Web Development - Introduction

INF1802

Profa. Melissa Lemos

Agenda

- Historical Perpective
- What is a Web Application
- Web 1.0, 2.0, 3.0
- Design Patterns

Main Reference

- Coursera – Course Web Application Architectures,
  - Prof. Greg Heileman
  - Universidade do Novo México
  - Module 1: Introduction and Background
  - https://pt.coursera.org/course/webapplications

Historical Perspective


1945
1970
1980
1990
2000
2010

This timeline starts in 1945, which is when computing actually started, so this is a fairly recent phenomena.

Wolrd War II

The electronic computer was created in 1946 and it was called the ENIAC, which stands for the *Electronic Numerical Integrator and Calculator*. This computer was used primarily to compute artillery tables.

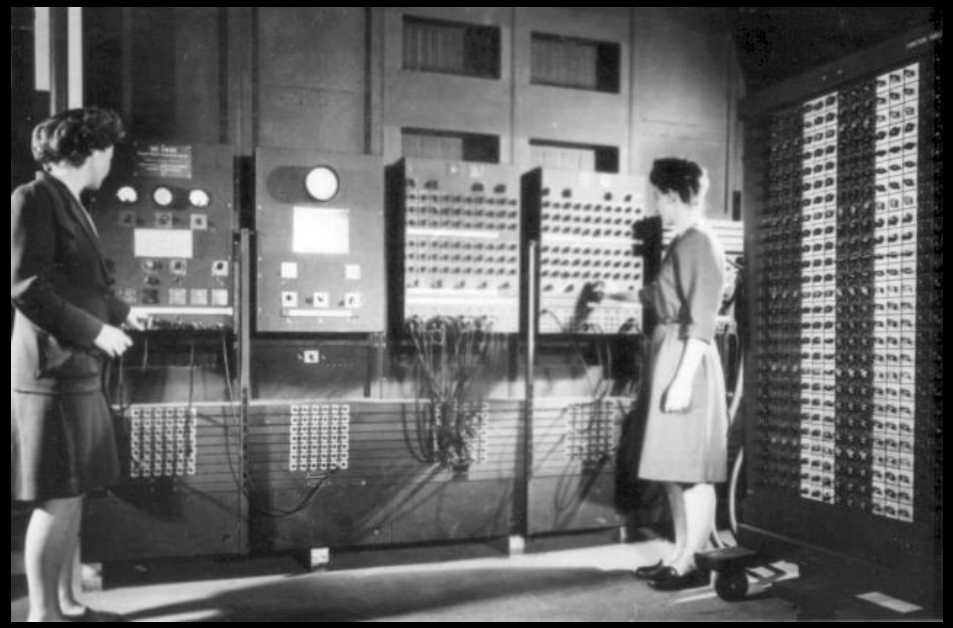
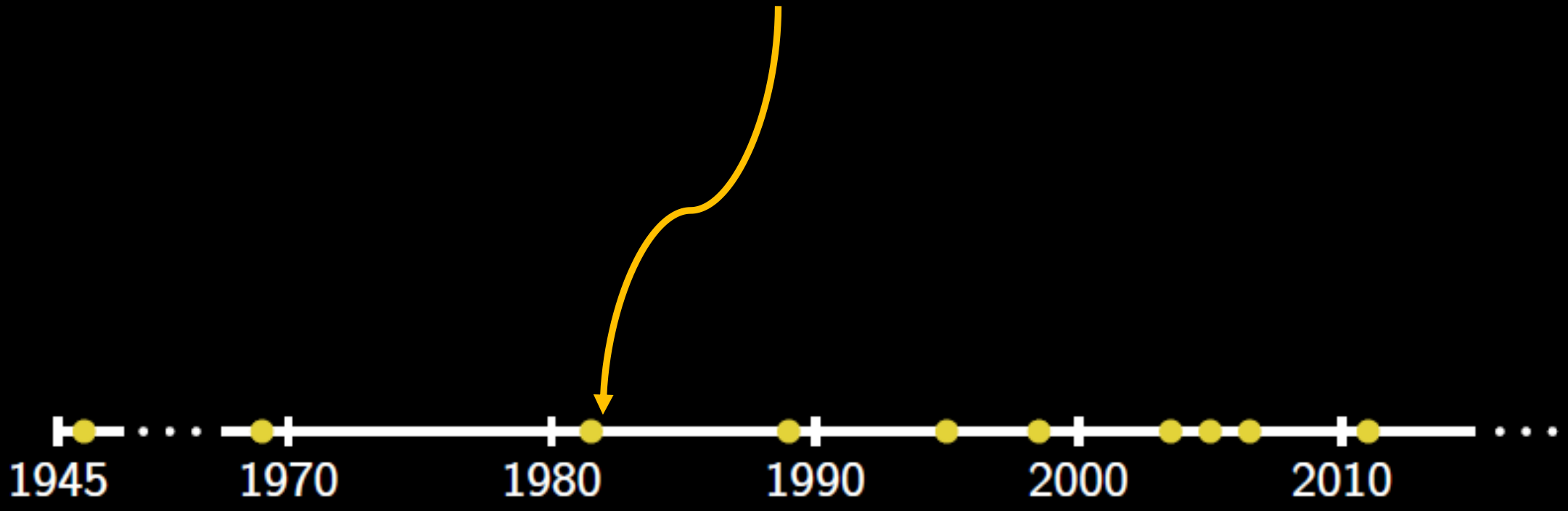


Image from wikipedia

In 1969, the ARPANET was produced. This is a communication network that was funded by ARPA, the *Advanced Research Project Agency* which is an agency of the Department of Defense for the United States government.
Early computing, was largely related to military applications.

Cold War

In 1981, the internet protocols were standardized.
In particular, the TCP/IP protocol which we still use in internet applications was standardized, and this opened up the door for the creation of the World Wide Web.
In the 1970s and 80s, business began to make more use of computing.

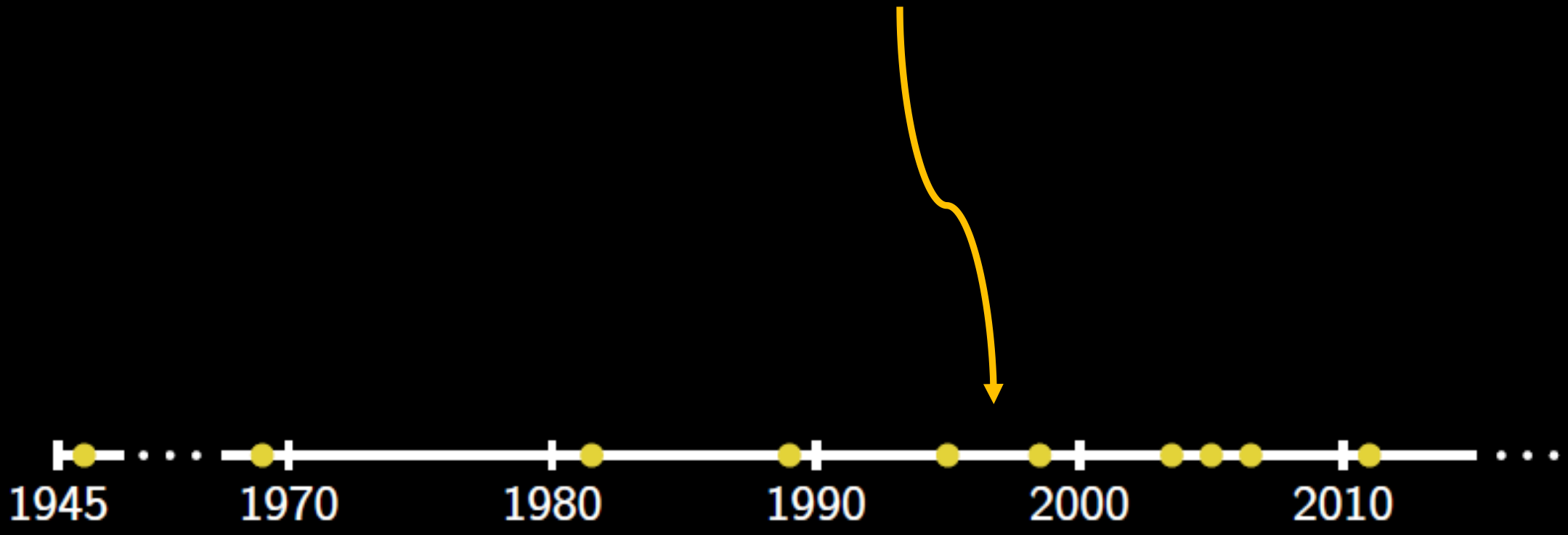


Tim Berners-Lee was working at CERN in 1989 when he conceived of the World Wide Web. The first web server and a website were created by Tim Berners-Lee in 1990.

Web 1.0 architectures involve the creation of static web pages and this is when the first web browser came about.

Some people refer to the 1980s through 90s as the **PC era**.
This is when the IBM PC was introduced and it became easy for anyone to purchase a computer and use it for word processing applications, spreadsheet applications and so on.

In 1995, Amazon was founded as a company.
In 1998, Google was founded.



Web 2.0 really led to the wide-scale adoption of the web as a computing platform for business purposes.
Interactivity and social networking became more prominent on the web.
Online commerce was fostered by Amazon and others.
There was some lightweight collaboration taking place and the first wikis appeared.

2011, HTML5 was released

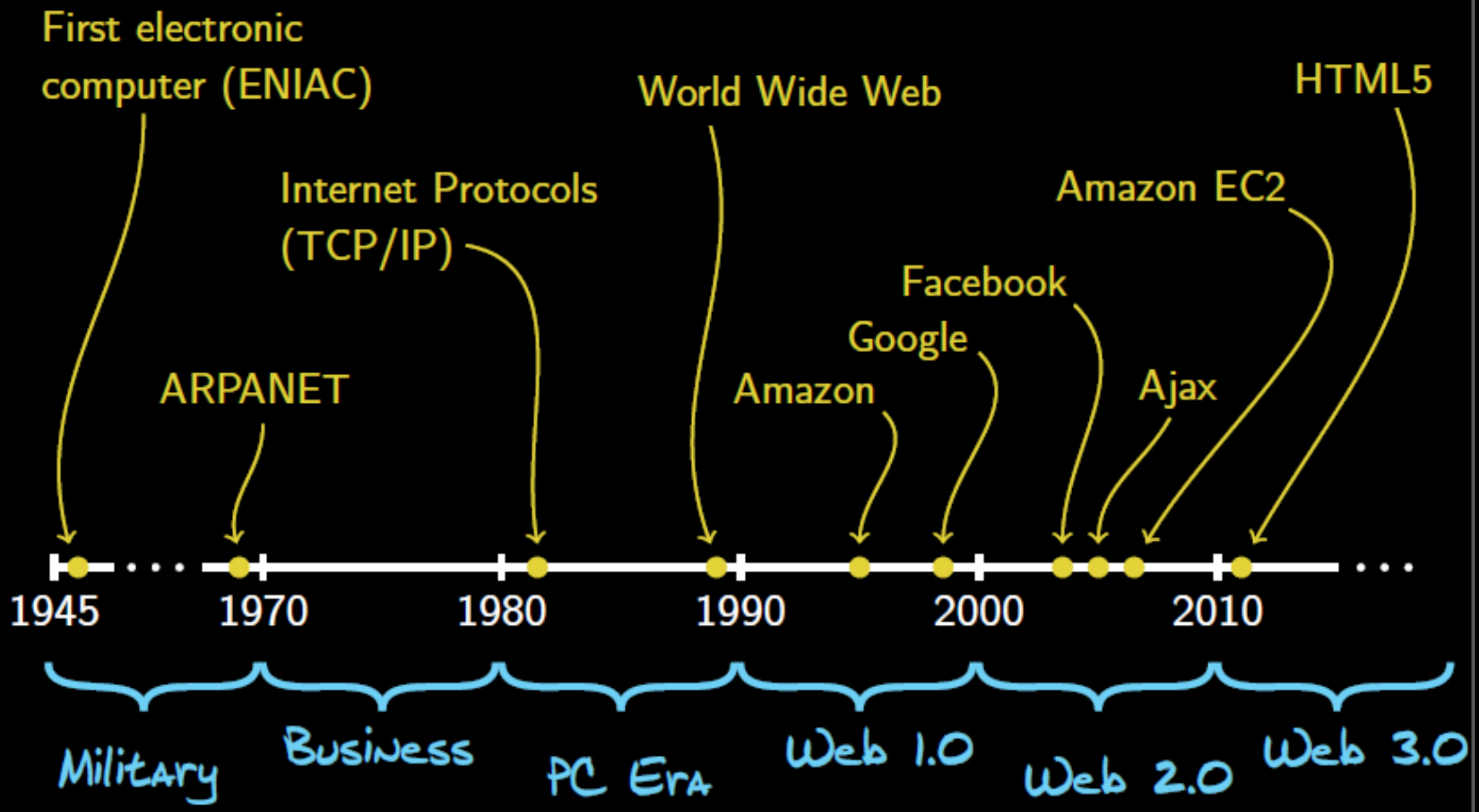
2006, Amazon EC2,
the first really widespread use of cloud computing

2005, Google – Ajax.
Web sites much more interactive

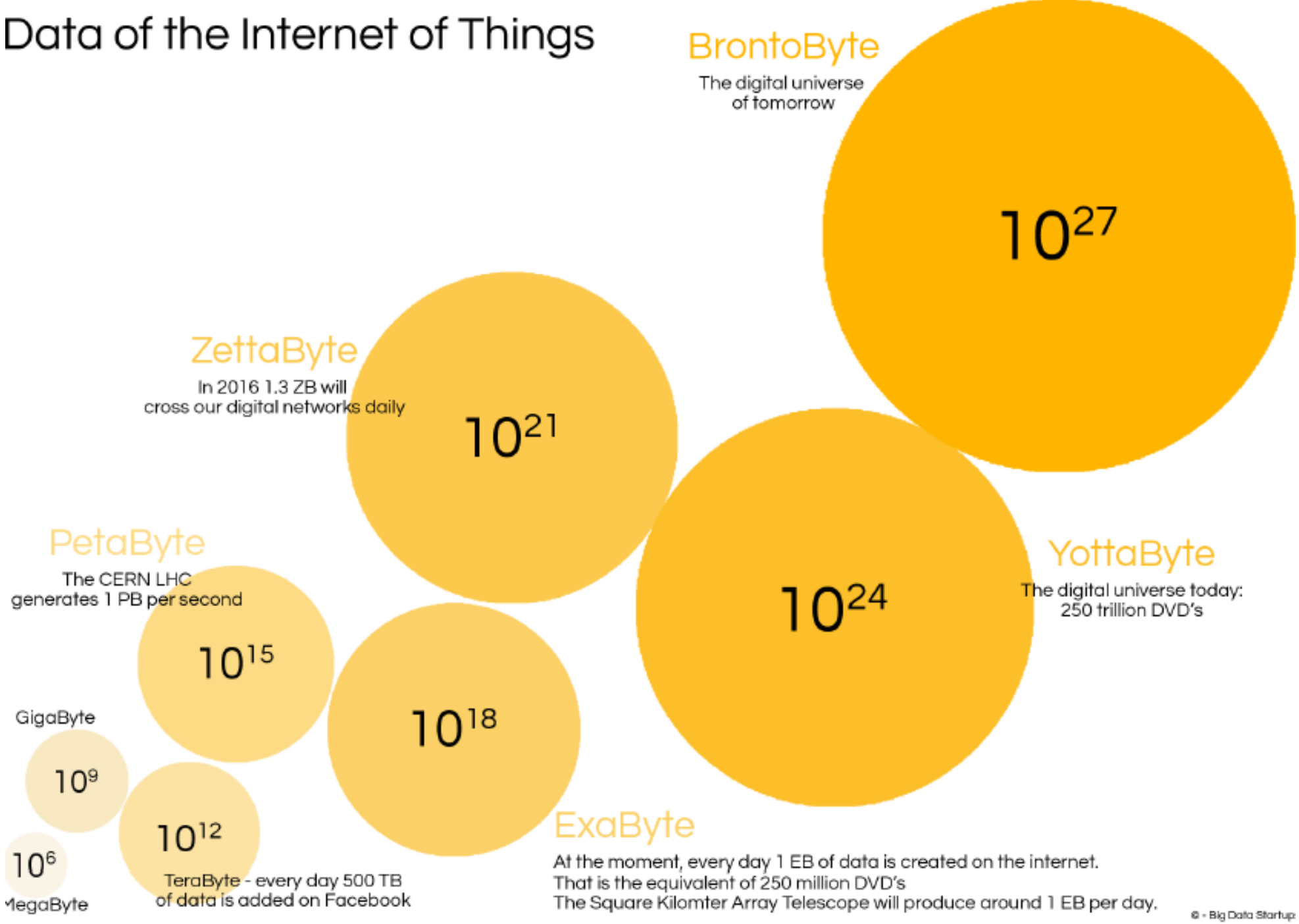
2004, Facebook

2003, Skype

We're now in the **Web 3.0** era.
In Web 3.0, we see the emergence of the “intelligent web”. This is machine-facilitated understanding of information that's contained on the web. And, you'll hear the term the semantic web or natural language processing.
Machine learning. Recommender systems. Cloud computing.
Mobile platforms. Metadata associated with the data.


First electronic computer (ENIAC)
World Wide Web
HTML5
Internet Protocols (TCP/IP)
Amazon EC2
Facebook
Google
ARPANET
Amazon
Ajax
1945
1970
1980
1990
2000
2010
Military
Business
PC Era
Web 1.0
Web 2.0
Web 3.0

Data of the Internet of Things



Variety of Data

Vehicle,asset,person & pet monitoring & controlling

Agriculture automation

Energy consumption

Security & surveillance

Building managment

Embedded Mobile

Internet of things

Everyday things get connected for smarter tomorrow

M2M & wireless sensor network

Everyday things

Smart homes & cities

Telemedicine & helthcare

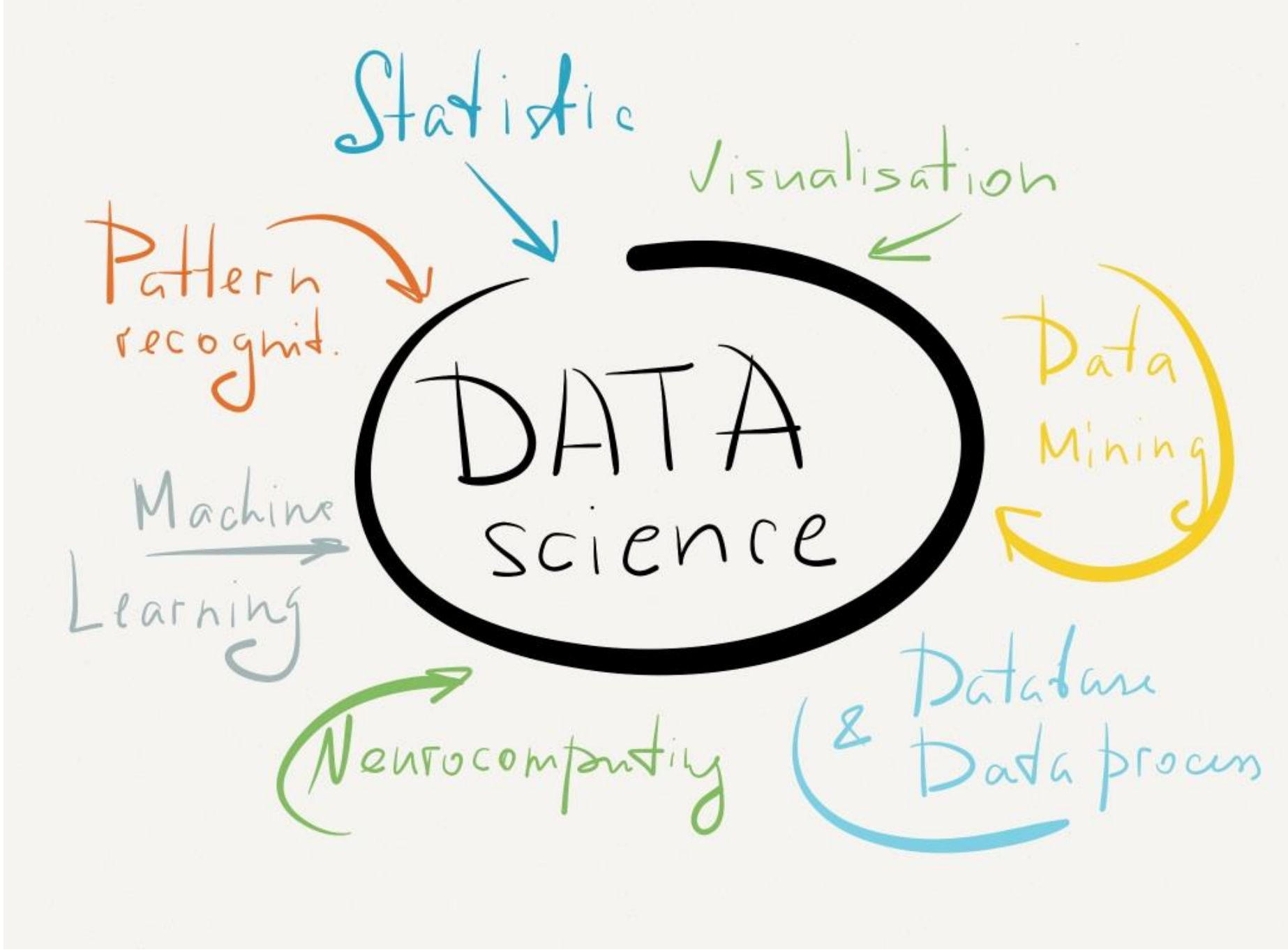
Light bulbs
Security
Pet Feeding
Irrigation Controller
Smoke Alarm
Refrigerator
Infotainment
Washer / Dryer
Stove
Energy Monitoring

Traffic routing
Telematics
Package Monitoring
Smart Parking
Insurance Adjustments
Supply Chain
Shipping
Public Transport
Airlines
Trains

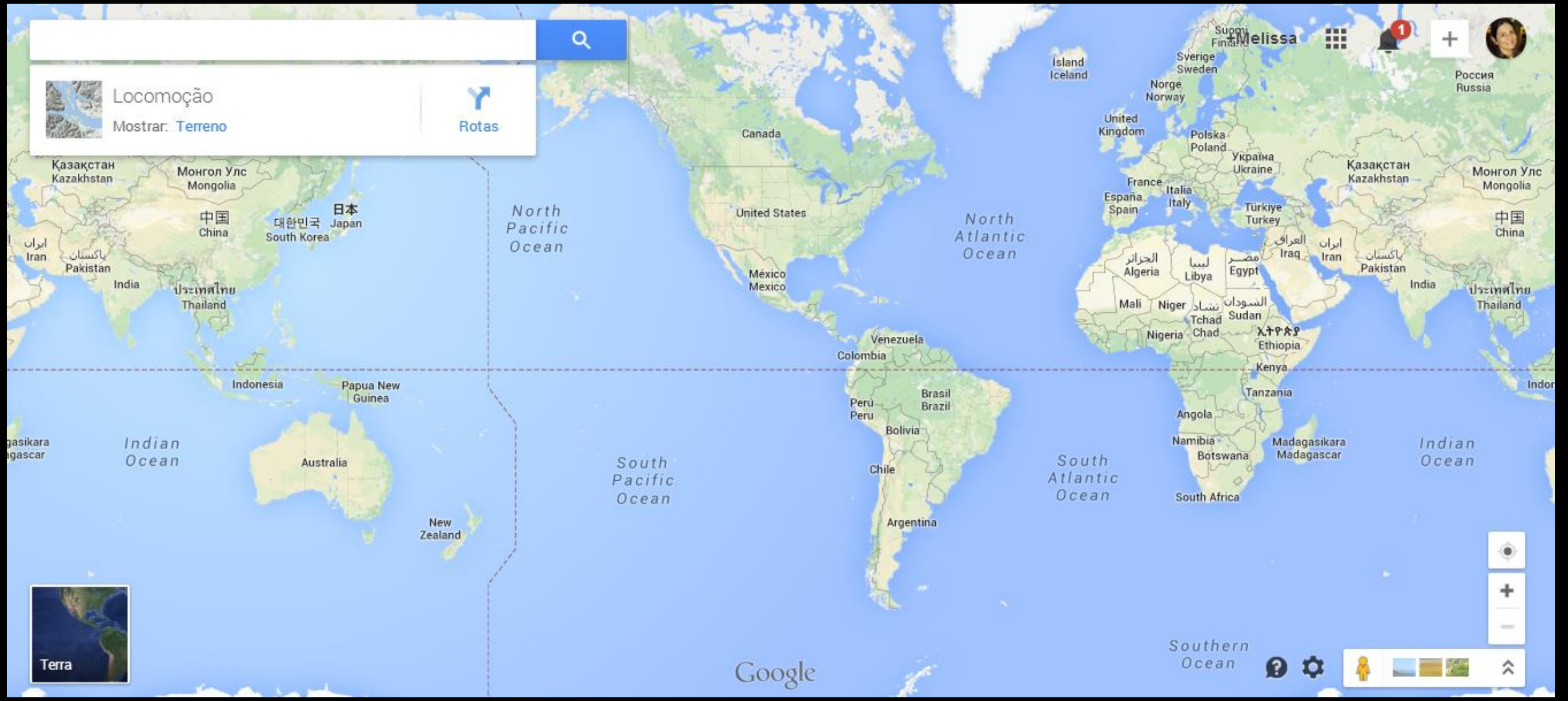
Patient Care
Elderly Monitoring
Remote Diagnostic
Equipment Monitoring
Hospital Hygiene
Bio Wearables
Food sensors

HVAC
Security
Lighting
Electrical
Transit
Emergency Alerts
Structural Integrity
Occupancy
Energy Credits

Electrical Distribution
Maintenance
Surveillance
Signage
Utilities / Smart Grid
Emergency Services
Waste Management


Statistic
Visualisation
Pattern recoghit.
DATA science
Data Mining
Machine Learning
Neurocomputing
Database & Data procus

Big Data


Locomoção
Mostrar: Terreno
Rotas
+Melissa
Canada
United States
México
Mexico
North Pacific Ocean
North Atlantic Ocean
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
Southern Ocean
Venezuela
Colombia
Perú
Peru
Brasil
Brazil
Bolivia
Chile
Argentina
Indonesia
Papua New Guinea
Australia
New Zealand
Қазақстан
Kazakhstan
Монгол Улс
Mongolia
中国
China
日本
Japan
대한민국
South Korea
ایران
Iran
پاکستان
Pakistan
India
ประเทศไทย
Thailand
Россия
Russia
Suomi Finland
Sverige
Sweden
Norge
Norway
Island
Iceland
United Kingdom
Polska
Poland
Україна
Ukraine
France
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Angola
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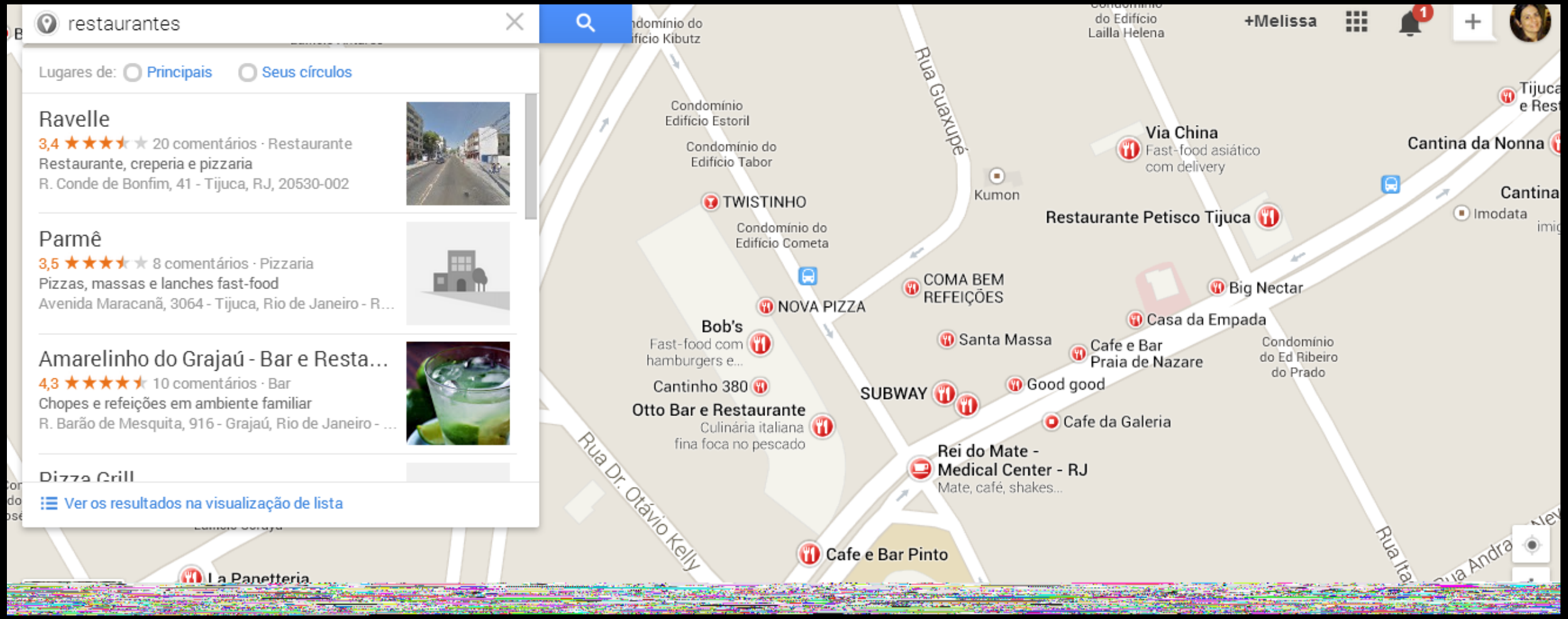
Botswana
South Africa
Madagasikara
Madagascar
Terra
Google

Small Data

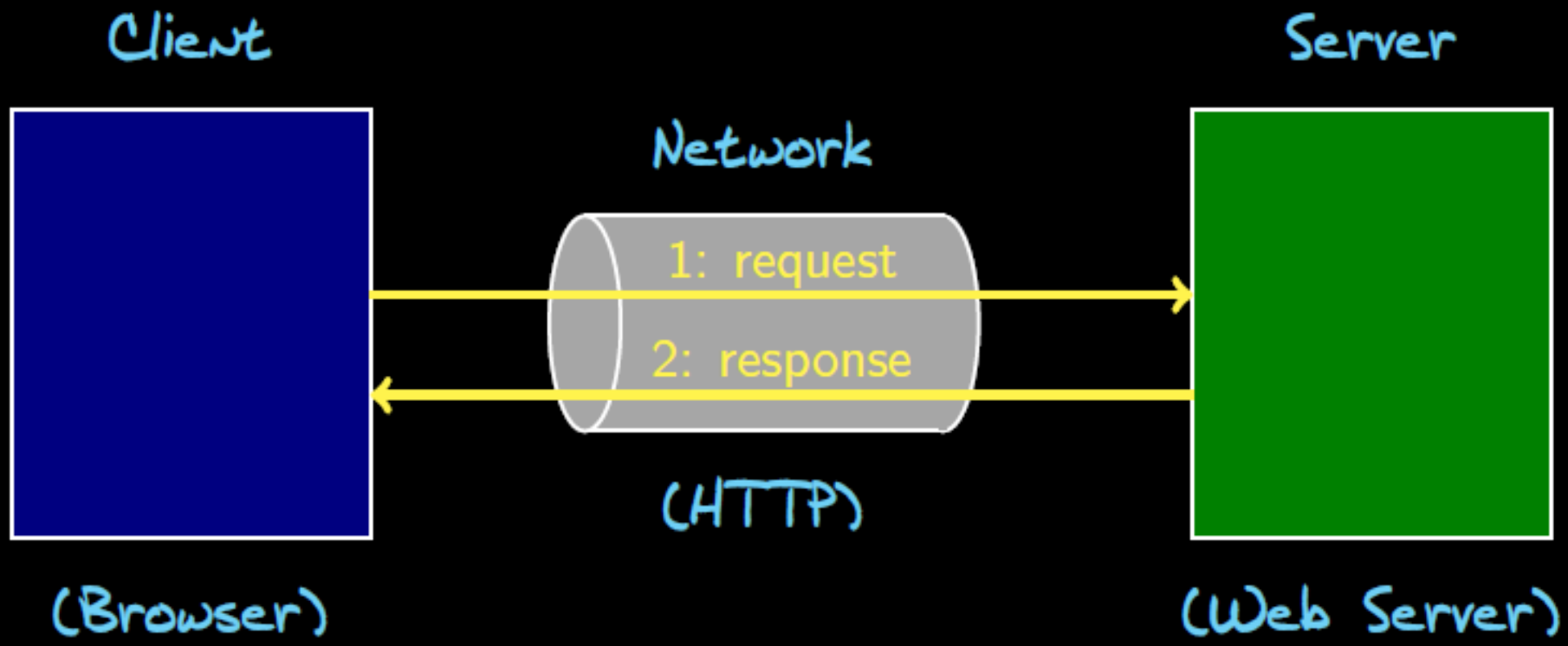

restaurantes
Lugares de: Principais Seus círculos
Ravelle
3,4 20 comentários · Restaurante
Restaurante, creperia e pizzaria
R. Conde de Bonfim, 41 - Tijuca, RJ, 20530-002
Parmê
3,5 8 comentários · Pizzaria
Pizzas, massas e lanches fast-food
Avenida Maracanã, 3064 - Tijuca, Rio de Janeiro - R...
Amarelinho do Grajaú - Bar e Resta...
4,3 10 comentários · Bar
Chopes e refeições em ambiente familiar
R. Barão de Mesquita, 916 - Grajaú, Rio de Janeiro - ...
Ver os resultados na visualização de lista
+Melissa
Rua Guaxupé
Condomínio Edifício Estoril
Condomínio do Edifício Tabor
Condomínio do Edifício Cometa
TWISTINHO
Kumon
Via China
Fast-food asiático com delivery
Restaurante Petisco Tijuca
Cantina da Nonna
Imodata
COMA BEM REFEIÇÕES
NOVA PIZZA
Bob's
Fast-food com hamburgers e...
Big Nectar
Casa da Empada
Santa Massa
Cafe e Bar Praia de Nazare
Condomínio do Ed Ribeiro do Prado
Cantinho 380
SUBWAY
Good good
Otto Bar e Restaurante
Culinária italiana fina foca no pescado
Cafe da Galeria
Rei do Mate - Medical Center - RJ
Mate, café, shakes...
Rua Dr. Otávio Kelly
Cafe e Bar Pinto
La Panetteria

What is Web Application?

Client-Server Model

- The client-server architecture is the most basic model for describing the relationship between the cooperating programs in a web application.
- The two parts of a client-server architecture are:
  - Server component – “listens” for request, and provides services and/or resources accordingly.
  - Client component – establishes a connection to the server, and requests services and/or resources from it.

Client-Server Model



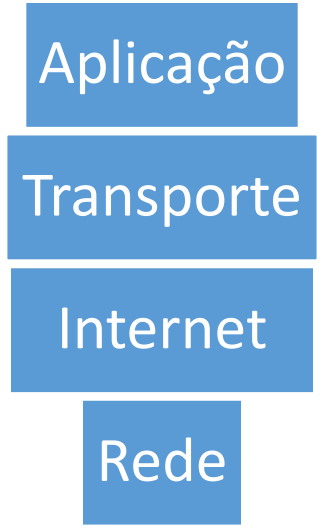
Web Applications

A web application is access by users over a network, using a browser as the client, and consists of a collection of client and server side scripts, HTML pages, and other resources that may be spread across multiple servers.

- The application itself is accessed by specific path events within that server. For example, www.google.com.

- Ex. Webmail, online retail stores, online banks, online auctions, wikis, blogs, document storage, etc.

Web Applications



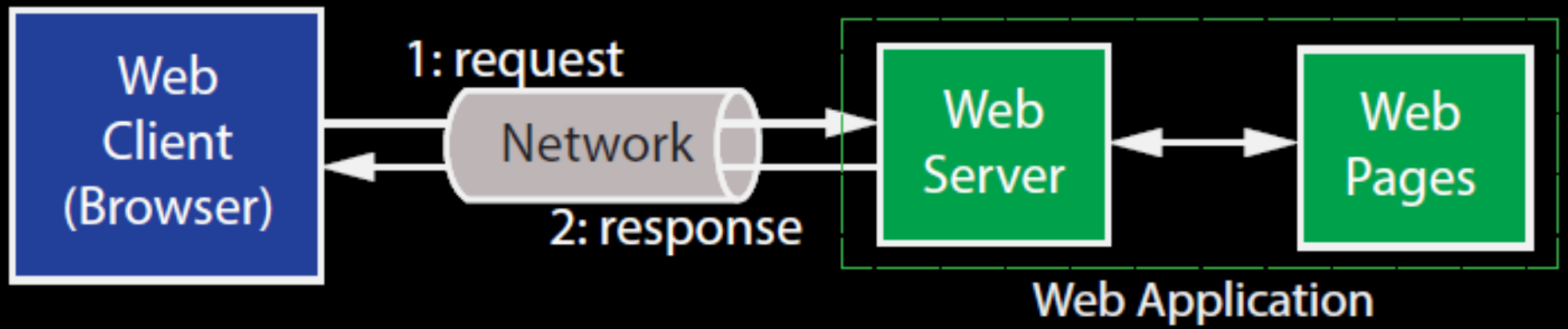
- The Internet, a global system of interconnected computer networks uses the standard Internet protocol suite (TCP/IP).
  - O TCP/IP é um conjunto de protocolos de comunicação entre computadores em rede.
  - Principal protocolo de envio e recebimento de dados na Internet.
  - Pode ser visto como um modelo de camadas, onde cada camada é responsável por um grupo de tarefas, fornecendo um conjunto de serviços bem definidos para o protocolo da camada superior.
  - As camadas mais altas, estão logicamente mais perto do usuário (chamada camada de aplicação) e lidam com dados mais abstratos, confiando em protocolos de camadas mais baixas para tarefas de menor nível de abstração.

Web Applications

- Web (World Wide Web - WWW)
  - A system of interlinked documents (web pages) accessed via the Internet using HTTP.
    - O Hypertext Transfer Protocol (HTTP), em português Protocolo de Transferência de Hipertexto, é um protocolo de comunicação (na camada de aplicação) utilizado para sistemas de informação de hipermídia, distribuídos e colaborativos.
  - Web pages contain hypermedia: text, graphics, images, video and other multimedia, along with hyperlinks to other web pages.
  - Hyperlinks give the Web its structure.
  - The structure of the Web is what makes it useful and gives it value.

Web Architectures

The Basic Architecture



Web 1.0

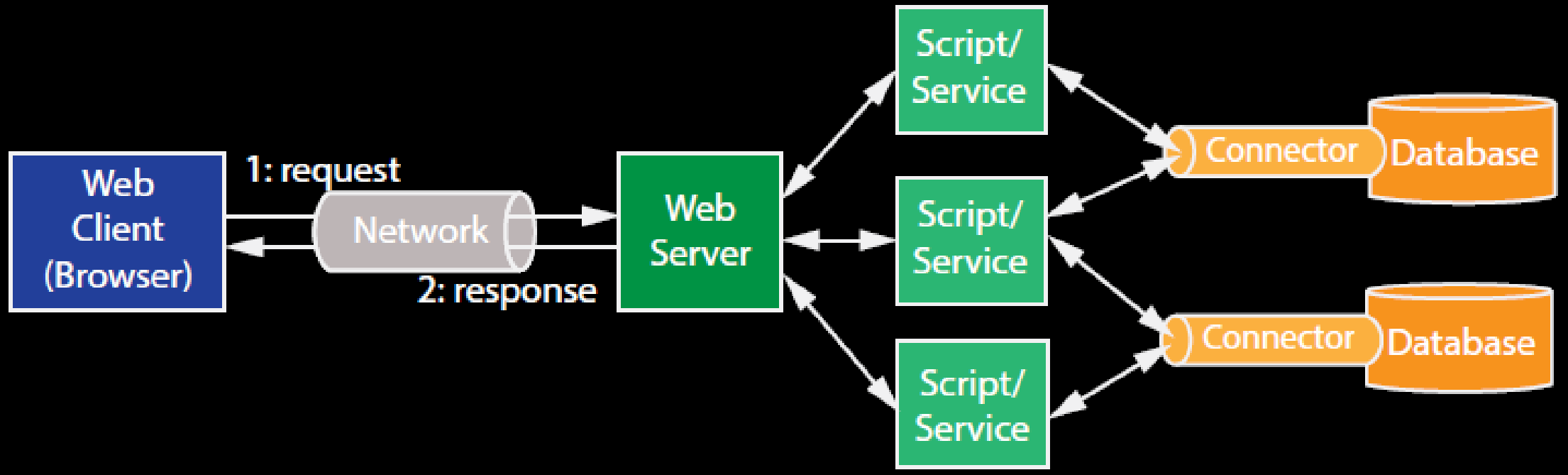
The Basic Architecture

- A Web 1.0 application architecture is not much more complicated than the client-server model we previously showed.
- The web server is primarily fetching static web pages – not much interactivity.
- No separation of data from its presentation.
- The browser is very simple – it only needs to render HTML.

The Basic Architecture

- As applications became richer, server-side scripts became more complicated, and Web 1.0 applications became very difficult to maintain.
- The browsers led to more functionality on the client side, along with compatibility issues. (Netscape ~1990, Microsoft ~2000)
- Developers began creating applications that were more interactive – requires saving state.
- Technologies that improved performance emerged – e.g., client-side scripts, faster web servers, web caching, etc.

The Current Architecture



Web 2.0, 3.0

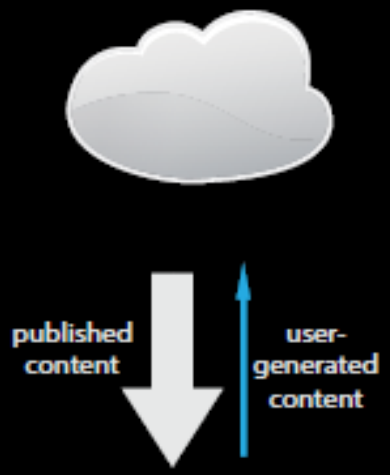
The Current Architecture

- Web 2.0 and 3.0 application architectures are better organized to deal with this complexity.
  - Server-side functionality is partitioned more intelligently
  - The browser is more capable, with better standards support
  - the web is more interactive
  - The machines can process your data more intelligently

Web 1.0

100,000 websites

(read-only Web)

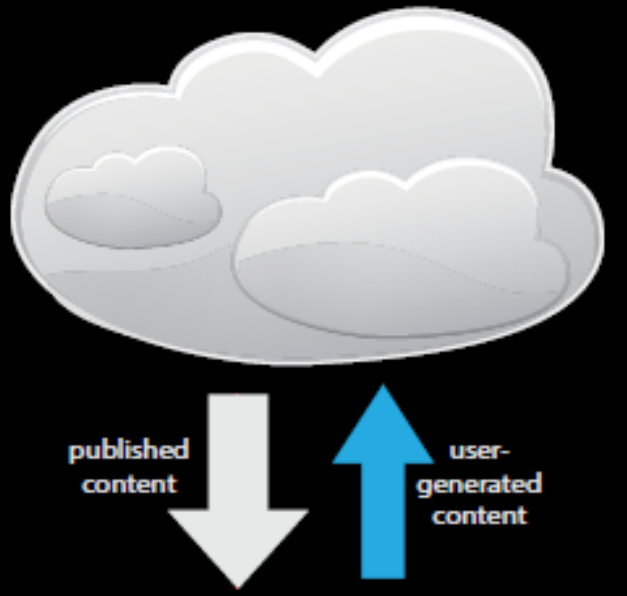


50,000,000 users

Web 2.0

100,000,000 websites

(read-write Web)

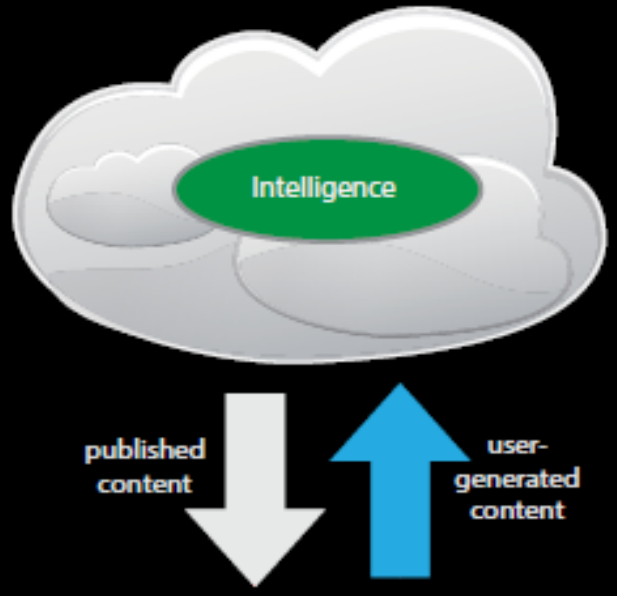


1,000,000,000 users

Web 3.0

1,000,000,000 websites

(read-write Web)



2,500,000,000 users

Design Patterns

Web Application Architectures

- We have already seen that modern web applications involve a significant amount of complexity, particularly on the server side.
- A typical web application involves numerous protocols, programming languages and technologies spread throughout the web stack.
- Developing, maintaining and extending a complex web application is extremely difficult – but, building it using a foundation of solid design principles can simplify each of these tasks.
- Software engineers use abstraction to deal with this type of complexity.
- Design patterns provide useful design abstractions for object-oriented systems.

Design Pattern

- Definition (Design Pattern): A design pattern is a description of interacting objects and classes that interact to solve a general design problem within a particular context.
  - A design pattern is an **abstract template** that can be applied over and over again.
  - The idea is apply abstract design patterns in order to solve specific design problems that occur while building real systems.

Client-Server Model

- The whole point of a client-server architecture is to distribute the components of an application between the client and the server in some way.
  - this makes sense if your trying to share a database or files among some users, share printers, etc.

- What gets put where determines the particular type of the client-server architecture.

- In order to build complex web applications, we're going to make use of numerous design patterns that will help us organize how pieces are placed within the client-server architecture.

n-tier Architecture

- The n-tier architecture is a highly useful design pattern that maps to the client-server model.
- This design pattern is based on the concept of **breaking a system into different pieces or tiers** that can be physically separated:
  - Each tier is responsible for providing **a specific functionality**.
  - A tier only interacts with the tiers adjacent to it through a well-defined interface.

Ex.

- Print server – 2-tier architectural pattern.
- Early web applications – 2-tier client-server architecture:
  - User interface (browser) functionality resided on the (thin) client.
  - Server provided static web pages (HTML).
  - Interface between the two via the hypertext transfer protocol (HTTP).

n-Tier Architecture

- Additional tiers show up when the application functionality is further partitioned.
- What are the advantages of such a design?
  - The abstraction provides a means for managing the complexity of the design.
  - Tiers can be upgraded or replaced independently as requirements or technology change — the new tier just needs to use the same interfaces as the old one.
  - It provides a balance between innovation and standardization.
  - Tiered systems are much easier to build, maintain, scale and upgrade.

3-tier Architecture

- One of the most common is the 3-tier architecture:
  - **Presentation tier** – The user interface.
  - **Application (logic) tier** – Retrieves, modifies and/or deletes data in the data tier, and sends the results to the presentation tier. Also responsible for processing the data itself.
  - **Data tier** – The source of the data associated with the application.
- A modern web application is often deployed over the Internet as a 3-tier architecture:
  - **Presentation tier** – User's web browser.
  - **Application (logic) tier** – The web server and logic associated with generating dynamic web content, e.g., collecting and formatting the results of a search.
  - **Data tier** – A database.

6-tier Architecture

- The Application tier is often subdivided into two tiers:
  - **Business logic tier** – Models the business objects associated with the application, e.g., accounts, inventories, etc., and captures the business rules and workflows associated with how these processes can be processed and manipulated.
  - **Data access tier** – Responsible for accessing data, and passing it to the business logic tier, e.g., account balances, transactions, etc.
- The Presentation tier is often subdivided into two tiers:
  - **Client tier** – client-side user interface components.
  - **Presentation logic tier** – server-side scripts for generating web pages.
- Finally, the web server is often separated out into its own **Web tier.**

6-tier Architecture