FIT1043 Introduction to Data Science

Module 4: Data Resources, Processes, Standards and Tools

Lecture 8

Monash University

Discussion

In the tutorial you used three different tools for data wrangling:

- SAS
  - general purpose Data Analytics
  - strange syntax!
  - very widely used commercial product
- DataWrangler
  - specialised Data Wrangling tool
  - intuitive Graphical User Interface (GUI)
  - no coding required!
- Python
  - general purpose open-source programming language
  - contains packages (Pandas) for manipulating data

Note that there are many other tools we could have used

- R, Matlab, Java, SPSS.

Unit Schedule: This Week

Module	Week	Content
1.	1	overview and look at projects
	2	(job) roles, and the impact
2.	3	data business models
	4	application areas and case studies
3.	5	characterising data and "big" data
	6	data sources and case studies
4.	7	resources and standards
	8	**resources case studies**
5.	9	data analysis theory
	10	data analysis process
6.	11	issues in data management
	12	data management frameworks

Standards and Issues (ePub section 4.5)

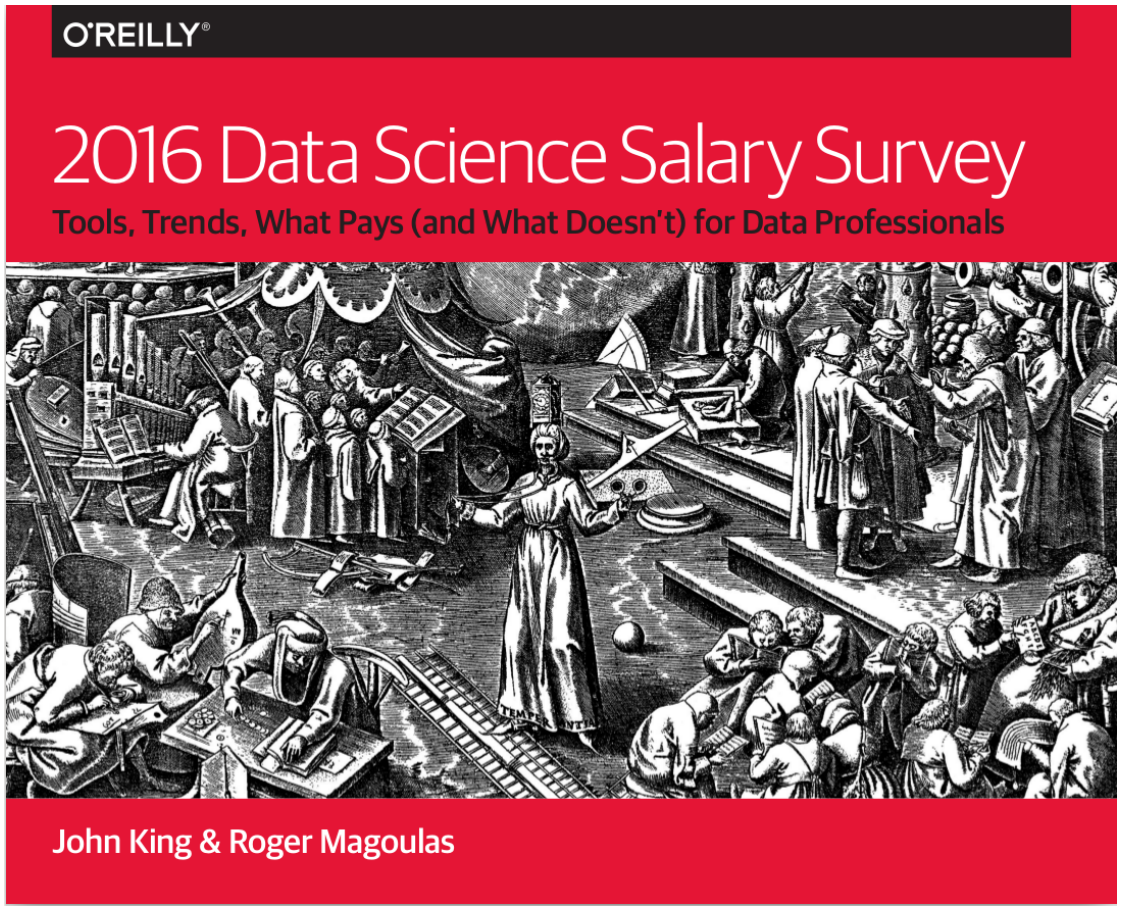
more on standards and issues

- some standards
  - some standards for semi-structured data, data science process and predictive models
- open data and open source software
  - critical infrastructure and tools
- APIs and SaaS
  - think Web 3.0

Standards and Issues
Open data and open source software

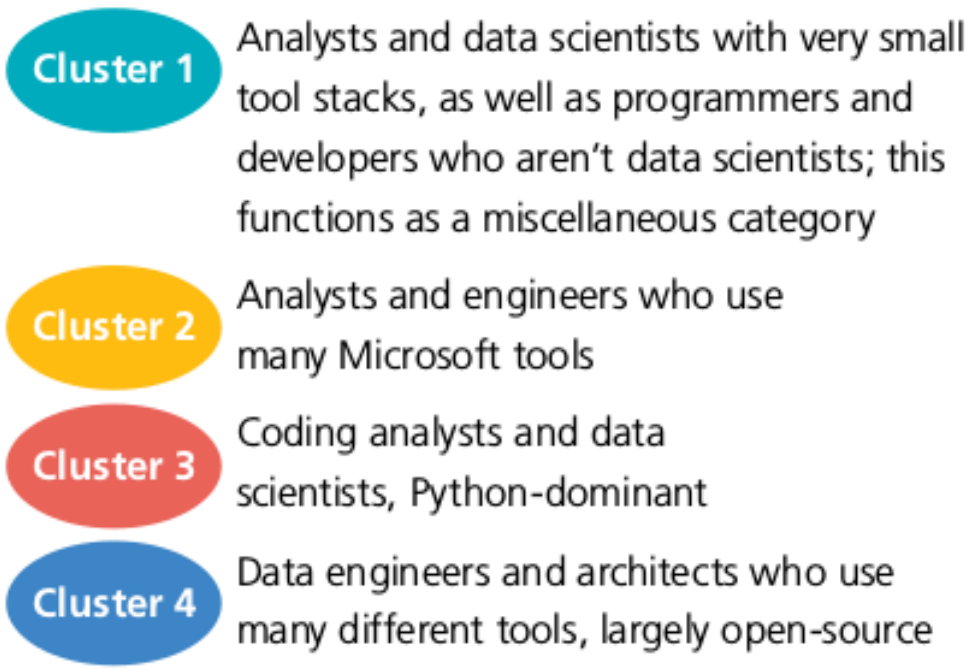
critical infrastructure and tools

Software Usage Survey



2016 Data Science Salary Survey (DSSS)

Survey: Clusters amongst the Respondents

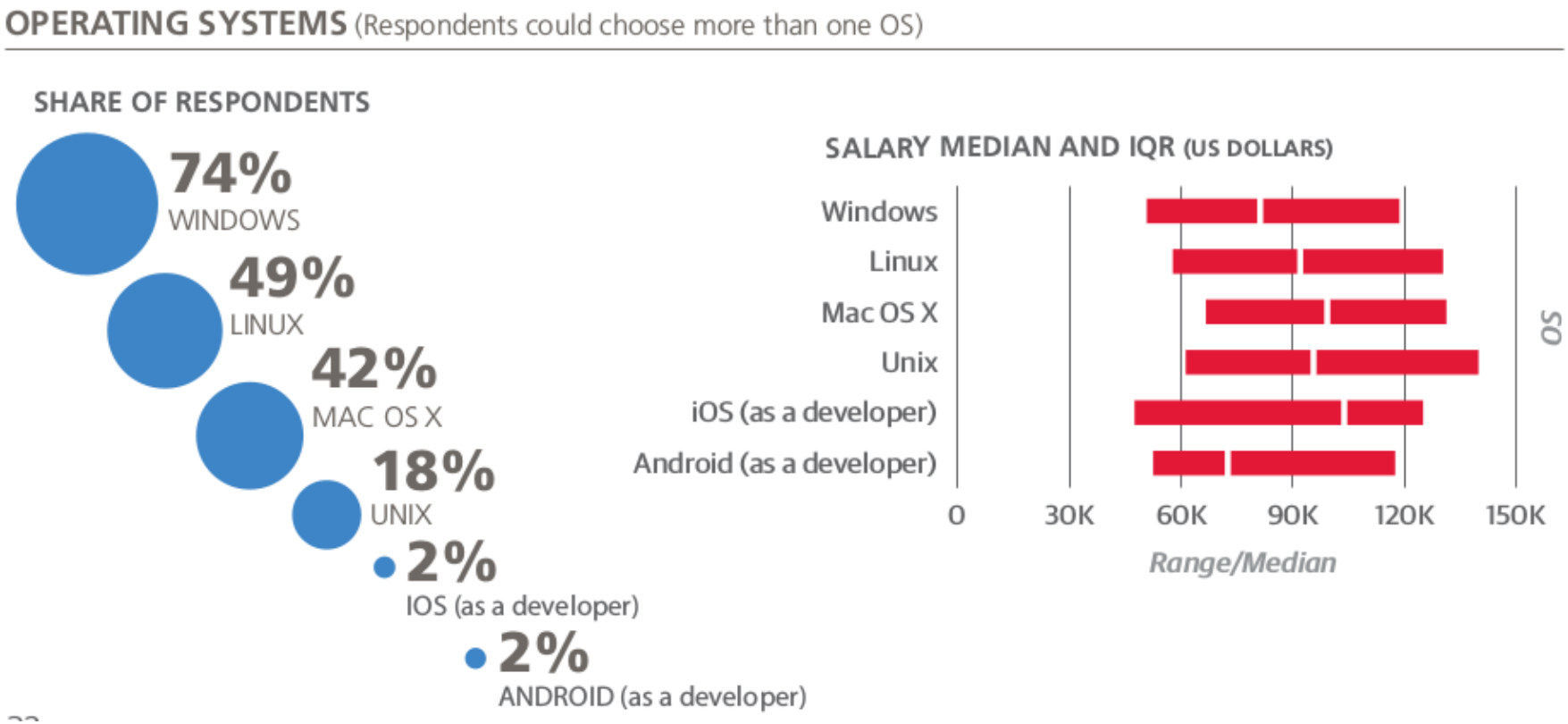


Survey: Commonly Used Software

	Cluster			
Tools	1	2	3	4
Windows	86%	92%	48%	55%
SQL	62%	75%	65%	80%
Excel	66%	84%	59%	60%
R	30%	69%	67%	69%
Python	27%	32%	96%	84%
Linux	37%	21%	70%	91%
Mac OS X	26%	23%	70%	67%
MySQL	26%	33%	41%	57%
ggplot	13%	33%	53%	52%
Microsoft SQL Server	32%	51%	17%	27%
Tableau	17%	56%	21%	37%
Scikit-learn	7%	7%	73%	57%
Matplotlib	5%	5%	67%	42%
Oracle	22%	31%	10%	30%
Bash	9%	7%	42%	58%
PostgreSQL	11%	12%	26%	53%
Spark	9%	6%	20%	69%

	Cluster			
Tools	1	2	3	4
Hive	11%	13%	23%	46%
Java	16%	8%	14%	44%
Unix	10%	12%	21%	36%
JavaScript	12%	8%	18%	39%
Apache Hadoop	5%	6%	18%	55%
Shiny	5%	19%	21%	27%
D3	5%	6%	20%	49%
Spark MlLib	2%	3%	14%	49%
Visual Basic/VBA	11%	24%	6%	5%
Cloudera	6%	8%	11%	30%
SQLite	7%	4%	15%	24%
Redshift	5%	7%	10%	21%
MongoDB	4%	5%	15%	24%
ElasticSearch	5%	3%	9%	33%
Teradata	6%	13%	8%	13%
PowerPivot	10%	19%	2%	2%
C++	7%	3%	13%	17%
Weka	5%	5%	8%	25%

Survey: Operating Systems



Survey: Number of Tools used

(from 2014 survey)

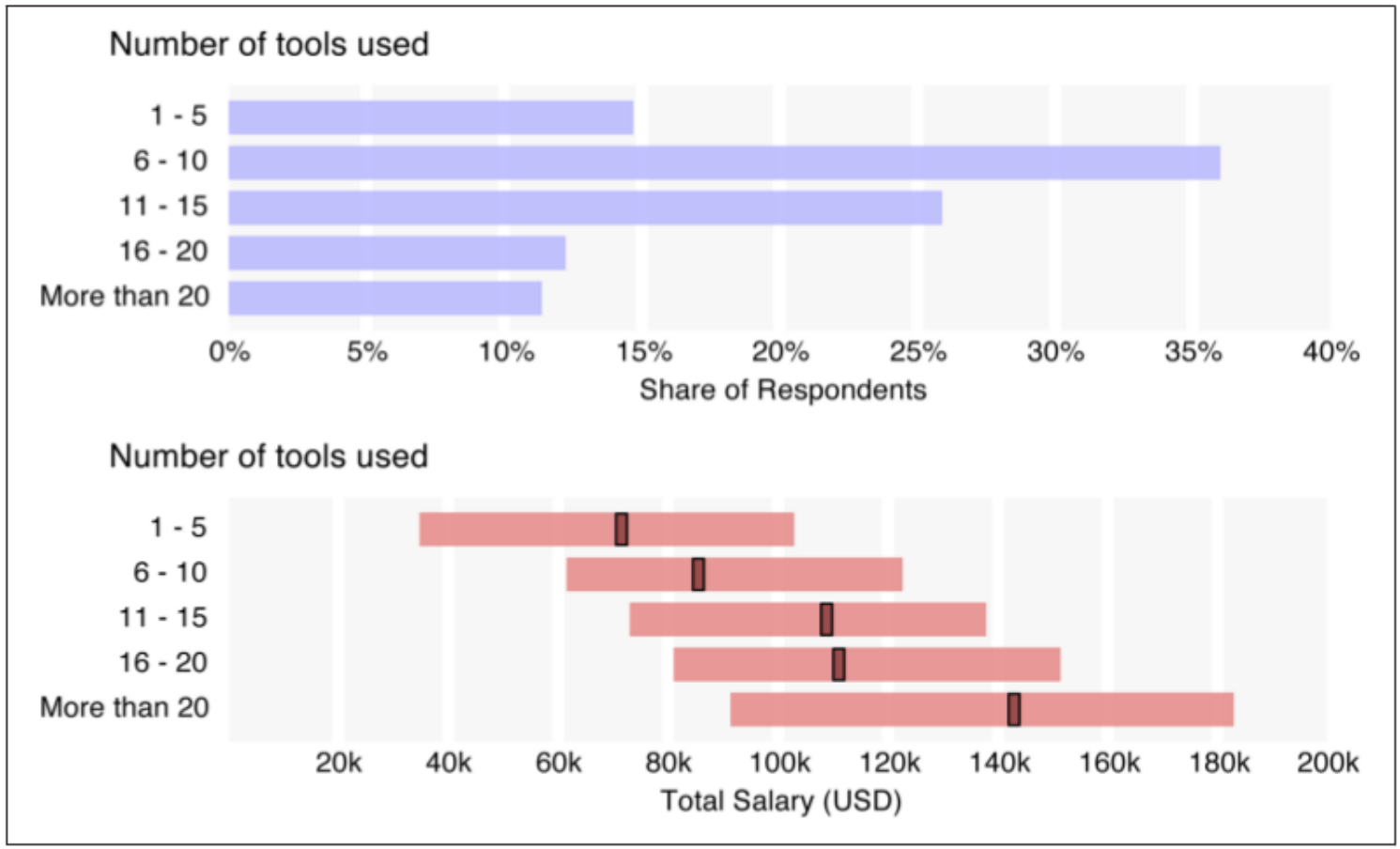
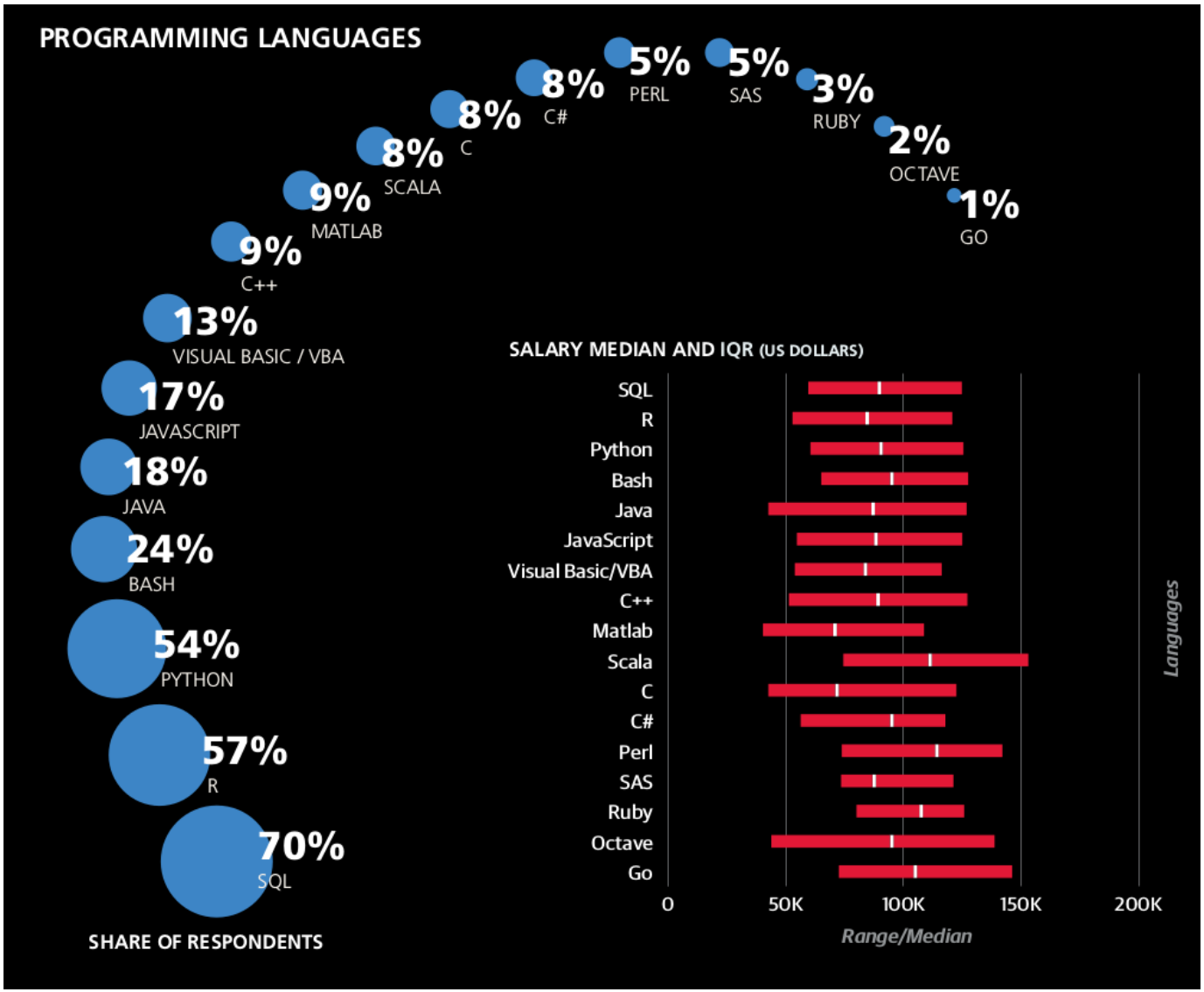
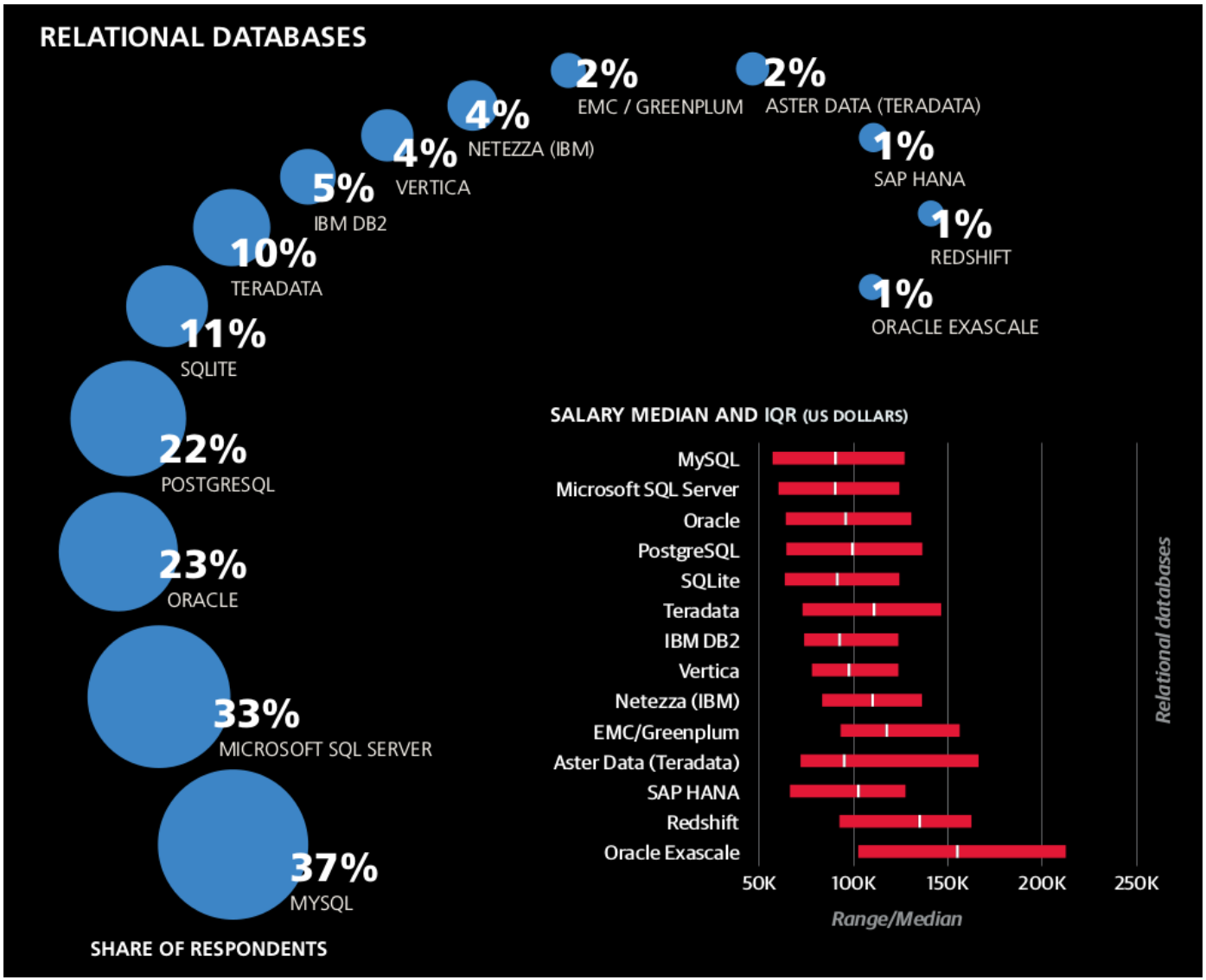


Figure 1-13. Number of tools used

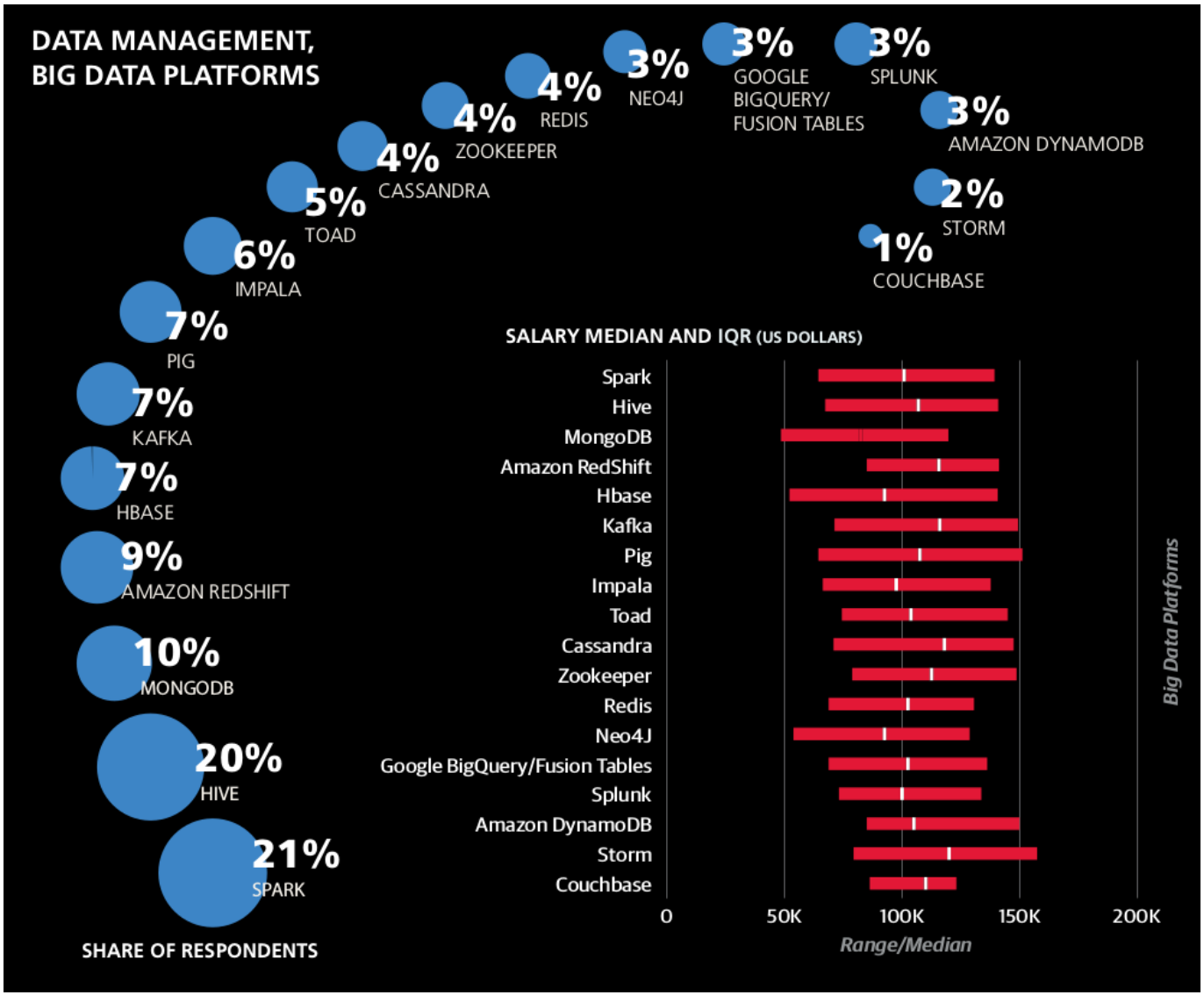
Survey: Programming Languages



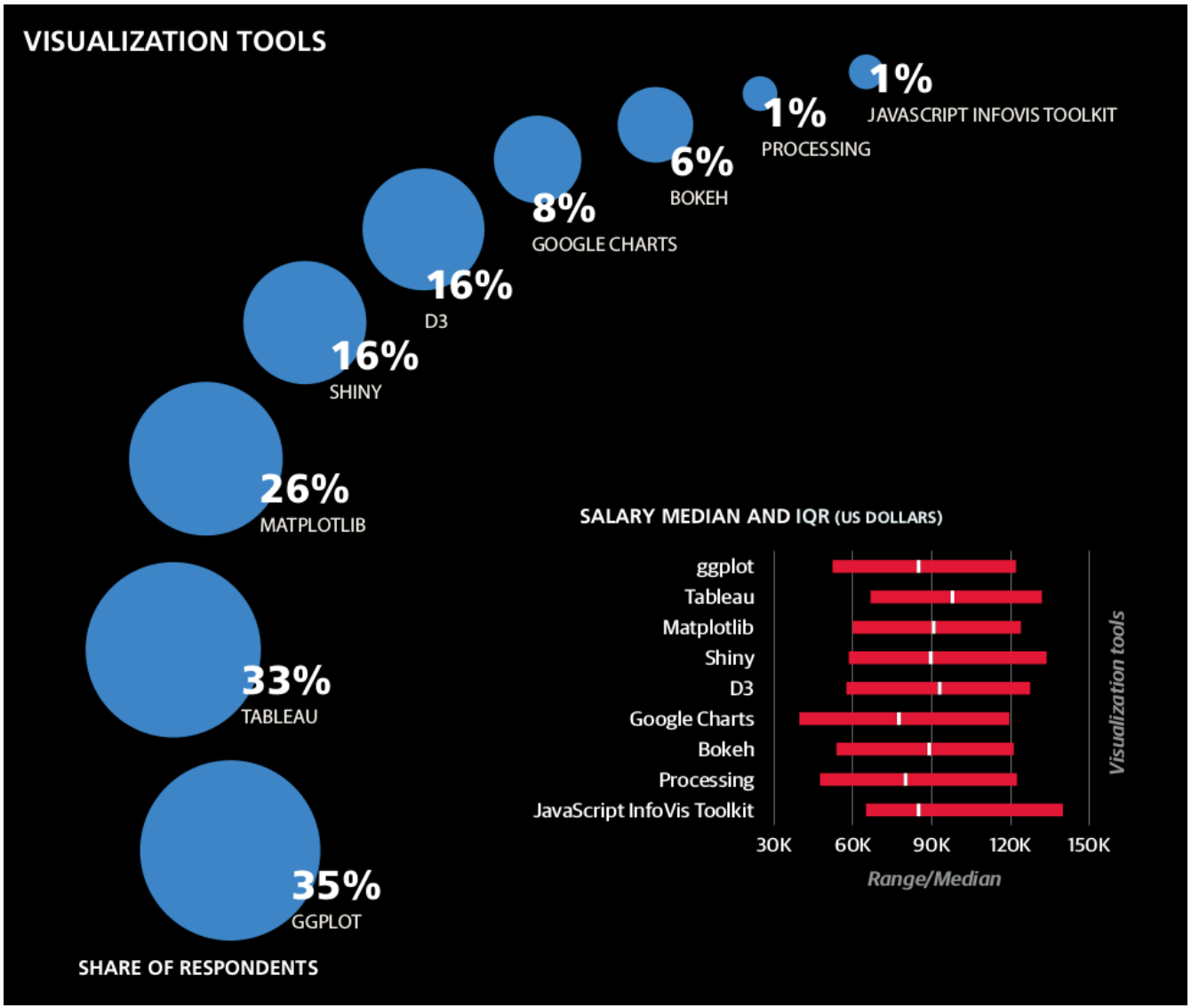
Survey: Relational Databases



Survey: Management and Big Data



Survey: Visualization



Open Source Software: Examples

Prize winning Open Source platforms for managing big data:

- *BOSSIE Awards for Big Data 2015*
- Similar awards also for applications:
  - *BOSSIE Awards for Applications 2015*

Many of the state-of-the-art platforms are integrated in:

- *Hortonworks Data Platform*

Popular Open Source Projects

Let's have a look at what all these Open Source Projects doing

1. *Hadoop Distributed File System (HDFS)*
2. *Apache Hadoop YARN*
3. *Apache Cassandra*
4. *Apache HBase*
5. *Apache Hive*
6. *Apache Mahout*
7. *Apache Pig*
8. *Apache Spark*
9. *Apache Storm*
10. *Apache Tez*

Standards and Issues
APIs and SaaS

think Web 3.0

REST API Terminology

API: **A**pplication **P**rogrammer **I**nterface

- Routines providing programatic access to an application.

REST: **RE**presentational **S**tate **T**ransfer

- a stateless API usually running over HTTP
- Watch a simple introduction to REST-based APIs in this video: *REST API concepts and examples* by WebConcepts

SaaS: **S**oftware **a**s **a** **S**ervice

- The provisioning of software in a Web browser and/or via an API over the Web as a subscription service.

The API Economy

Companies provide functionality via APIs so that others can make use of their data and services:

- *The Application Economy: A New Model for IT* (CISCO)
- *ProgrammableWeb API Category: Data*
- *Top 30 Predictive Analytics API*

Example APIs

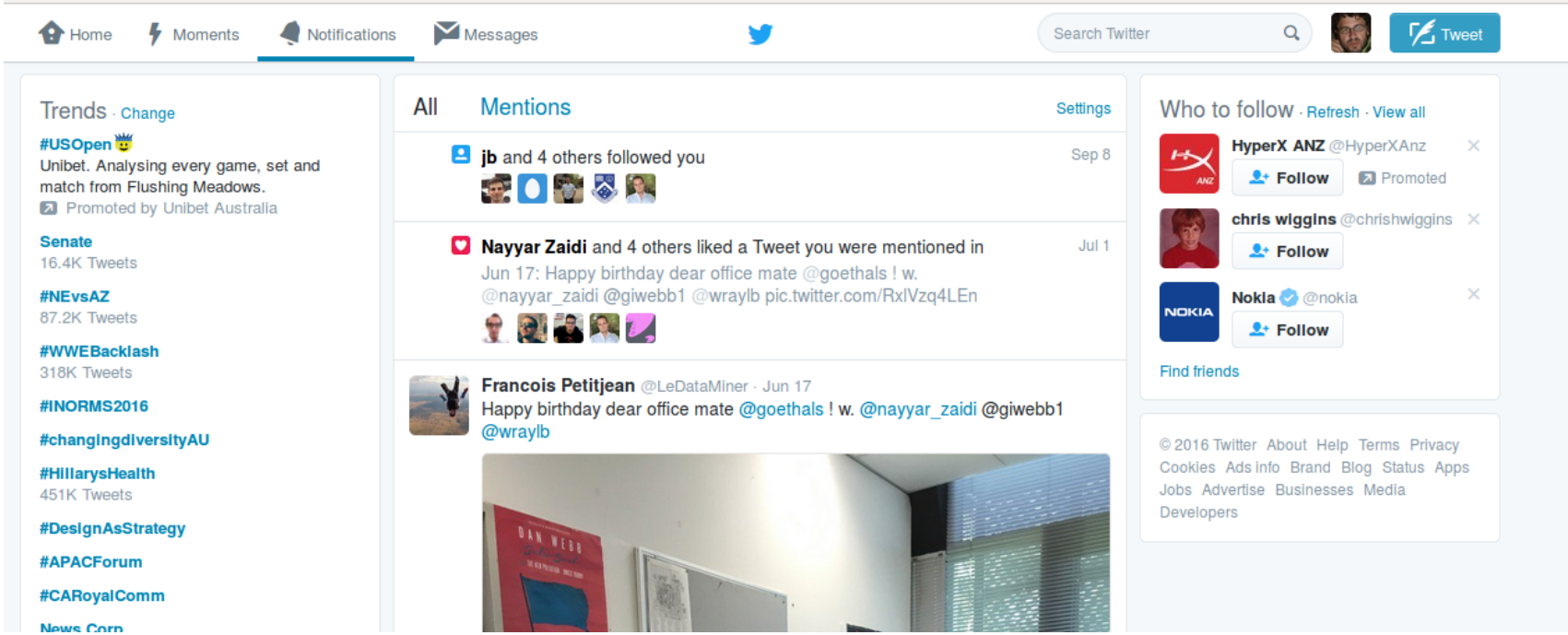
Many companies are exposing their data **and their website functionality** as APIs for others to make use of:

- *Facebook API*
- *Twitter API*
- *LinkedIn API*
- *Google Maps API*
- *Youtube API*
- *Amazon Advertising API*
- *TripAdvisor API*

Case Studies of Data and Standards (ePub section 4.8)

look at some examples of standardised data collections

Twitter



- microblogging with attached media
- big corporate use
- also has information about users, their follower network, locations, hashtags, emojis+emoticons, ...

Sample Twitter XML Data

```
<?xml version="1.0" encoding="UTF-8" ?>
- <statuses type="array">
  - <status>
      <created_at>Wed Jun 10 00:57:28 +0000 2009</created_at>
      <id>2097065233</id>
      <text>sitting in vegas @ airport, kid in stroller, with dvd player in lap. First ever for me. HELLO!</text>
      <source>web</source>
      <truncated>false</truncated>
      <in_reply_to_status_id />
      <in_reply_to_user_id />
      <favorited>false</favorited>
      <in_reply_to_screen_name />
    - <user>
        <id>5189091</id>
        <name>kristin bednarz</name>
        <screen_name>kristinbednarz</screen_name>
        <location>iPhone: 33.447393,-101.821675</location>
        <description>photographer in WEST TEXAS</description>
        <profile_image_url>http://s3.amazonaws.com/twitter_production/profile_images/80432676/BIO_norr
        <url>http://www.yourlifemypassion.com</url>
        <protected>false</protected>
        <followers_count>245</followers_count>
        <profile_background_color>352726</profile_background_color>
        <profile_text_color>3E4415</profile_text_color>
        <profile_link_color>D02B55</profile_link_color>
        <profile_sidebar_fill_color>99CC33</profile_sidebar_fill_color>
        <profile_sidebar_border_color>829D5E</profile_sidebar_border_color>
        <friends_count>90</friends_count>
        <created_at>Thu Apr 19 04:54:45 +0000 2007</created_at>
        <favourites_count>3</favourites_count>
        <utc_offset>-21600</utc_offset>
        <time_zone>Central Time (US & Canada)</time_zone>
```

Twitter App Ecosystem

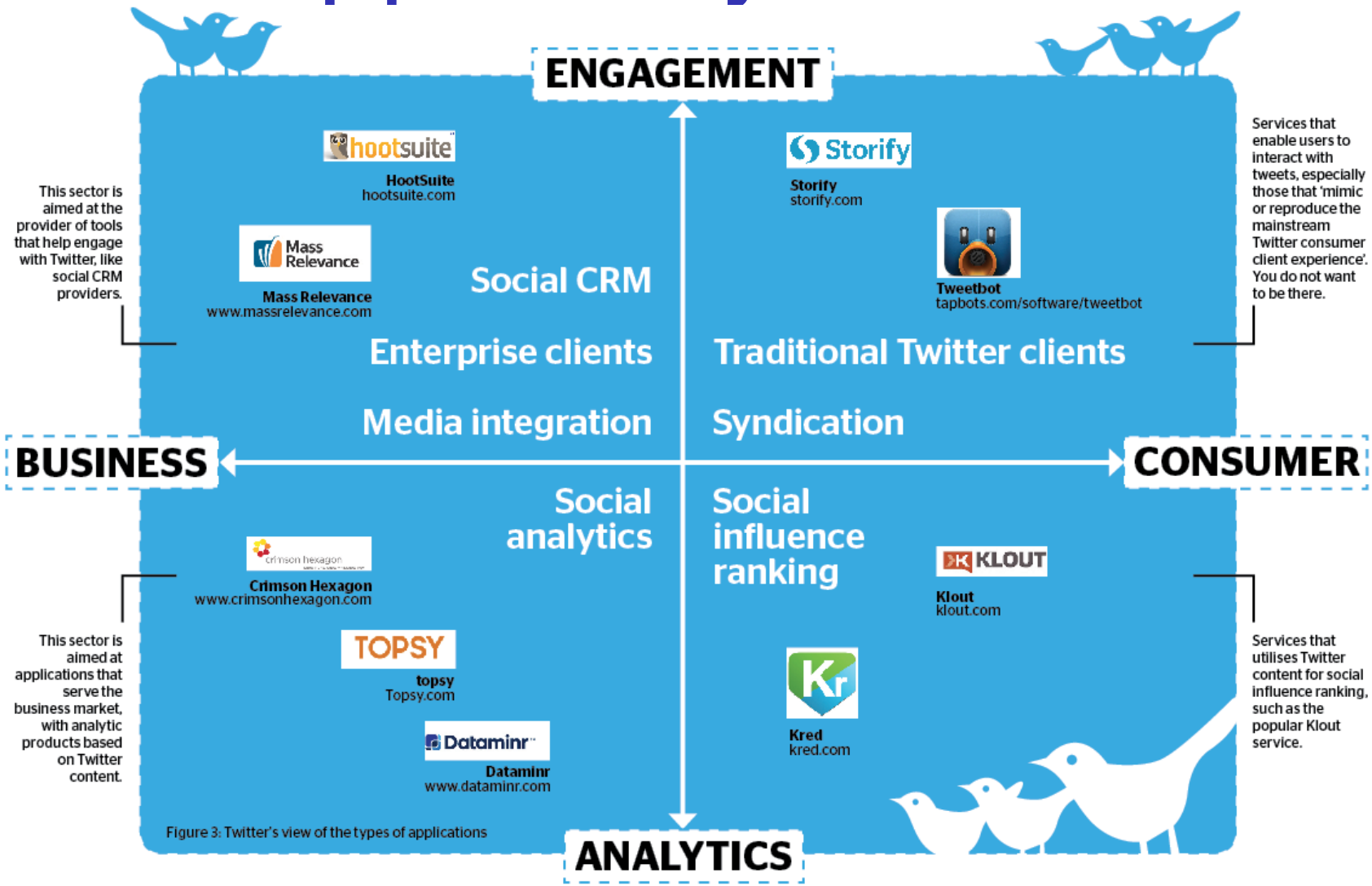


Figure 3: Twitter's view of the types of applications

from *Gadgetdaily.xyz*

Twitter Developer API

See *Twitter's developer platform*

- library interfaces for Java, C++, Javascript, Python, Perl, PHP, Ruby, ...
- allows other applications to manage Twitter data for users
- extensive developer policy
- lots of *example case studies*

Freebase and DBPedia

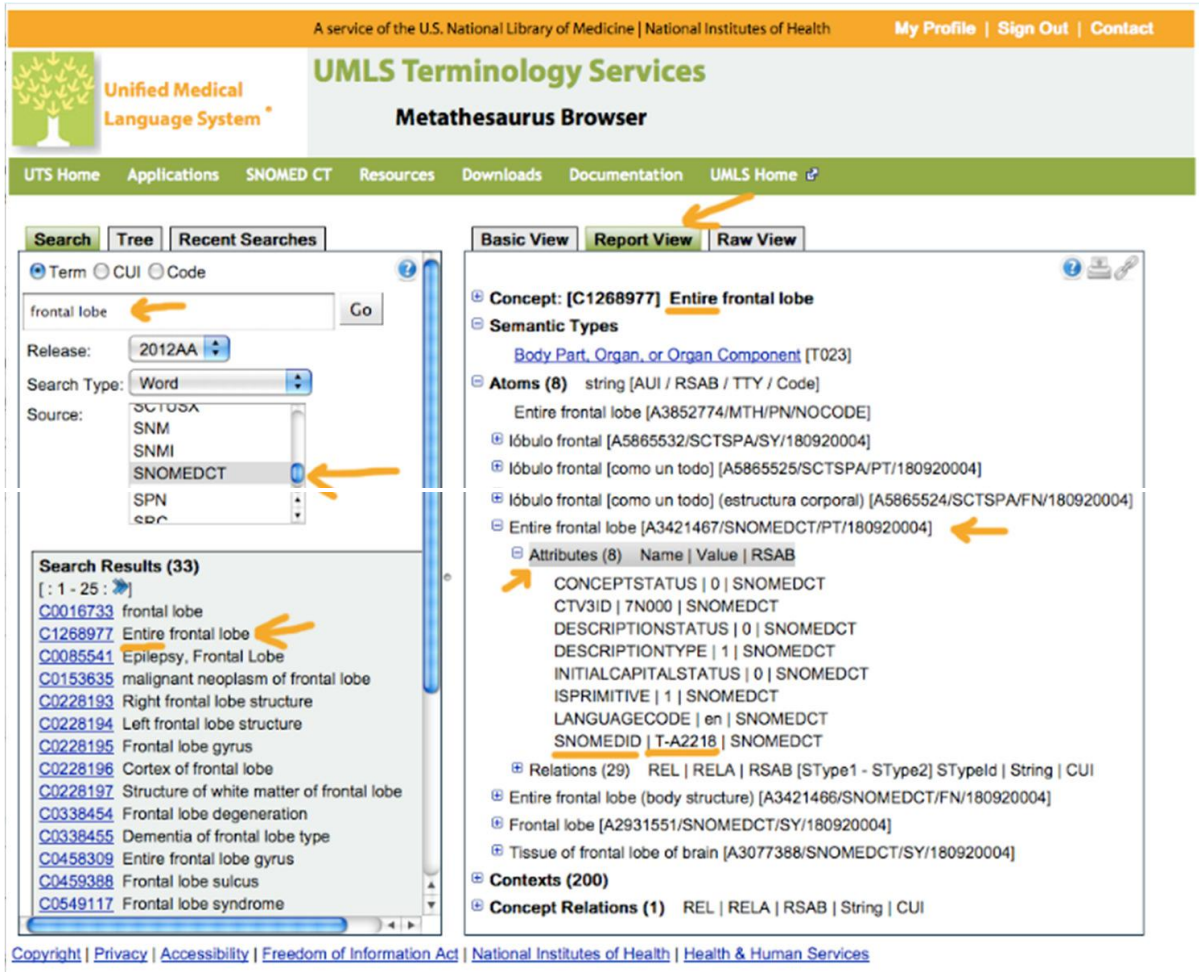
Freebase:

- an example of a graph database we looked at earlier
- graph can be represented in RDF which is triples of URIs
- now owned by Google, currently read-only (may be decommissioned soon)
- used by others as a knowledge-base in many text processing pipelines:
  - *e.g.*, using *TextRazor* to extract meaning from text

DBpedia:

- aim to extract all structured content from information in Wikipedia
- open source project

Medical Data Dictionaries



The Unified Medical Language System (UMLS)

Medical Data Dictionaries, cont.

ICD: the **I**nternational **C**lassification of **D**iseases

- used to classify diseases and other health problems
- based on health and vital records
- for example:
  - *Pneumonia due to Streptococcus pneumoniae*

Medical Data Dictionaries, cont.

Other Medical Dictionaries:

- *SNOMED CT*
  - Systematized Nomenclature of Medicine Clinical Terms
- *Gene Ontology*
  - concepts for describing gene function

Usage of Medical Dictionaries:

- controlled vocabularies
- semantic data exploration
- clinical surveillance
- decision support

Publishing Repositories

- PUBMED, we have seen before
- *ACM Digital Library*
- Patent databases (for WIPO, USPTO, EPO, *etc.*), *e.g.*, *Global Patent Search Network*

News and Event Registry

Event Registry

- collect news article globally, process and organise as events
- perform concept and event identification
- create a document database for inspection
- sometimes news stored as *NewsML*

Government Data

- US Government's *Data.GOV*
- *NYC Open Data*
- *Australia's Urban Intelligence Network (AURIN)*
- *BioGrid Australia*

Unit Schedule: Next Week

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	4	application areas and case studies
3.	5	characterising data and "big" data
	6	data sources and case studies
4.	7	resources and standards
	8	resources case studies
5.	**9**	**data analysis theory**
	10	data analysis process
6.	11	issues in data management
	12	data management frameworks