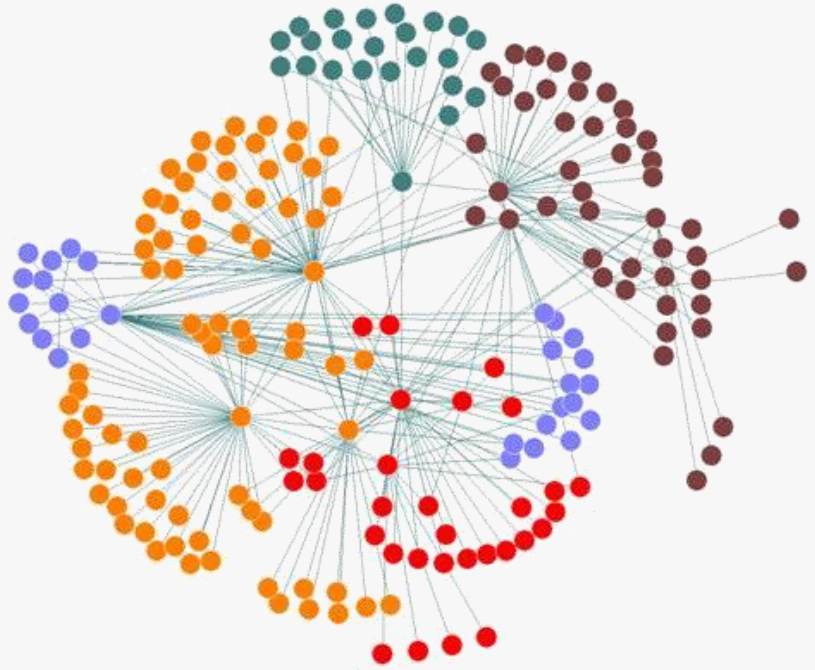
Social Network Analysis

By
Dr. Hussein Hazimeh



Lebanese University
Faculty of Information 1

Data Science Departement

3rd year – Social Network Analysis

Spring – 2022 – Chapter 1

Agenda

- Course introduction
- Grades distribution
- Major topics to be covered

Course Introduction

Course name

- *Social Network Analysis - SNA*

Credits

- *4*

Number of hrs

- *45*

Technical skills

- *Python*

Course pre-requisite

- *Linear Algebra*

Course domain

- *Graph Data Analytics*

Grades Distribution

Assignment 1

- *20%**

Assignment 2

- *20%**

Final exam

- *60%**

*After presentation

Topics to be Covered

Graph Theory

- *1 Week*

Social Networks

- *2 weeks*

Centrality Measures

- *2 weeks*

PageRank Algorithm

- *1 week*

Knowledge Graphs

- *2 weeks*

Free Topic

- *2 weeks*

1

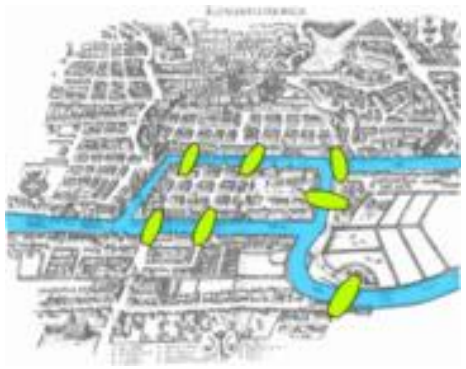
Graph Theory

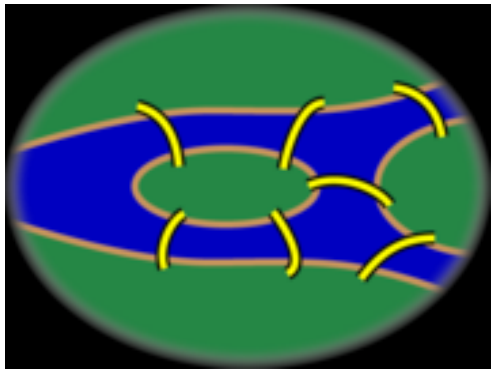
Introduction

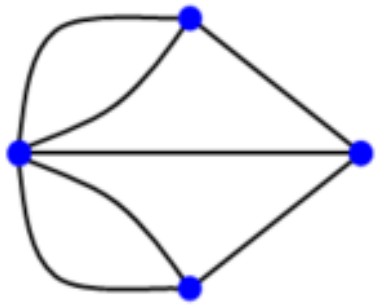
Graph Theory - History

Leonhard Euler's paper on "*Seven Bridges of Königsberg*" ,

published in 1736.

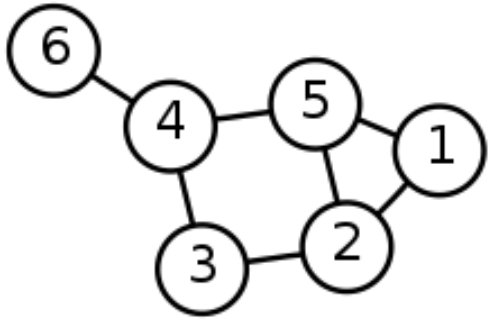




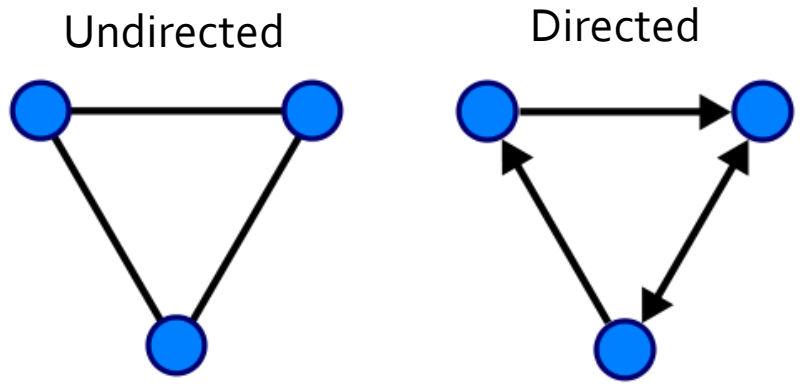


Graph Theory

- In mathematics, **graph theory is the study of graphs**, which are mathematical structures used to model pairwise relations between objects. A graph in this context is made up of vertices (also called nodes or points) which are connected by edges (also called links or lines). (*Wikipedia*)



- A distinction is made between undirected graphs, where edges link two vertices symmetrically, and directed graphs, where edges link two vertices asymmetrically.



- Graphs are one of the principal objects of study in discrete mathematics.

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Social Networks Analysis

Introduction

“Think Link”

“Social relationships are hidden to Real World”

What is Network Analysis?

» **S**ocial network analysis is a method by which one can **analyze** the ***connections*** across individuals or groups or institutions. That is, it allows us to examine how political actors or institutions are *interrelated*.

Network Analysis

- The advantage of social network analysis is that, unlike many other methods, it **focuses on interaction** (rather than on individual behavior).

- Network analysis allows us to examine how the configuration of networks influences how individuals and groups, organizations, or systems function.

Network Analysis

- It can be **applied across disciplines**—there are social networks, political networks, electrical networks, transportation networks, and so on.

Definition

- **Social network analysis (SNA)** is a collection of techniques, tools, and methods to map and measure the relationships among people and organizations. (*Wikipedia*)
- **SNA is multidisciplinary** and deals with
  - Sociology
  - Graph theory
  - Computer science
  - Mathmatics

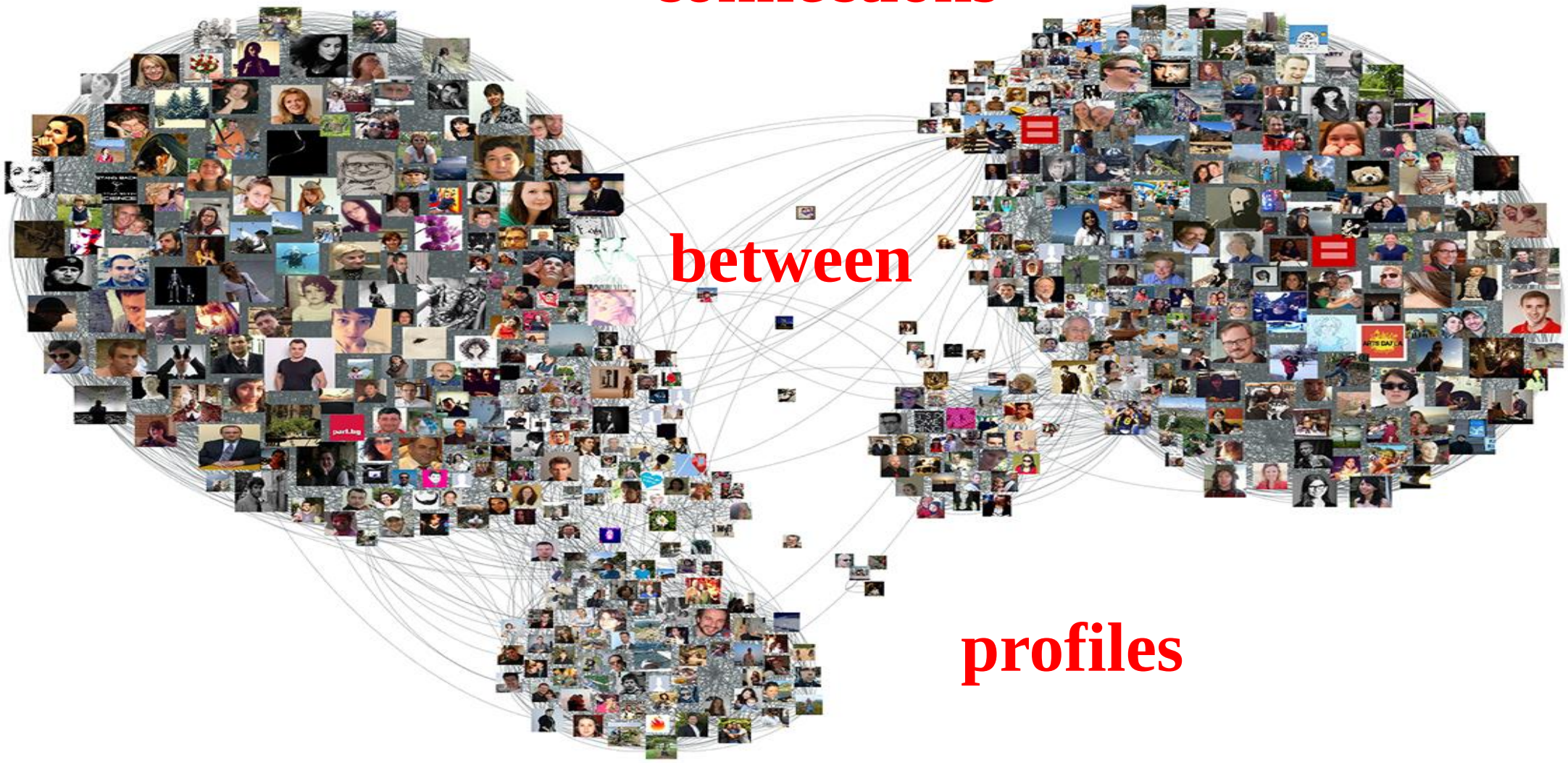
Social Network for Sports

Social Network for Facebook

all about
connections

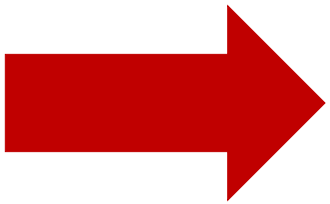
between

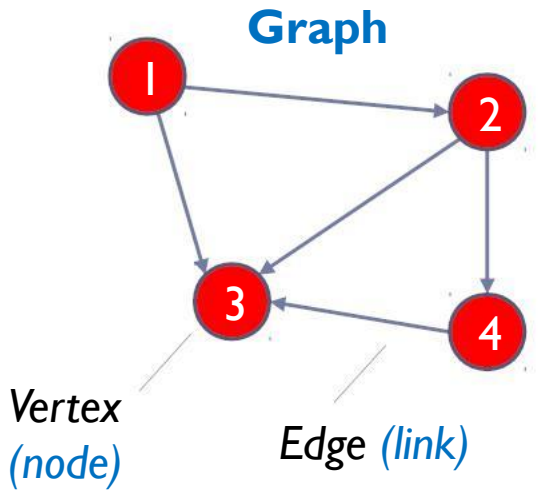
profiles



Social Networks representation

Social Network Structure



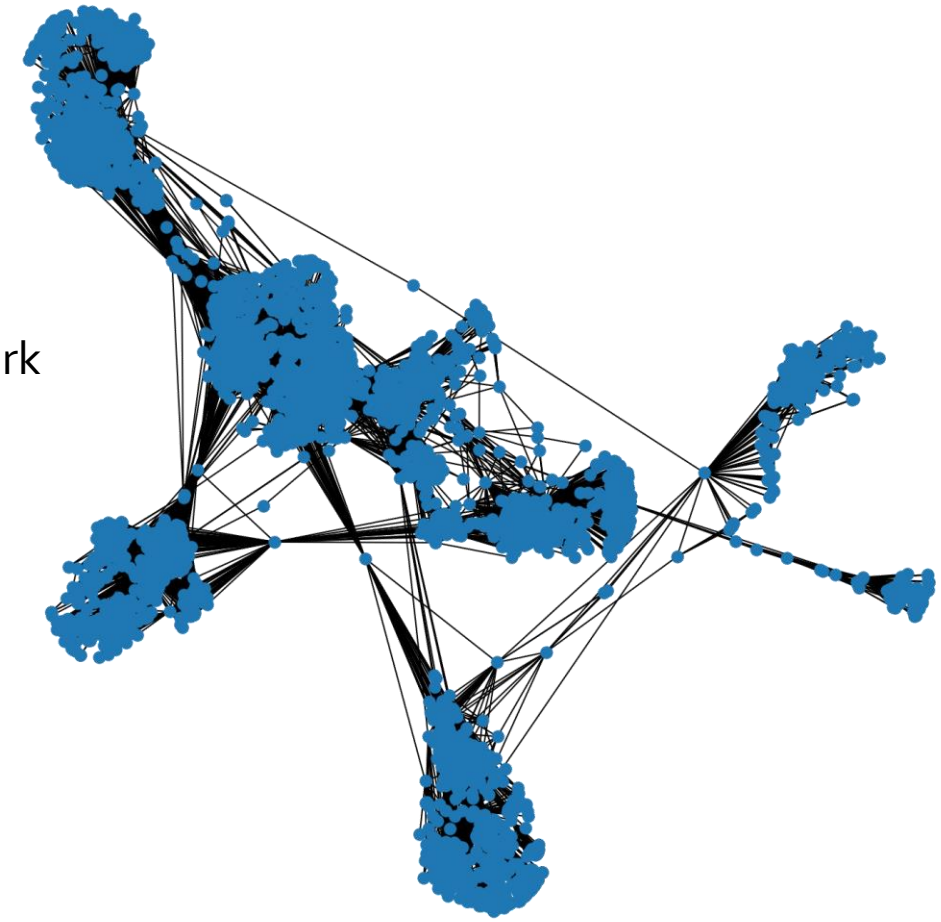


Social Networks representation

Dataset

```
104 113
104 122
104 123
104 128
104 142
104 169
104 186
104 188
104 200
104 203
104 212
104 239
104 252
104 271
```

Social Network



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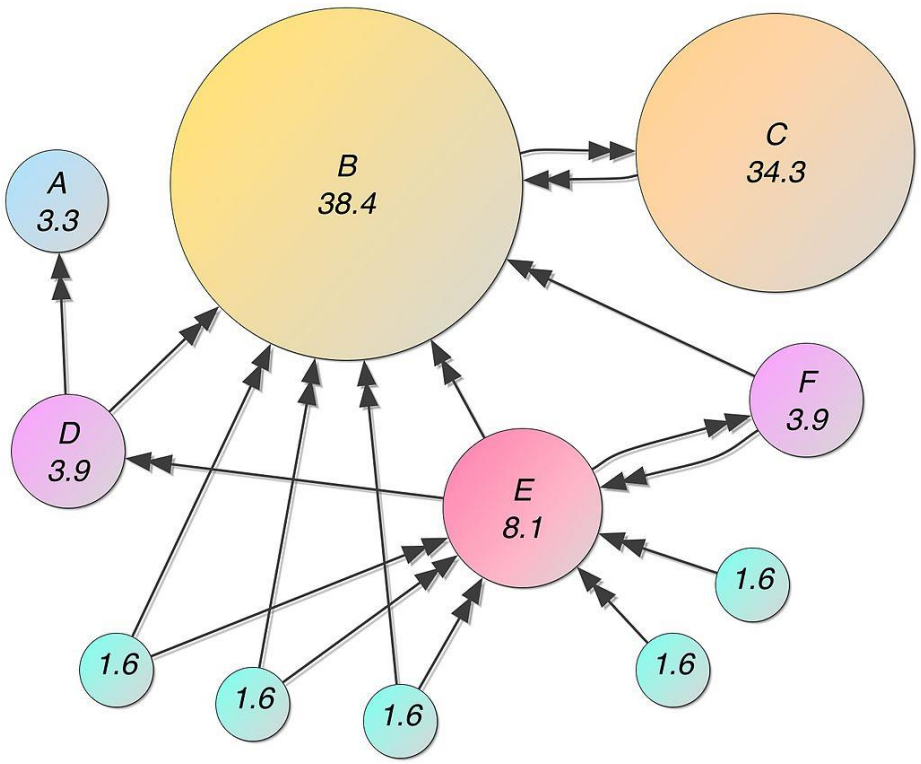
PageRank Algorithm

Introduction

PageRank Algorithm

- **PageRank** (PR) is an algorithm used by Google Search to rank web pages in their search engine results. **PageRank** is a way of measuring the importance of website pages. According to Google:
  - **PageRank** works by counting the number and quality of links to a page to determine a rough estimate of how important the website is. The underlying assumption is that more important websites are likely to receive more links from other websites.
- Currently, **PageRank** is not the only algorithm used by Google to order search results, but it is the first algorithm that was used by the company, and it is the best known¨. As of September 24, 2019, **PageRank** and all associated patents are expired. (*Wikipedia*)



$$PR(u) = \sum_{v \in B_u} \frac{PR(v)}{L(v)}$$

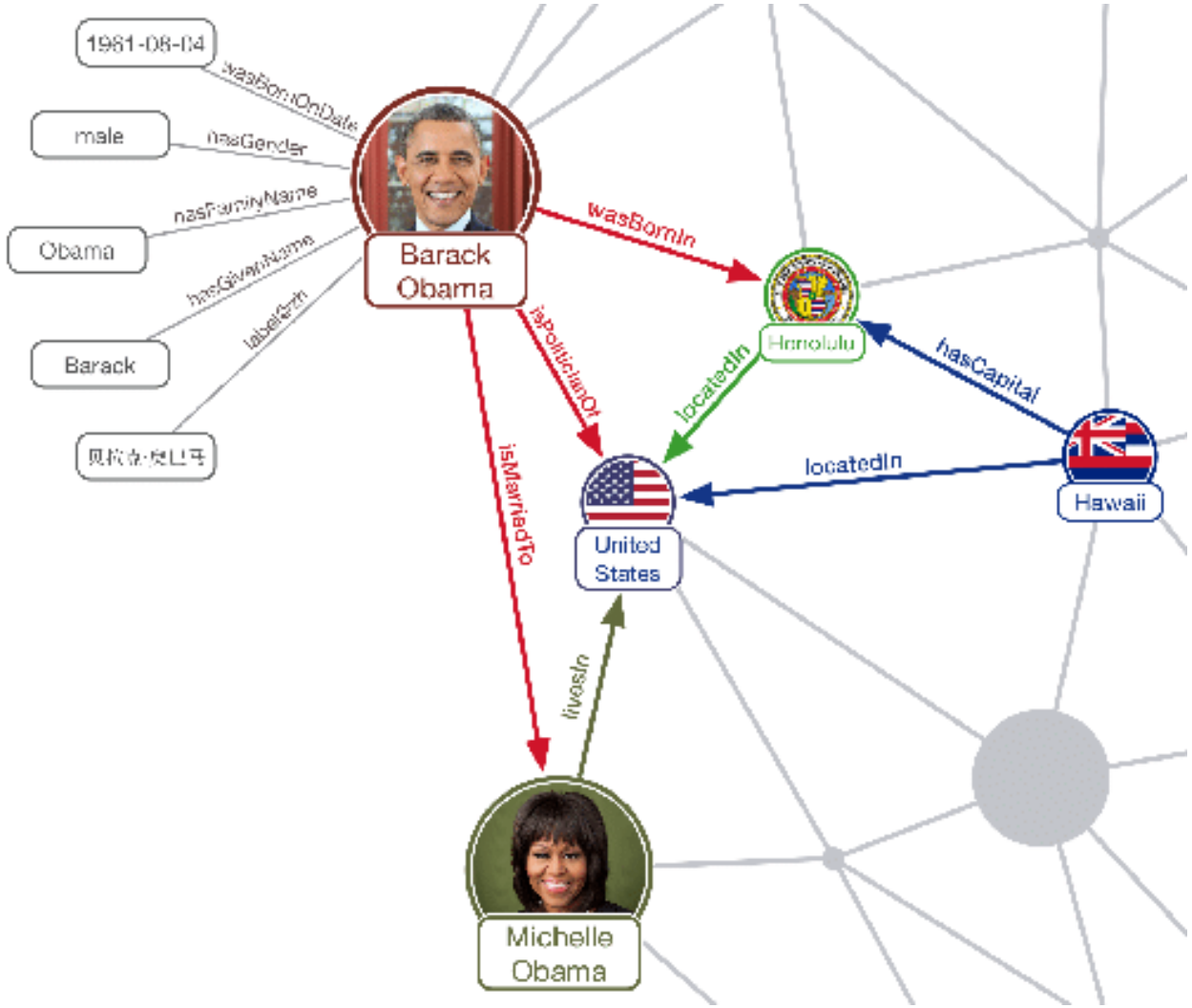
4

Knowledge Graphs

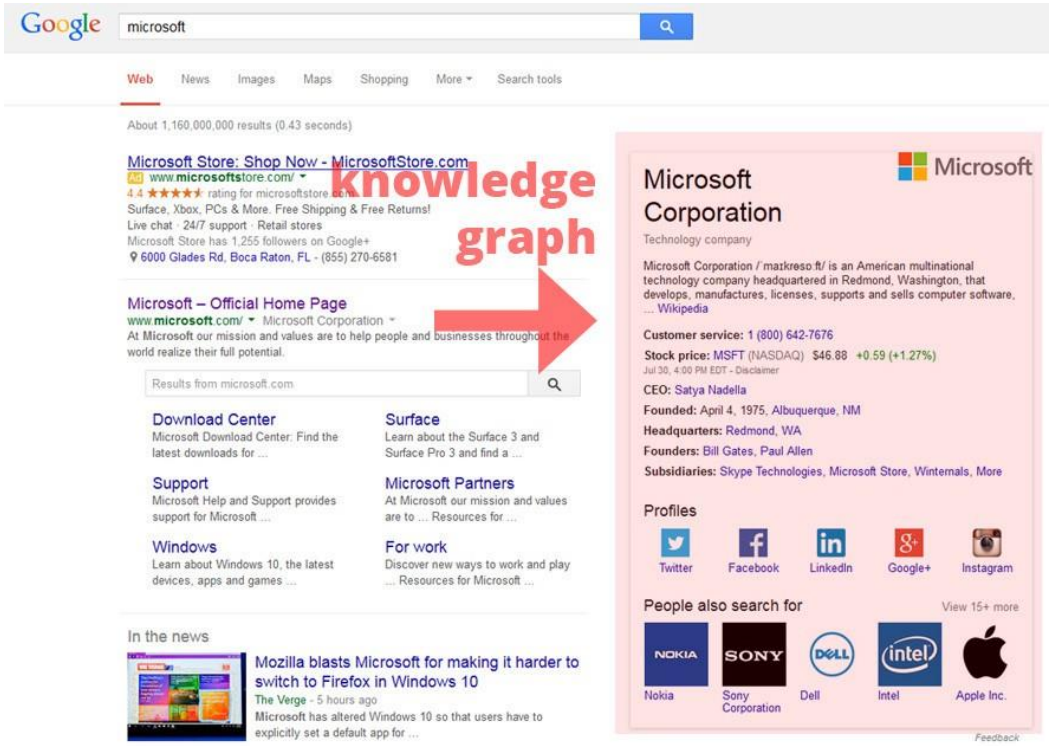
Introduction

Knowledge Graph Overview

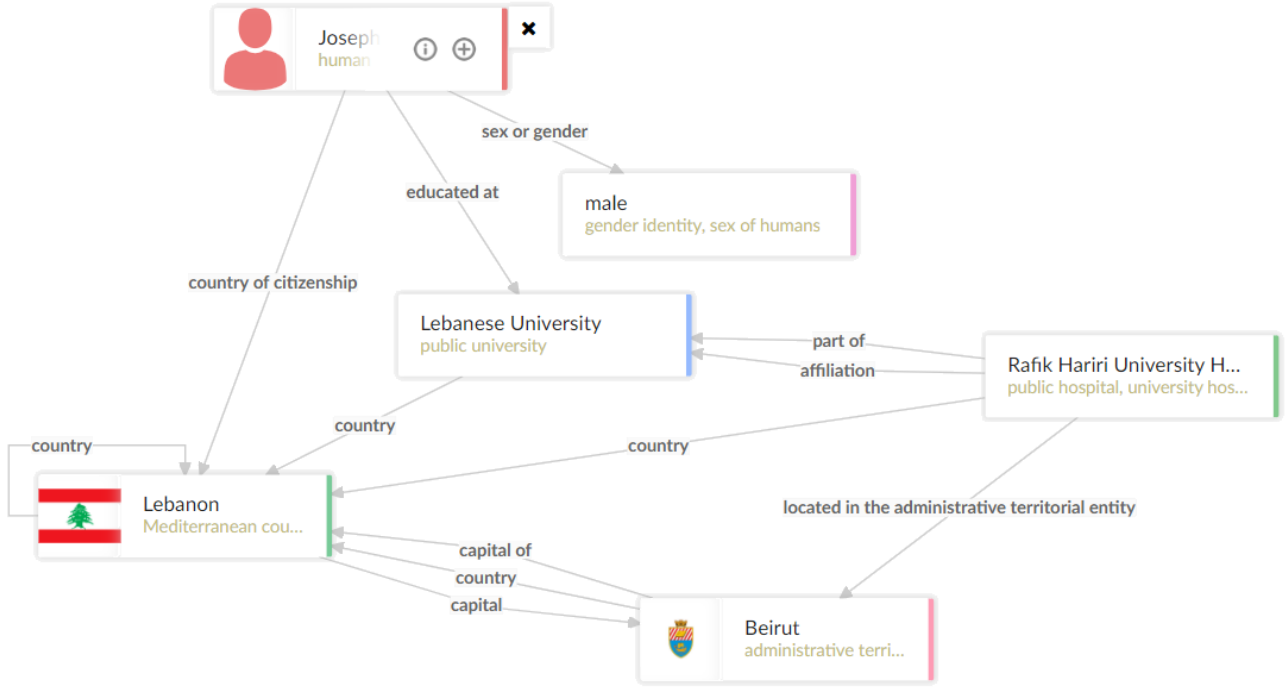
- **Knowledge Graphs** are networks (graphs) of knowledge that represents who knows what. Dislike Social Networks that addresses who knows who.
- **Knowledge Graphs** uses the same concepts of Graph theory, that is used similarly in SNA structure.
- **Definition**: **knowledge graph** is a knowledge base that uses a graph-structured data model or topology to integrate data.
- **Knowledge graphs** are often used to store interlinked descriptions of entities – objects, events, situations or abstract concepts – with free-form semantics.



Knowledge Graphs platforms



Google KG



Wikidata KG