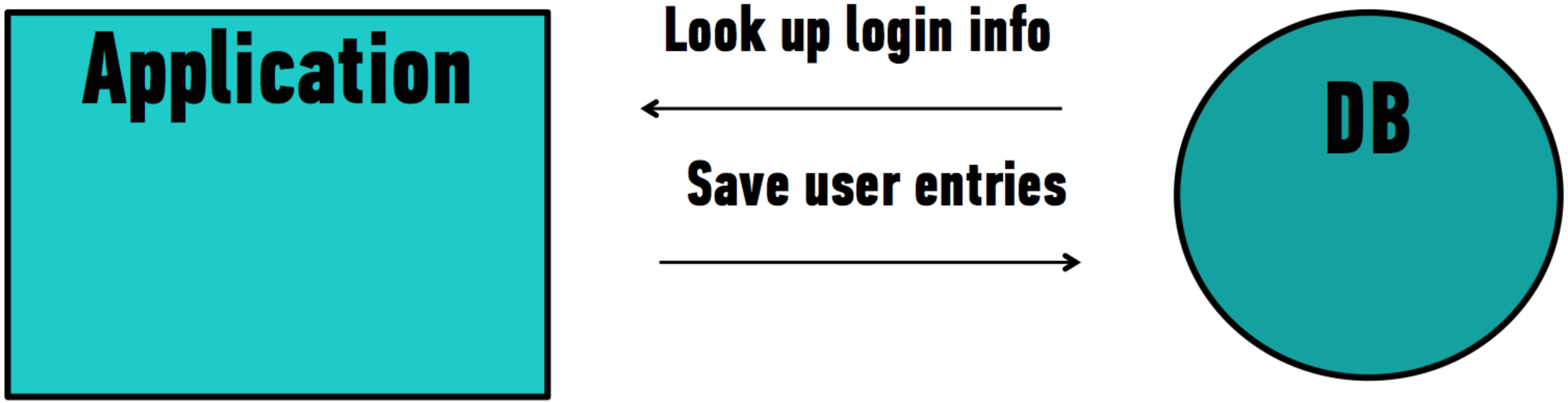
structured : we will have to define some pre-defined organization strategy

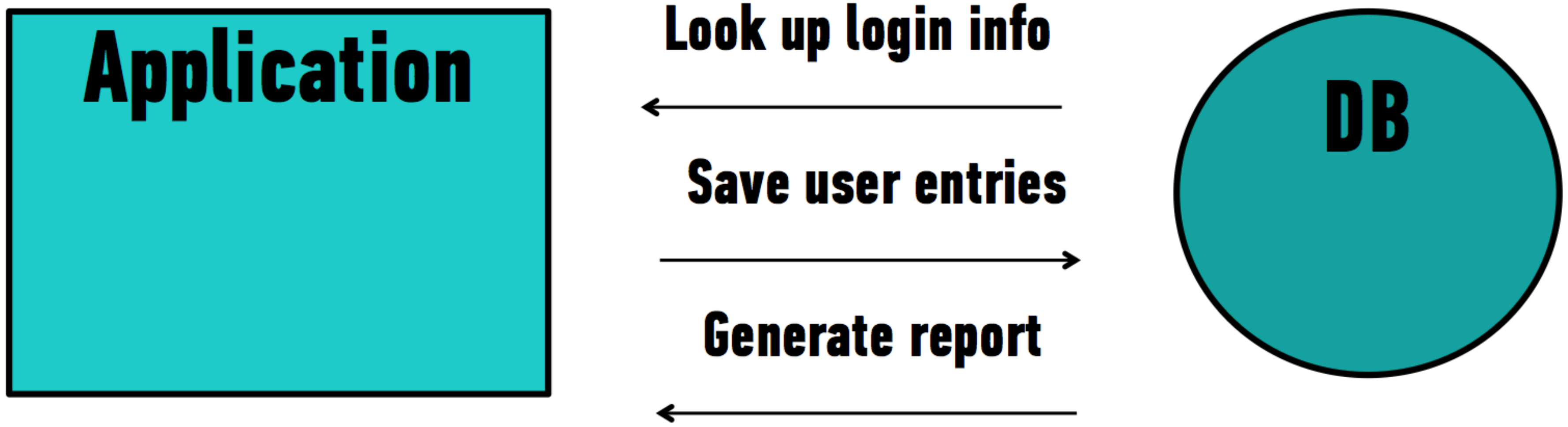
retrieval : the ability to read data out

storage: the ability to write data and save it

Application
DB


Application
Look up login info
DB


Application
Look up login info
Save user entries
DB

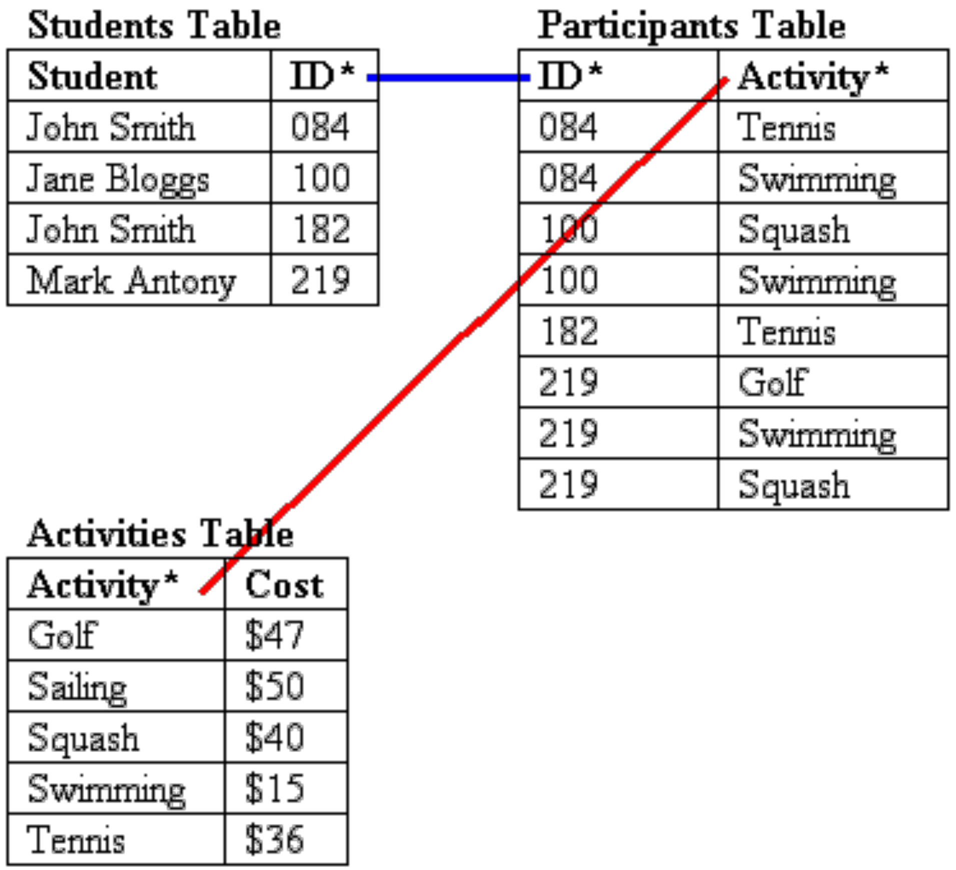

Application
Look up login info
Save user entries
Generate report
DB

RELATIONAL DATABASES

Relational database are traditionally organized in the following manner:

- *A database has **tables** which represent individual entities or objects*

RELATIONAL DATABASES



Students Table

Student	ID*
John Smith	084
Jane Bloggs	100
John Smith	182
Mark Antony	219

Participants Table

ID*	Activity*
084	Tennis
084	Swimming
100	Squash
100	Swimming
182	Tennis
219	Golf
219	Swimming
219	Squash

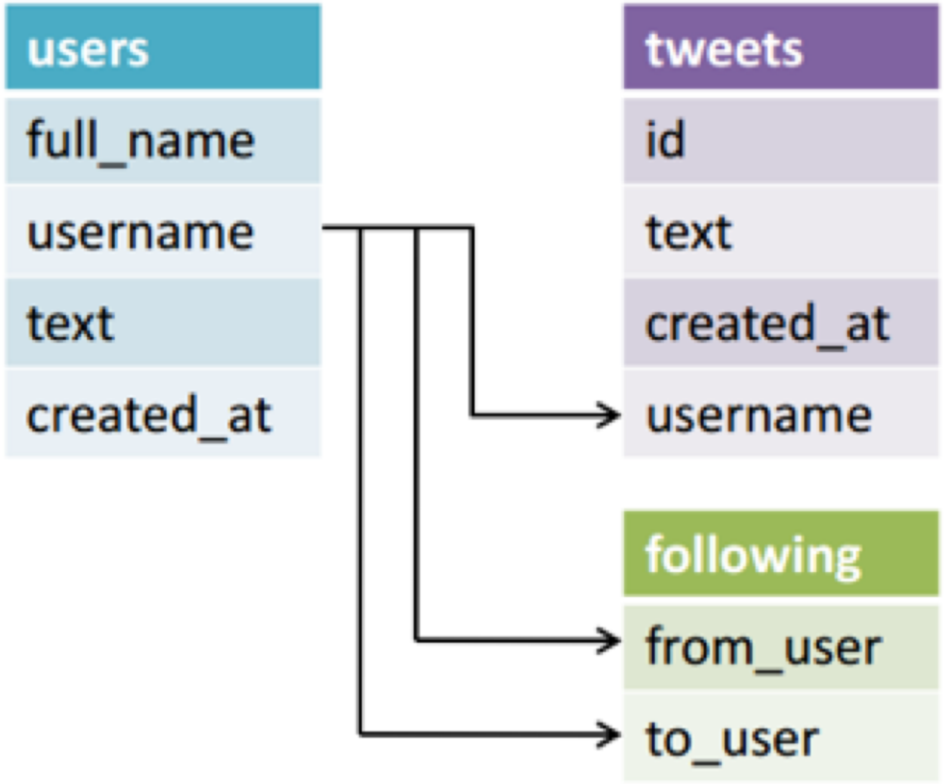
Activities Table

Activity*	Cost
Golf	$47
Sailing	$50
Squash	$40
Swimming	$15
Tennis	$36

Relational database are traditionally organized in the following manner:

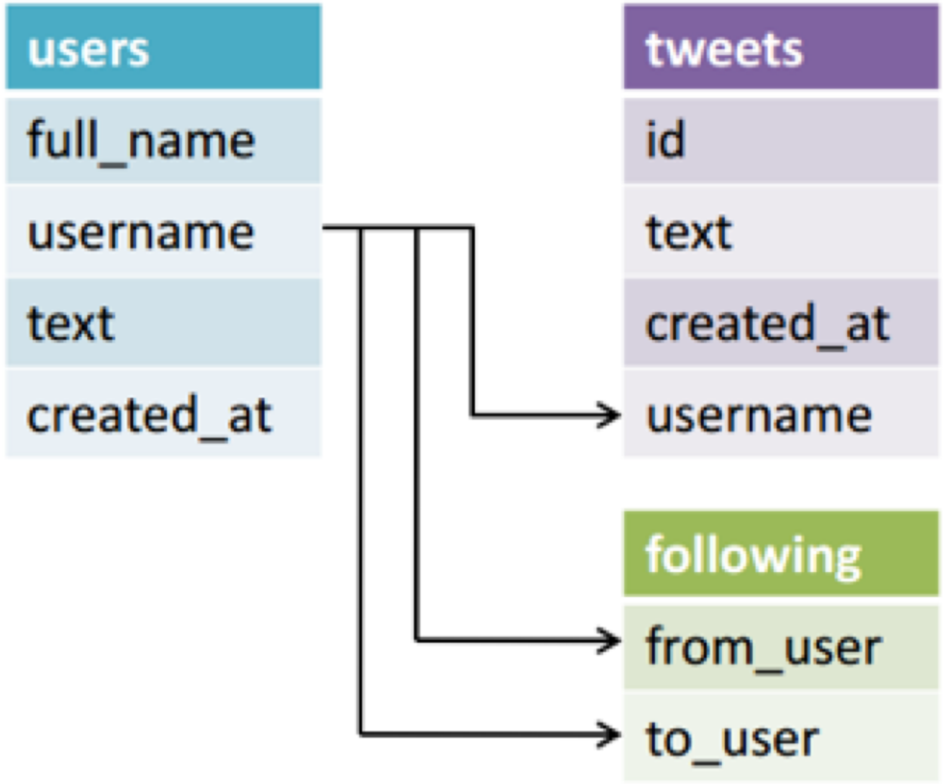
- *A database has **tables** which represent individual entities or objects*
- *Tables have a predefined **schema** - rules that tell it what columns exist and what they look like*

RELATIONAL DATABASES



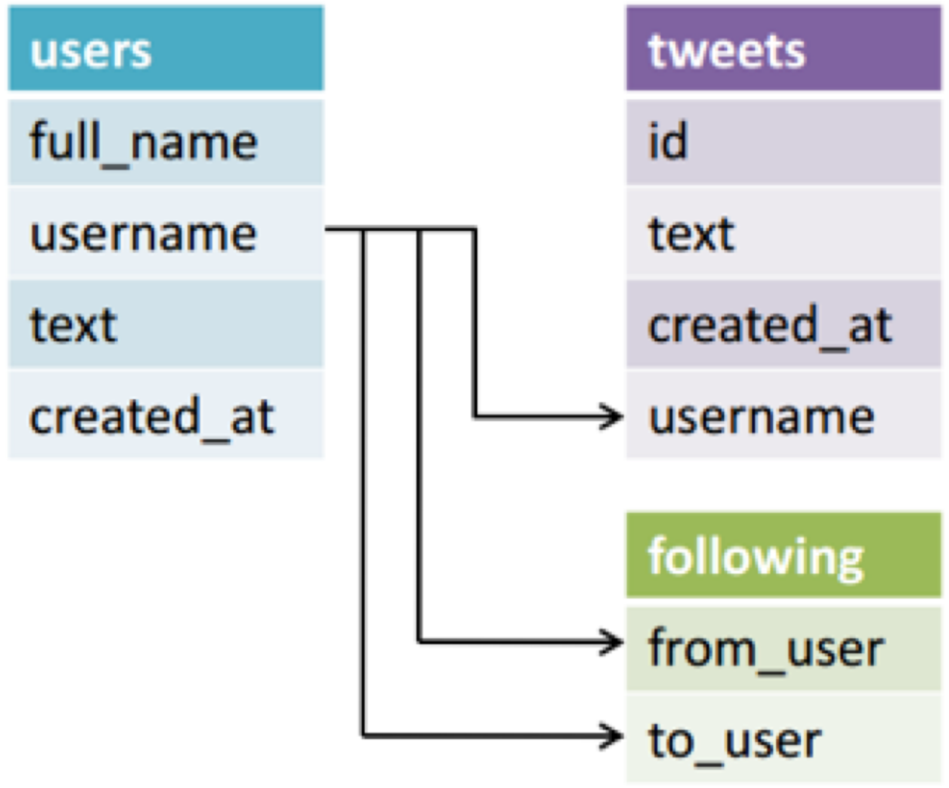
Each table should have a **primary key** column**-** a unique identifier for that row

RELATIONAL DATABASES



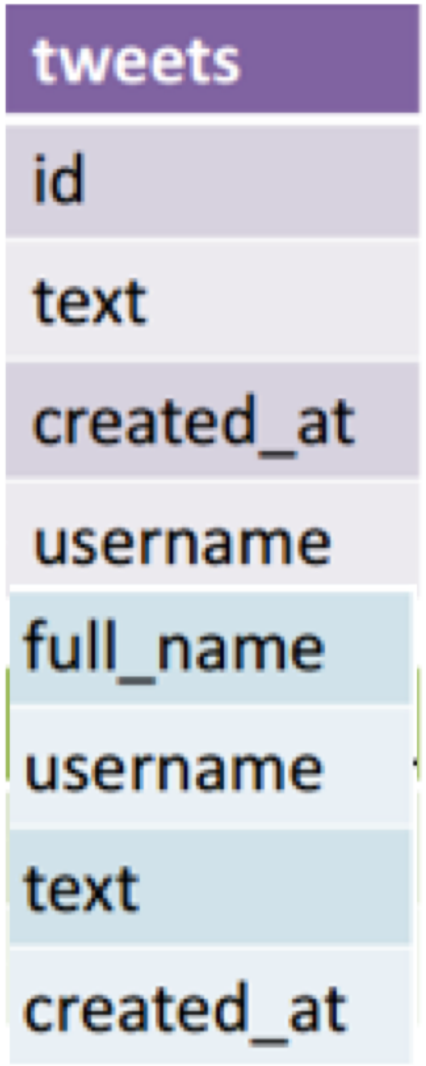
*Additionally each table can have a **foreign key** column- an id that links this to table to another*

RELATIONAL DATABASES



We could have had a table structure like this:

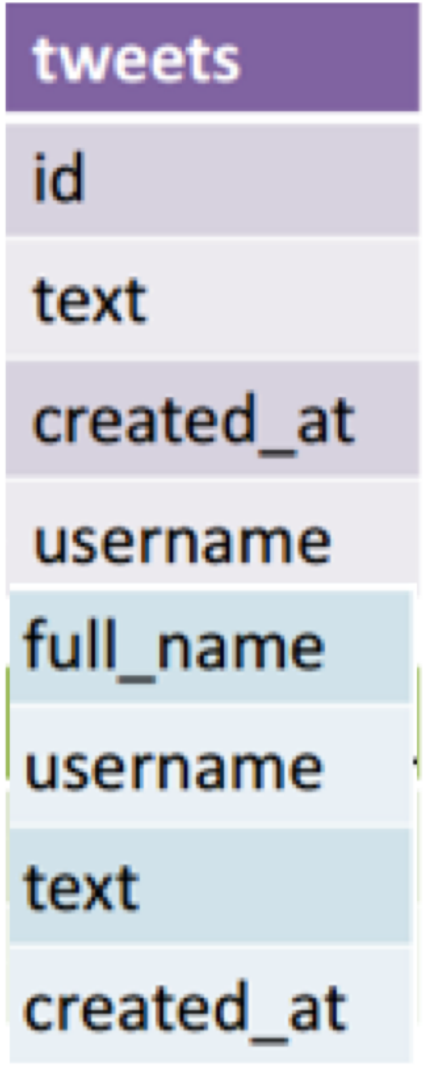
Why is this different?



tweets
id
text
created_at
username
full_name
username
text
created_at

We would repeat the user information on each row.

This is called **denormalization**.



tweets
id
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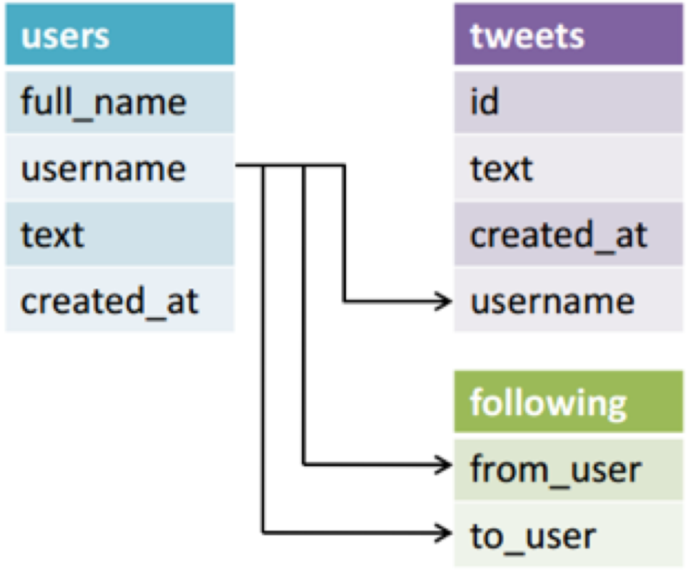
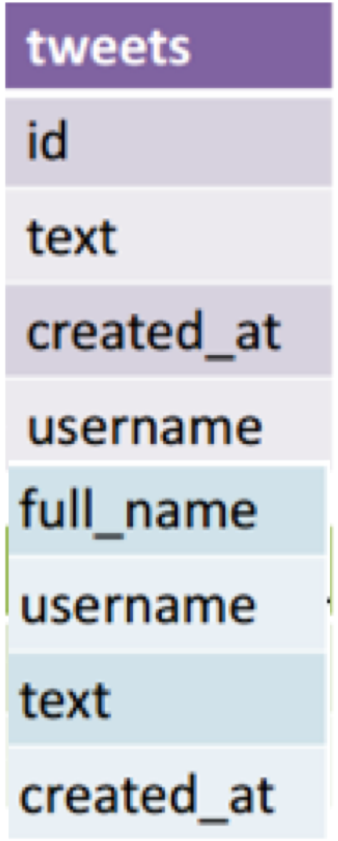
Normalized Data:

Many tables to reduce redundant or repeated data in a table



Denormalized Data:

Wide data, fields are often repeated but removes the need to join together multiple tables



tweets
id
text
created_at
username
full_name
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NORMALIZED VS DENORMALIZED

Normalized Data: Many tables to reduce redundant or repeated data in a table

Denormalized Data: Wide data, fields are often repeated but removes the need to join together multiple tables

Trade off of speed vs. storage

Q: How do we commonly evaluate databases?

Q: How do we commonly evaluate databases?

read-speed vs. write speed

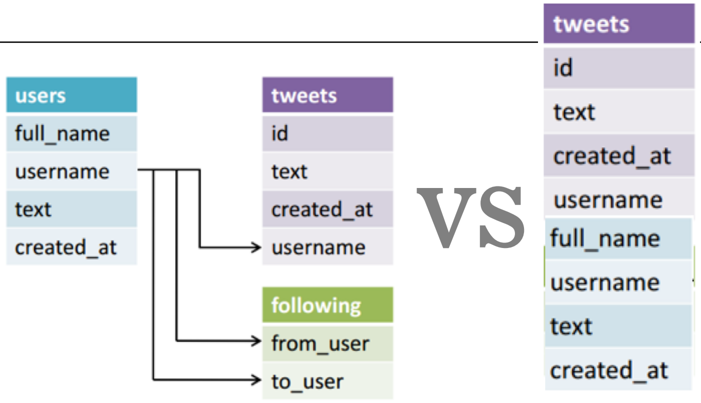
space considerations

(...and many other criteria)

Q: Why are normalized tables (possibly) slower to **read**?

NORMALIZED VS DENORMALIZED

Q: Why are normalized tables (possibly) slower to **read**?

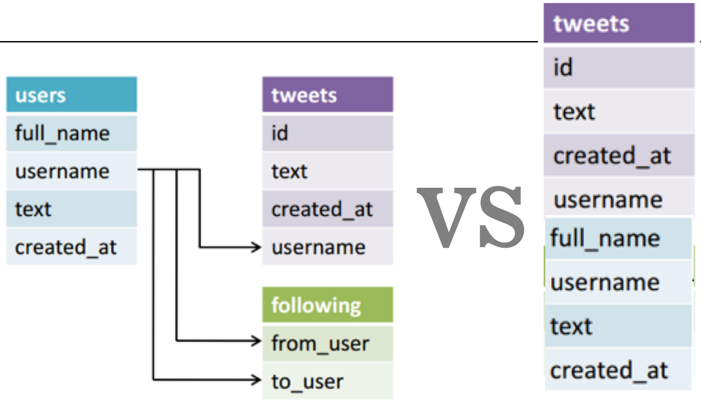


A: We'll have to get data from multiple tables to answer some questions.

Q: Why are denormalized tables (possibly) slower to **write**?

NORMALIZED VS DENORMALIZED

Q: Why are denormalized table (possibly) slower to **write**?



A: We'll have to write more information on each write.

SQL is a query language to load, retrieve and update data in relational databases

THE SELECT COMMAND

SELECT: *Allows you to* ***retrieve*** *information from a table*

Syntax:

```
    SELECT col1, col2, …
    FROM table
    WHERE <some condition>
```

THE SELECT COMMAND

Syntax:

SELECT col1, col2, …

FROM table

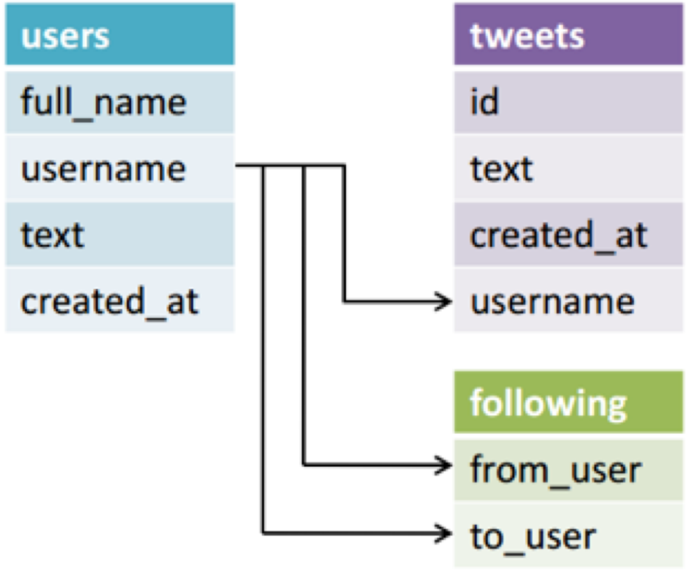
WHERE <some condition>

Example:

SELECT full_name, text

FROM users

WHERE created_at > '2015-05-01'



THE GROUP BY COMMAND

GROUP BY: *Allows you to* ***aggregate*** *information from a table*

Syntax:

```
SELECT col1 , count(col2), …
FROM table
GROUP BY col1
```

THE GROUP BY COMMAND

Syntax:

SELECT col1 , count(col2), …

FROM table

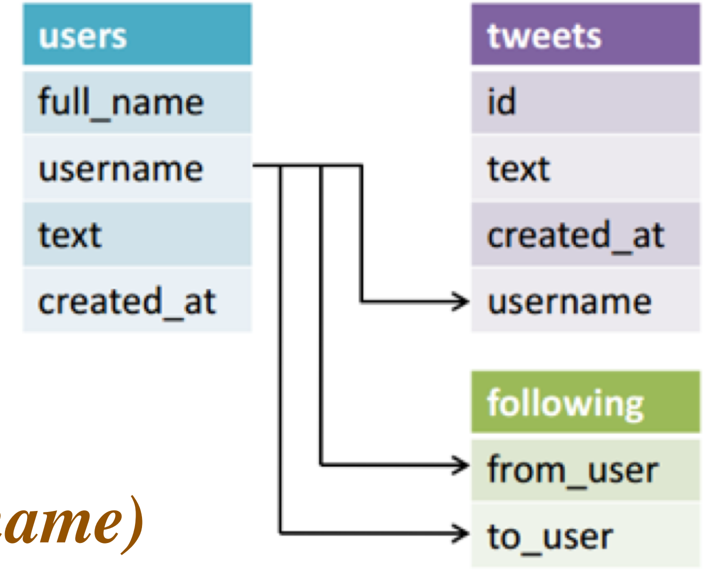
GROUP BY col1

Example:

SELECT created_at, count(username)

FROM users

GROUP BY created_at



common group by functions:

- **count**
- **max**
- **min**
- **avg**
- **sum**

THE JOIN COMMAND

JOIN: *Allows you to* ***combine*** *multiple tables*

Syntax:

```
SELECT table1.col1, table1.col2, table2.col2, …
FROM table1 JOIN table 2
ON table1.col1 = table2.col1
```

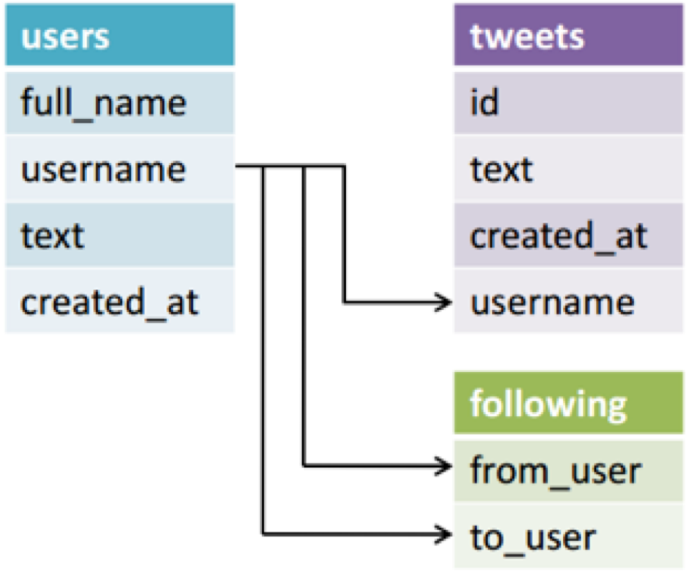
THE JOIN COMMAND

Syntax:

```
SELECT table1.col1, table1.col2, table2.col2, …
FROM table1 JOIN table 2
ON table1.col1 = table2.col1
```

Example:

```
SELECT users.full_name, tweets.text
FROM users JOIN tweets
ON users.username = tweets.username
```

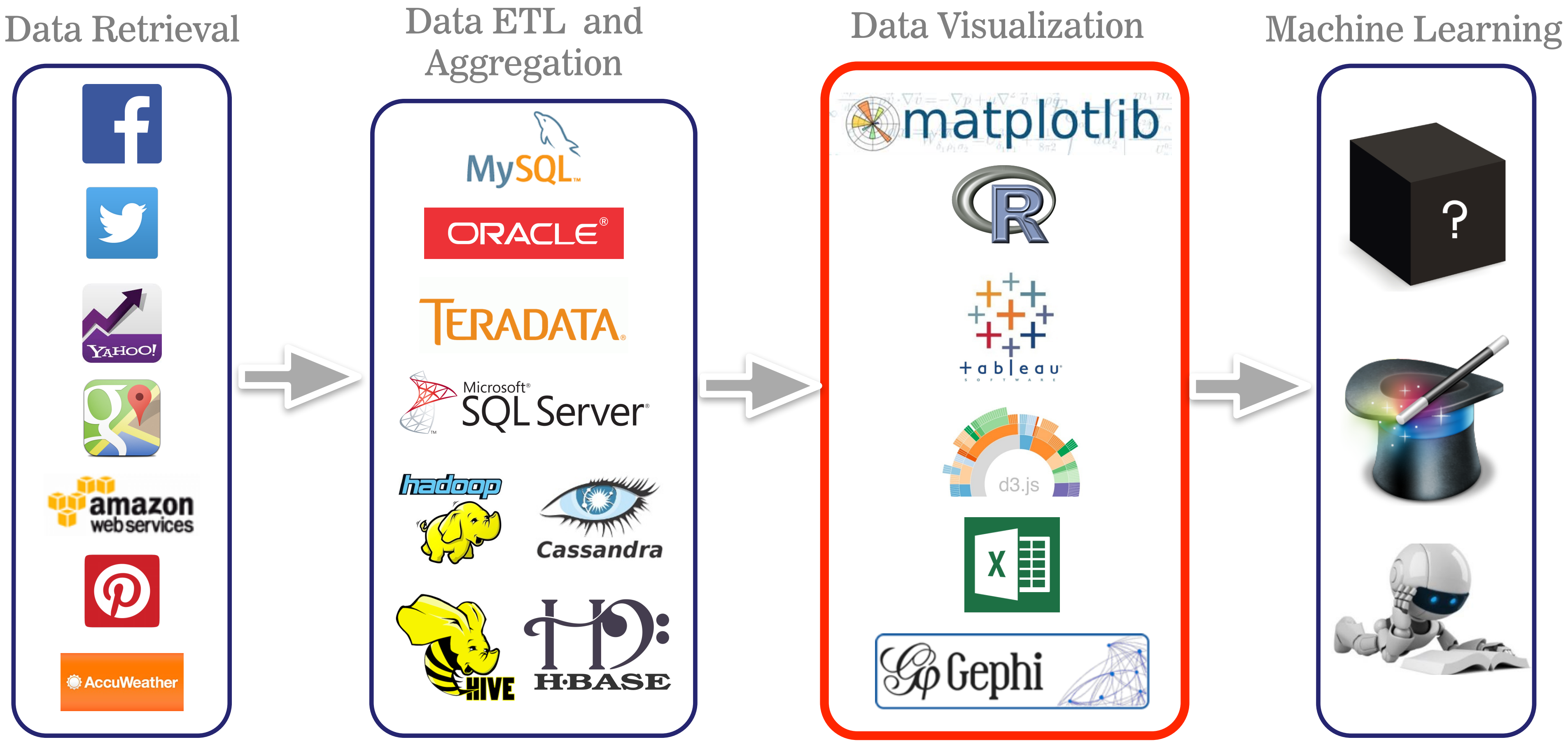


WANT TO KNOW MORE ABOUT SQL?

http://www.w3schools.com/sql/

III. VISUALIZATION

DATA FLOW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HIVE
HBASE
matplotlib
R
tableau
d3.js
X
Gephi
?

https://github.com/mbostock/d3/wiki/Gallery

IV. PANDAS INTRO

V. MINING TWITTER VIA API

HOMEWORK 1:

HTTPS://GITHUB.COM/GA-STUDENTS/DAT_SF_14/TREE/MASTER/HOMEWORK/HW1

DISCUSSION