

Introduction to applications for Internet

Web Systems I

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Tim Berners-Lee



Tim Berners-Lee

- Computer Scientist
- Inventor of the World Wide Web
- Oxford University
- Massachusetts Institute of Technology (MIT)
- CERN
- Implemented the Hypertext Transfer Protocol (HTTP) • Director of the World Wide Web Consortium (W3C)
 - The W3C oversees the continued development of the web
- Founder of the World Wide Web Foundation

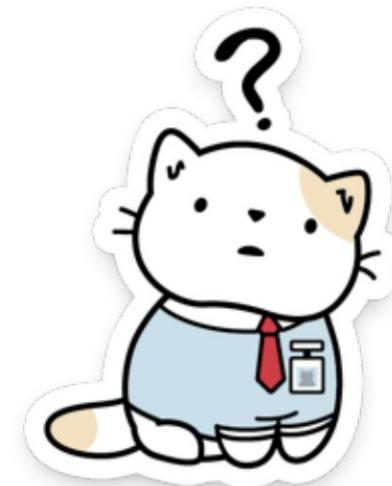


Tim Berners-Lee

- TED Talk - Tim Berners-Lee, A Magna Carta for the web (2014)
<https://www.youtube.com/watch?v=rCplocVemjo>
- TED Talk - Tim Berners-Lee, The Next Web (2009)
https://www.ted.com/talks/tim_berners_lee_the_next_web



What is an Internet application?



What is an Internet application?

- A Web application is any application that uses a Web browser as a client. The application can be as simple as a message board or a guest sign-in book on a website or as complex as a word processor or a spreadsheet.
Nations, Daniel. "[Web Applications](#)". About.com.
- An Internet application, sometimes called a rich Internet application, is typically an interactive program that can be accessed through a web browser. Reference.com



What is an Internet application?

- Simply put, an Internet application is an interactive, compiled application that can be accessed through a corporate or through the Internet. Internet applications can perform complex business processes on either the client or the server. In a server-based Internet application, the application uses the Internet protocol to receive requests from a client, typically a Web browser, associated process code, and return data to the browser. Microsoft Visual Basic Concepts
- A web application is a computer program that uses web browsers and web technology to perform tasks over the Internet.



What is an Internet application?

- A Web application (Web app) is an application program that is stored on a remote server and delivered over the Internet through a browser interface.
- Web applications are so named because they run on the Internet. That is, the data or files you work on are processed and stored within the website. These applications generally do not need to be installed on your computer.
- Web applications are a type of software that is coded in a language supported by web browsers and whose execution is carried out by the browser on the Internet or an intranet (hence the name Web App).



What is an Internet application?

- Client - Server
 - Services or functions that require access to information that is difficult to distribute, special equipment, or computing capacity
 - Servers, which run services on request
 - Clients, who request the execution of a service, with reduced computing capacity, and present the answer
 - Request - response protocol
 - Network that supports interactions



What is an Internet application?

- Web System: infrastructure or system that allows a Web application to function
- Web

Application: –

- distributed application
- performs a (business) function
- based on Web technologies –
- consists of specific Web resources



What is an Internet application?

- Characteristics:
 - Rapid evolution
 - Large scale and strongly distributed
 - Multi user, language, cultural
 - Security and confidentiality
 - Different means of access and user agents
 - Large volume of information, various formats and processes



Advantages of web applications



Advantages

01

COMPATIBILIDAD MULTIPLATAFORMA

Una aplicación web se puede ejecutar sin problemas en múltiples Sistemas Operativos Windows, Linux, Mac, Android, etc.



02

ACCESO DESDE INTERNET

A la aplicación web se accede a través de internet, por lo que son especialmente interesantes para desarrollar aplicaciones multiusuario y así compartir información.

03

APLICACIONES LIGERAS

Las Aplicaciones se ejecutan desde el navegador, por lo que el Usuario no necesita tener un ordenador de grandes prestaciones para trabajar, al no tener que instalar nada

04

FÁCILES DE ACTUALIZAR

Las aplicaciones web siempre se mantienen actualizadas y el usuario no tiene que descargar e instalar actualizaciones. Siempre se trabaja con la última actualización.

05

ACCESO INMEDIATO

Las Aplicaciones Web no necesitan ser descargadas, instaladas y configuradas. Además se puede acceder desde cualquier ordenador conectado a la internet.

06

COMPATIBILIDAD DE VERSIONES

No hay problemas de incompatibilidad entre las versiones que utilizan los Usuarios, porque todos los Usuarios trabajan con la misma, la última actualización.

Advantages

- They save installation and deployment time • “There are no compatibility problems” • There is no need to install them and they do not take up space
- Immediate updates
- Low resource consumption • Multiplatform • Portable (PC, Mobile,...) • High availability
- Difficult to attack by virus
- Ideal for collaboration



Disadvantages of web applications



Disadvantages

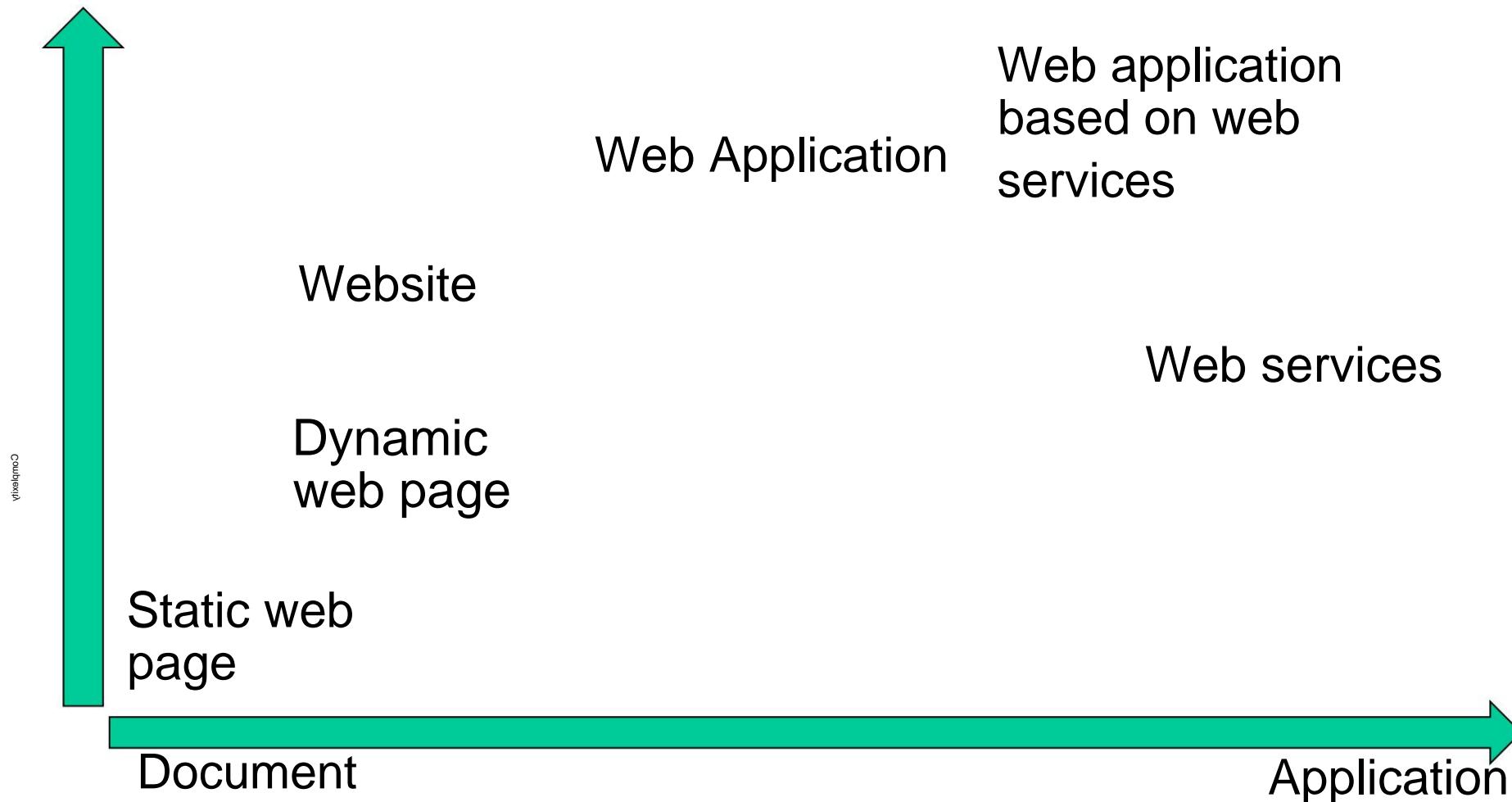
- Less functionality than desktop applications
- Browser limitations
- Availability subject to network provider
- High dependency on the server
- Limitation due to the HTTP protocol used
- Bandwidth bottleneck for large amounts of data
- Need to encrypt files data
- Need for additional software or specific versions of browsers



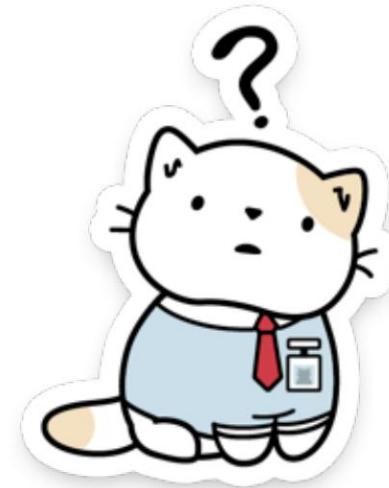
TERMS AND COMPARISON



Terms map



Website vs web application

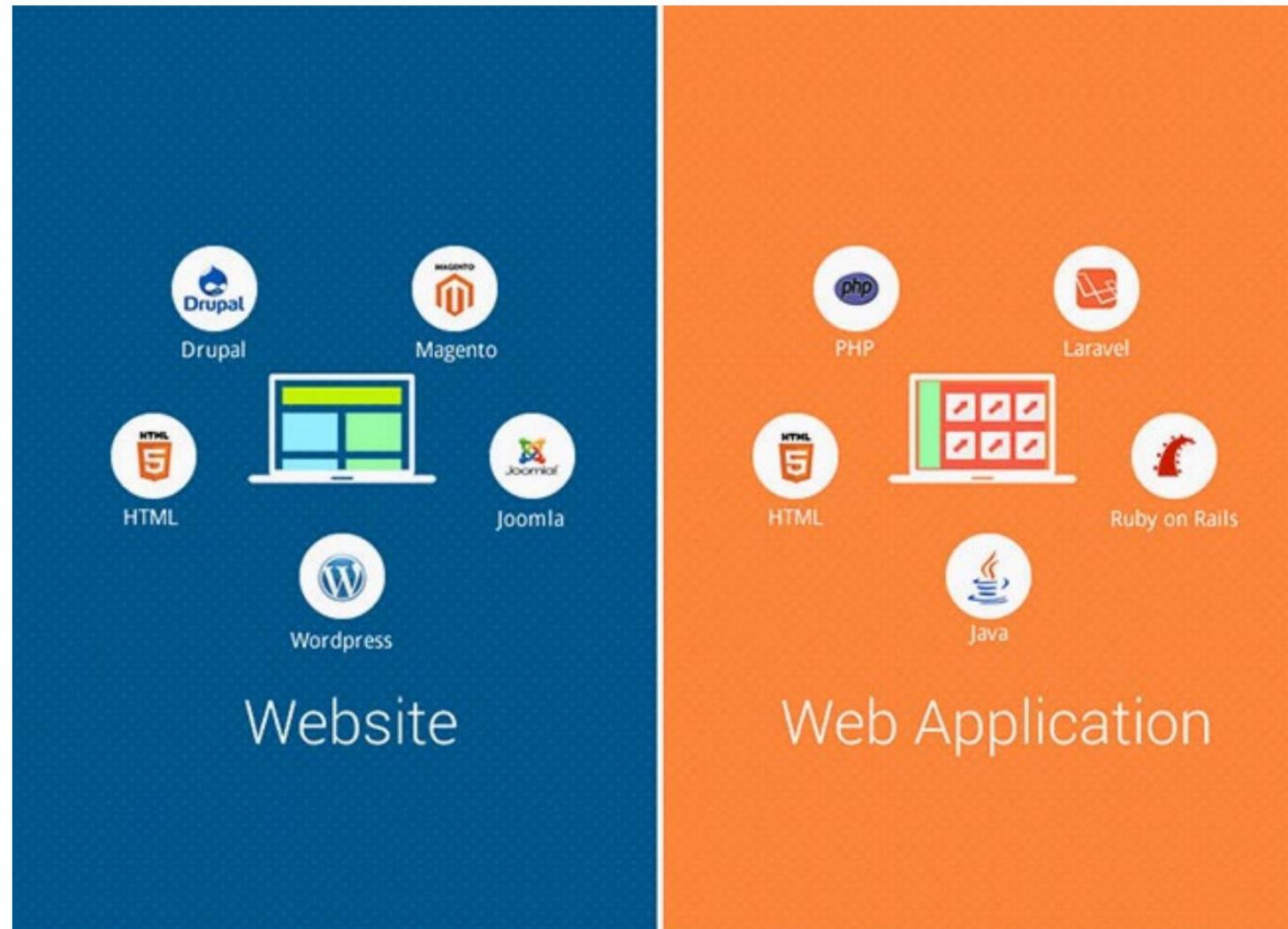


Website vs web application

- Website:
 - Set of web pages on the same domain – Business information pages – Require little or no interaction from the user – Can be created with a CMS (Content Management System)
 - Ex.: uspceu, neighborhood store information.
- Web application:
 - It is usually the business itself – They require interaction on the part of the user and usually register
 - For example: Netflix, Facebook, Instagram, online banking, CEU intranet.



Website vs web application



Web application VS web services

Web application •

Designed for humans

- They have interfaces
- Human To Machine
- They have a user
- Information and presentation (HTML)

Web services

- Designed for machines • Expose

APIs

• Machine to Machine

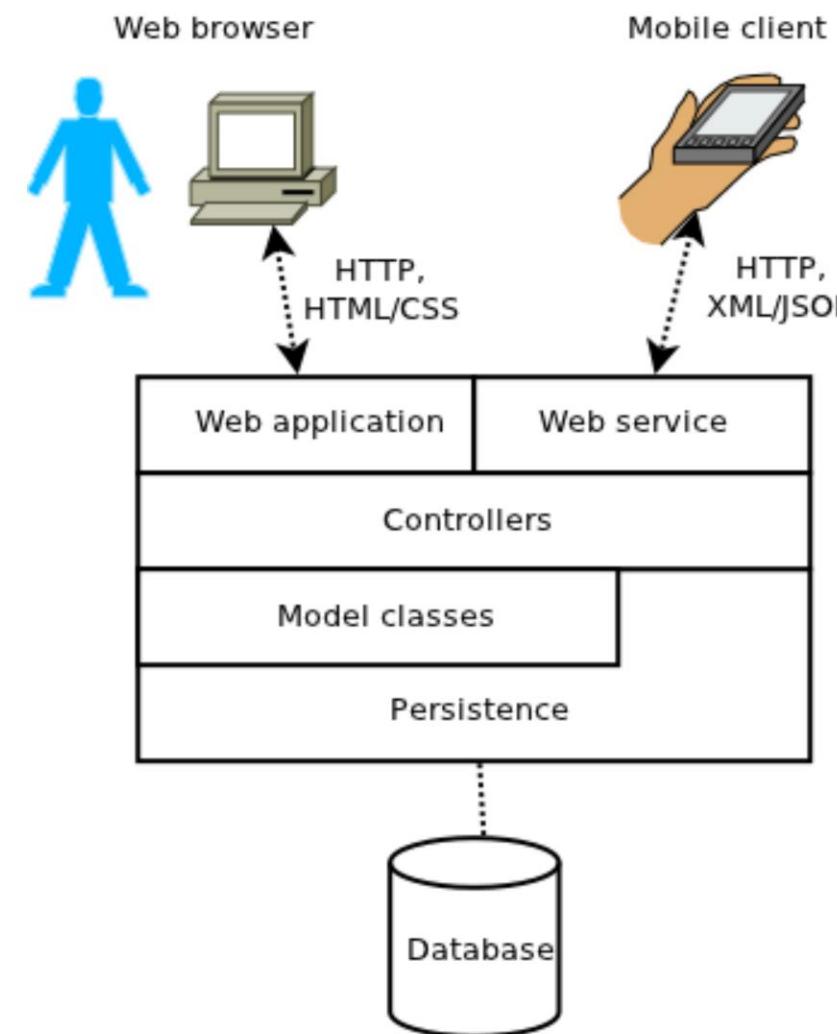
- They have applications •

Information without presentation

(XML, JSON)



Web application VS web services



ARCHITECTURE



Architecture

- Access layer (browser layer)
- Server layer
- Persistence layer



Physical architecture

- Basic model:
 - A dedicated computer running a server
 - Connection to a network to receive requests and return responses
 - If the network is internal to an organization: intranet
- Model with separation of functions:
 - A dedicated computer running a server
 - Connection to a network to receive requests and return responses
 - Connectivity to other servers (databases, for example)



Physical architecture

- Model with network separation:
 - A dedicated computer running a server
 - Connection to a network to receive requests and return responses
 - Connectivity to other servers on an internal network through a firewall
- Complete separation of functions model
 - Computers to serve static content (HTML pages)
 - Different computers to generate dynamic content – Different computers for databases – Different computers for management, security, etc.



Physical architecture

- Model for high performance
 - Multiple dedicated computers running the same server
 - Connection to a network through a load balancer to receive requests and return responses
 - Connectivity to other servers (databases, for example)
- Model for high availability
 - The load distributor sends the request to two or more servers
 - All elements are duplicated

HISTORY

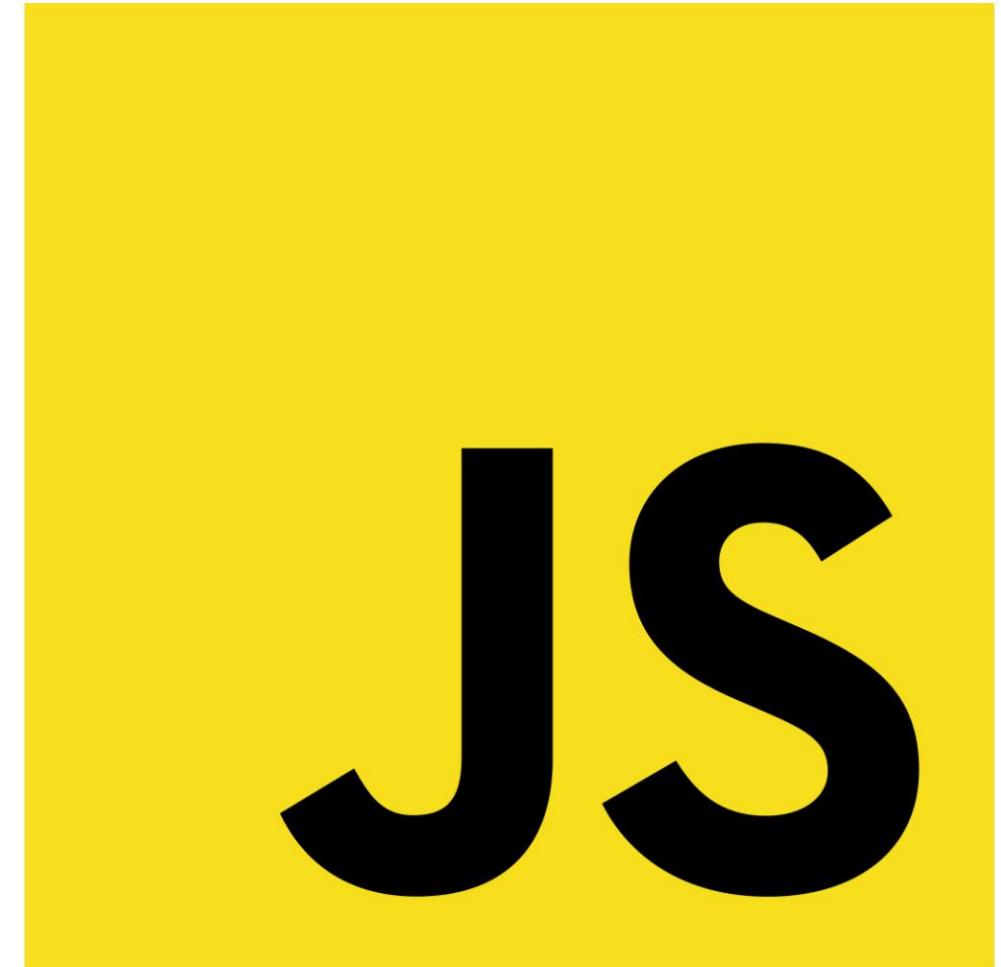


nineteen ninety five

- JavaScript (JS) •

Added to Netscape browser • Scripting language • To enrich pages

- At that time most were static



nineteen ninety five

- 1995 Java applets •
Small Java applications
 - or any language that compiles to Java bytecodes

- 3D acceleration
- Run faster than Javascript • Security issues •

Deprecated in Java 9 (2017)



nineteen ninety six

- 1996 Flash
- Boom in 2002 with video support •
Made the pages very heavy
- Discontinued in 2020



2008

- 2008 HTML5
- W3C Recommendation
- Multimedia support

HTML



FRONT END AND BACK END



Front end and Back end



Front end vs. Back end.

Front end



Front end

- Web performance •
- Responsive web design •
- Cross-browser compatibility •
- End-to-end testing •
- Build automations
- Accessibility •
- Usability •
- Image editing tools •
- User Interface
- Search Engine Optimization (SEO)

Front end – Web performance

- Reduce loading times
 - How long is too long •

Make the site usable as soon as possible

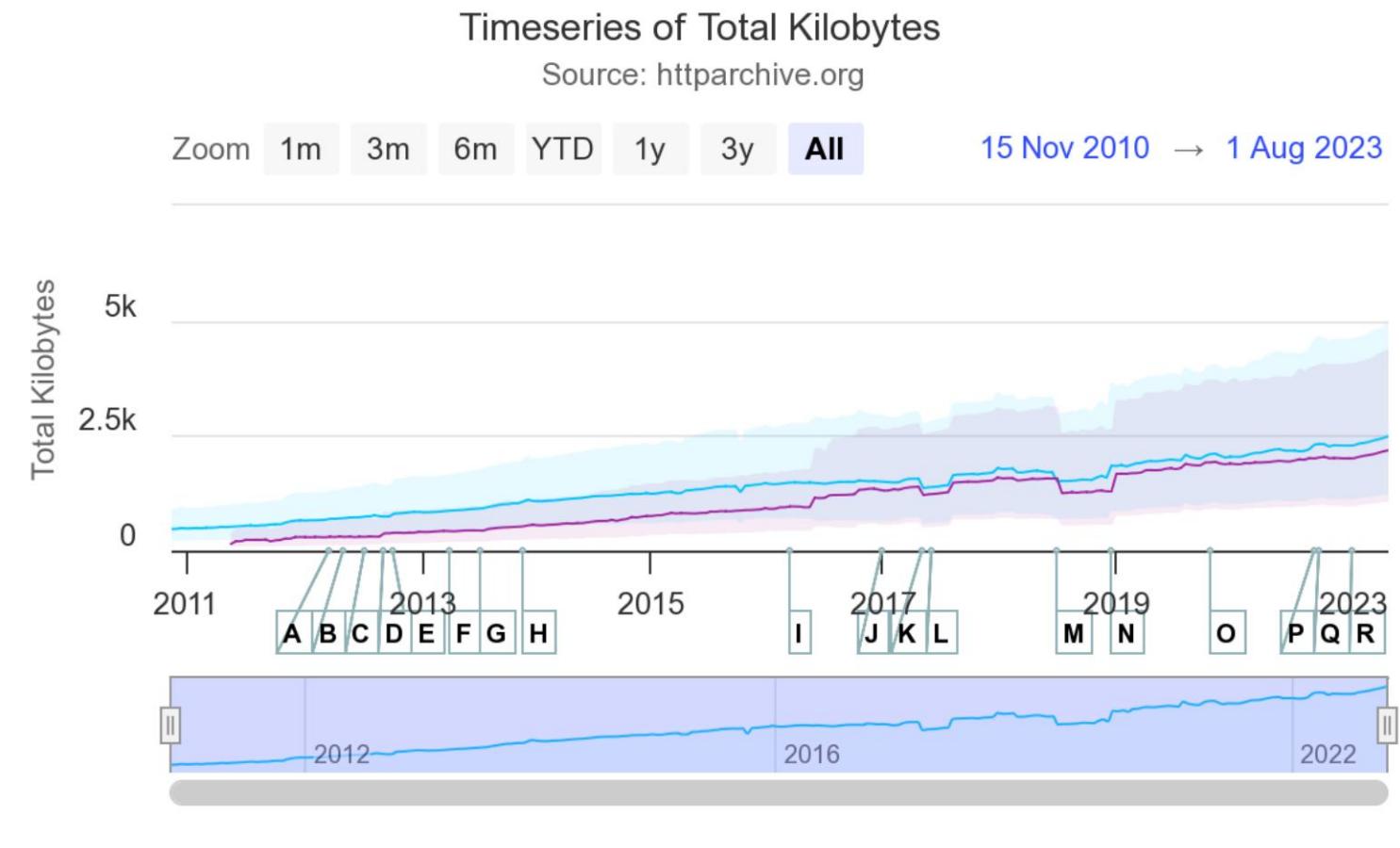
- Softness and interactivity
- Operating measurements
- More info



Front end – Web performance

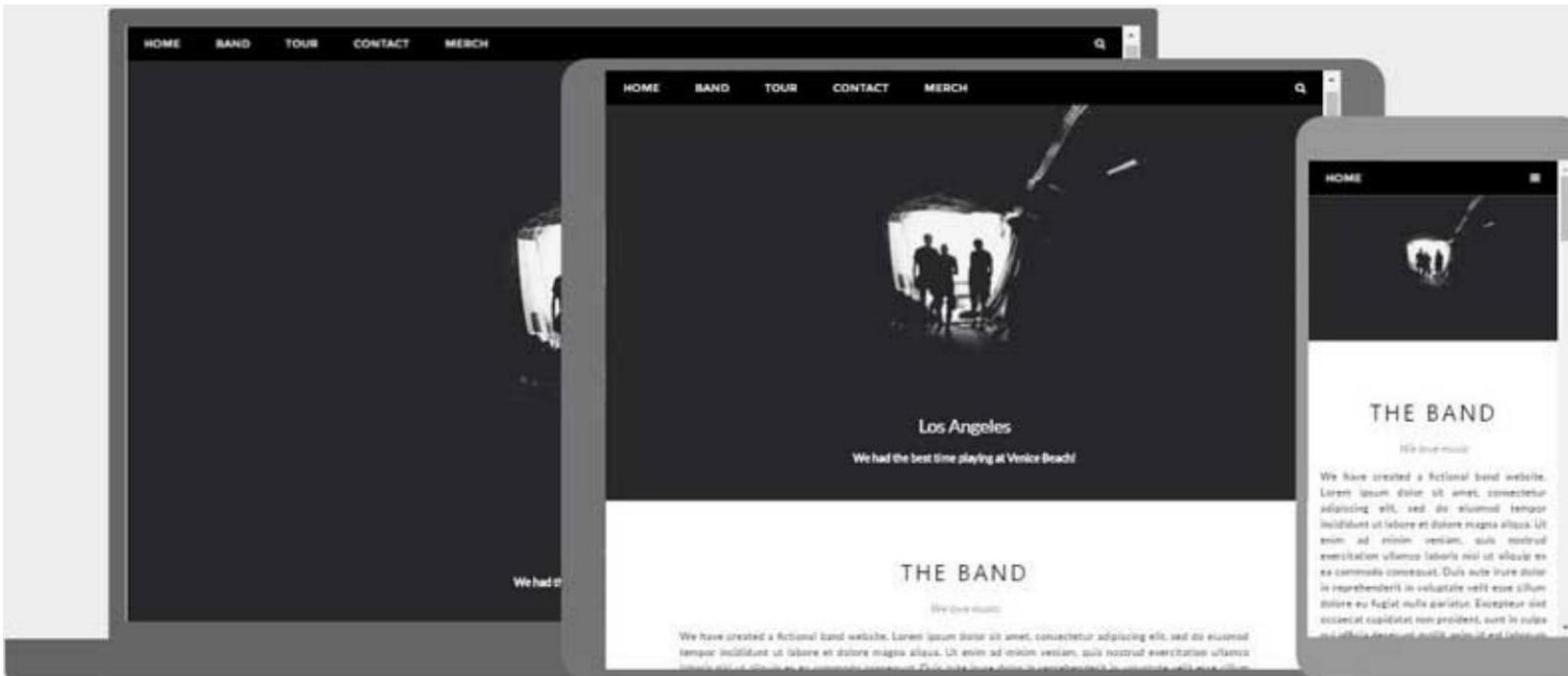
Average web size:

- Desktop: 2.5 MB
- Mobile: 2.2 MB



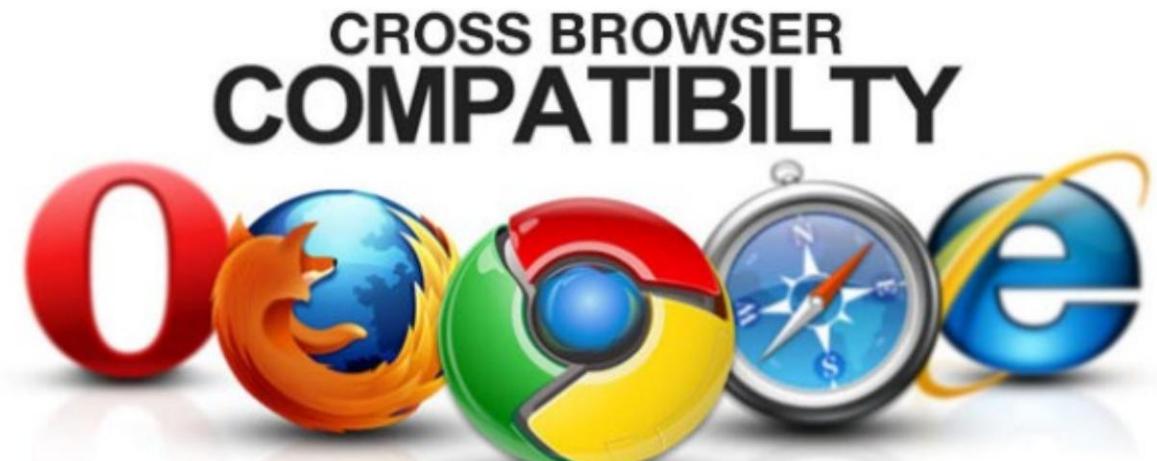
highcharts.com

Front end – Responsive web design



Front end – Cross-browser compatibility

- Check in different browsers
 - Functionality
 - Performance
 - Accessibility
- More info



Front end – End-to-end testing

- Replicate real scenarios •
- Integration validation • Data integrity validation
- More info



Front end – Build automations

- Packaging •
- Minify • Reduce image size



Front end – Accessibility

- Ensure that the pages are used by the greatest number of people regardless of your abilities
- Universal and accessible web
- More related to the technical part:
 - Alternative text in the pictures
- More info



Front end – Usability

- Improve the user experience • Avoid ambiguities
- Placement of elements
- Quality of experience

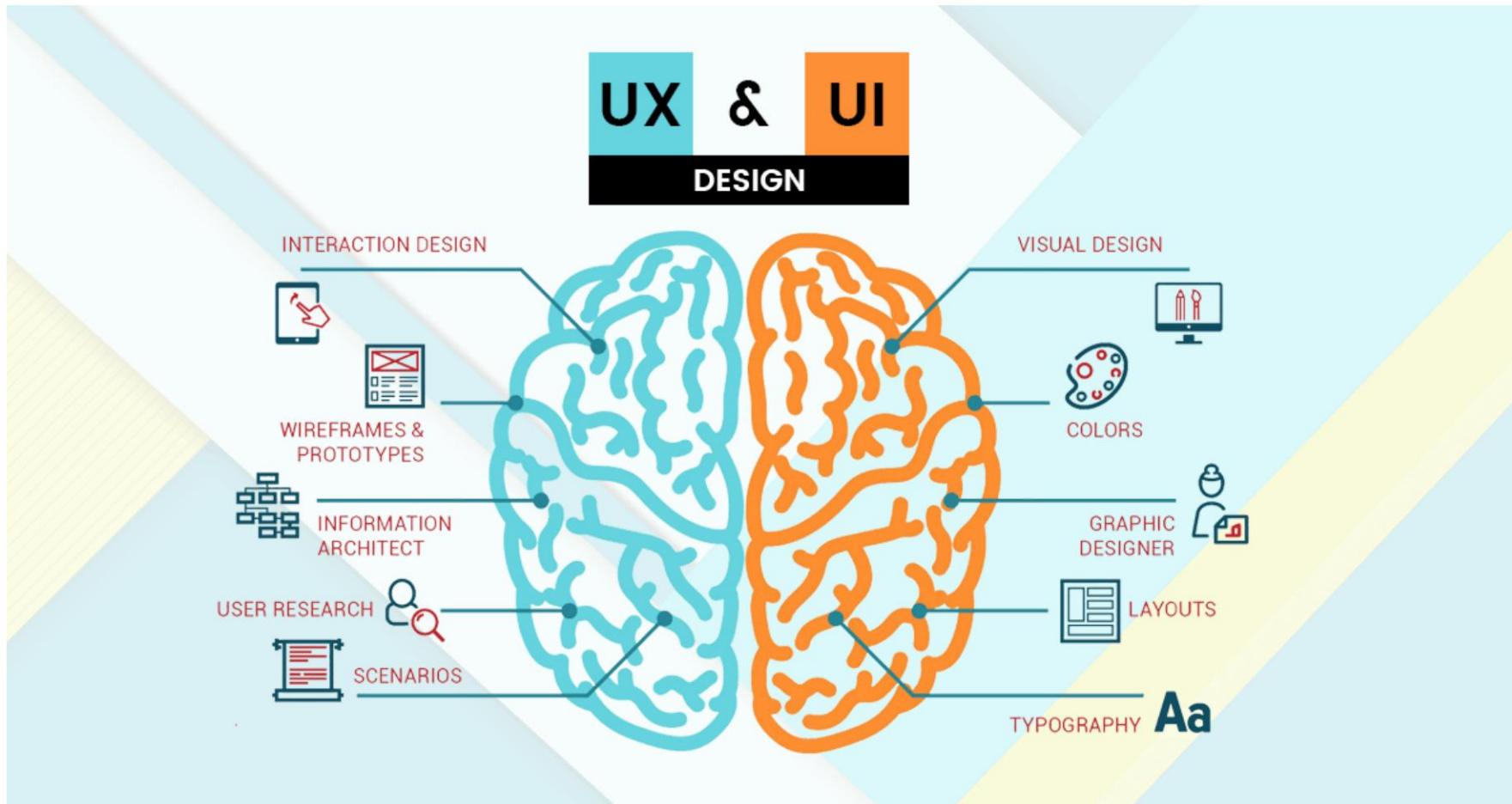


Front end – Image editing tools

- Photoshop
- GIMP
- Basic knowledge of image formats:
 - lossless vs lossy
 - transparencies
 - vector images –
animations
 - gif, jpeg, png, svg, webp...



Front end – User interface



Front end – Search Engine Optimization (SEO)



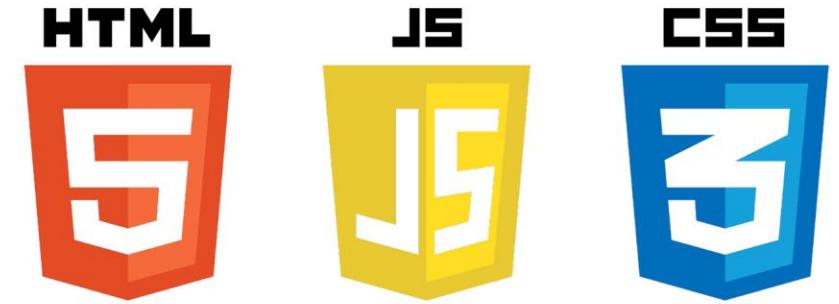
Front end – Search Engine Optimization (SEO)

- The reality is different:
 - SEO is destroying content on the Internet



Front end – Technologies

- HTML
- CSS
- JavaScript
- Libraries:
 - Saas (Syntactically Awesome Style Sheets)
 - jQuery
- Frameworks:
 - Bootstrap
 - React
 - Angular
 - vue.js



back end



back end

- Automated testing •
- Application Data Access •
- Application Business Logic •
- Database administration
- Scalability
- High availability •
- Security •
- Software Architecture
- Data transformation
- Backups



Back end – Automated testing

- Server check • API check •

Database check:

- ACID properties –
- CRUD operations
- Schema
- Indices
- Duplicate information
- Security
- Performance



Back end – Application Data Access

- Roles
- Security •

Do not trust customer requests



Back end – Application Business Logic

- Domain Logic •

Business logic • Rules:

- How information can be created, stored and changed



Back end – Scalability

- Design with scalability in mind • Consumption and performance control
- Monitoring



Back end – Database administration

- Efficient operation of the DB
 - Query optimization
 - Use of indexes
- Resource management:
 - Memory
 - Disc
 - Grid
- Modification of the structure
- User profiles
- Backup



Back end – High availability

- Deployment in different regions • Low recovery time
- Related to scalability
- Availability: – 99%
 - just over 3 days downtime – 99.9% – almost 9 hours
 - 99.99% – 53 minutes
 - 99.999% – 5.2 minutes



Back end – High availability

- Amazon S3:

- durability of objects: 11 9's
- availability: 4 9's
- Glacier availability: 3 9's

Back end – High availability

Cost

- Facebook crash of 6 hours in October 2021:
 - Profit losses of \$164,000 per minute
 - Shares fell \$47000M
- Amazon crash of 75 minutes in July 2018:
 - Losses estimated at \$100M
- For small businesses it is estimated between \$100 - \$450 per minute
- Cost estimation

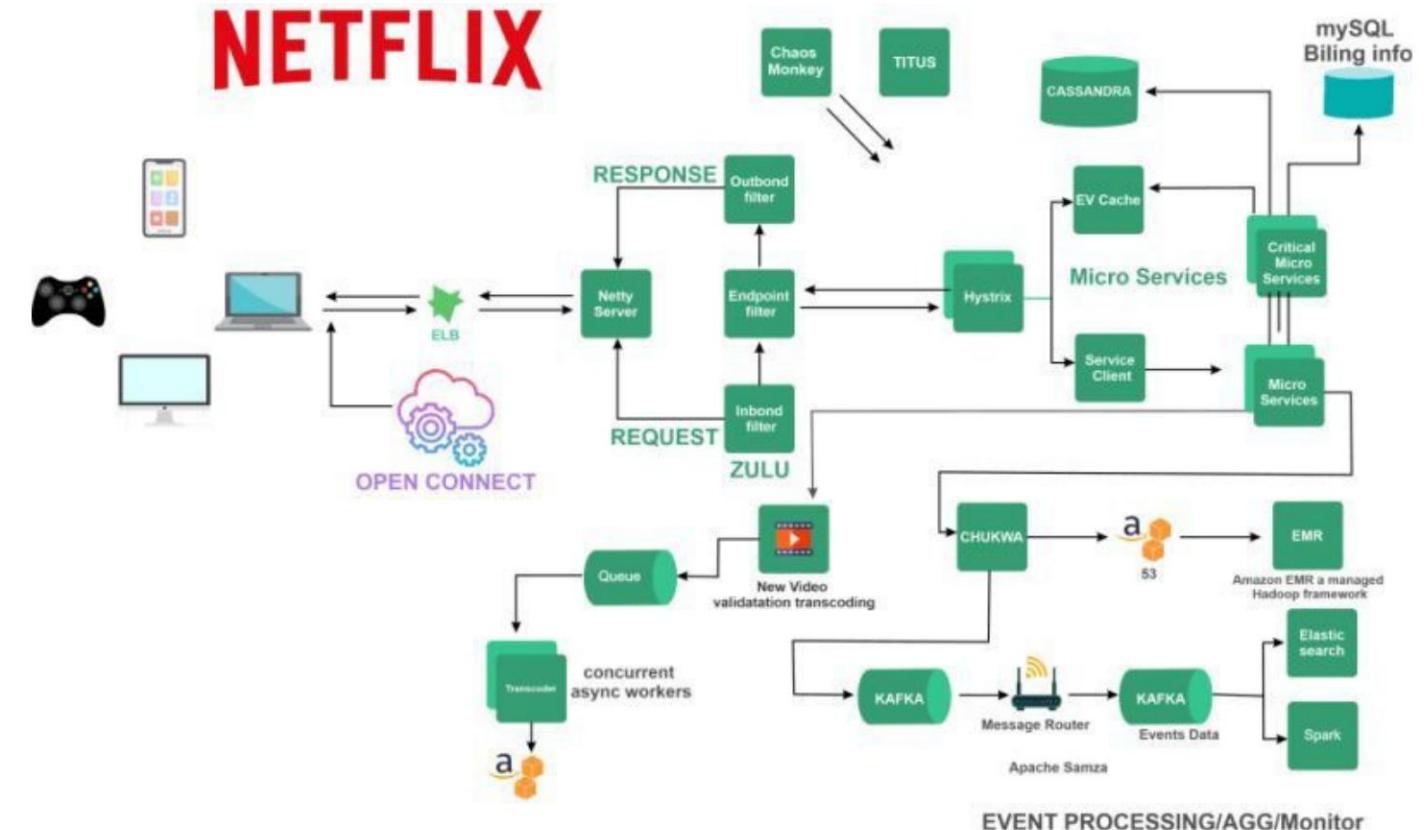
Backend – Security

10 Popular Backend Security Risks

-
- | | | | |
|---|--|----|---|
| 1 | Data Injection Risks | 6 | Lack of Vulnerability Scanning |
| 2 | Lack of Authentication Security | 7 | Sensitive Data Exposure |
| 3 | Access Control Related Misconfigurations | 8 | Lack of Encryption between Frontend and Backend |
| 4 | Software Misconfigurations | 9 | SSL Misconfigurations and Lack of Monitoring |
| 5 | Outdated Software Components | 10 | Lack of Centralized Log Management |

Back end – Software Architecture

- Design the system
- Authentication
- Authorization
- Logs
- Requests
- Design of the topic base



Back end – Data transformation

- Conversion between formats
 - Unstructured
 - Semi-structured (JSON, XML...)
 - Structured (DB)
- Validation



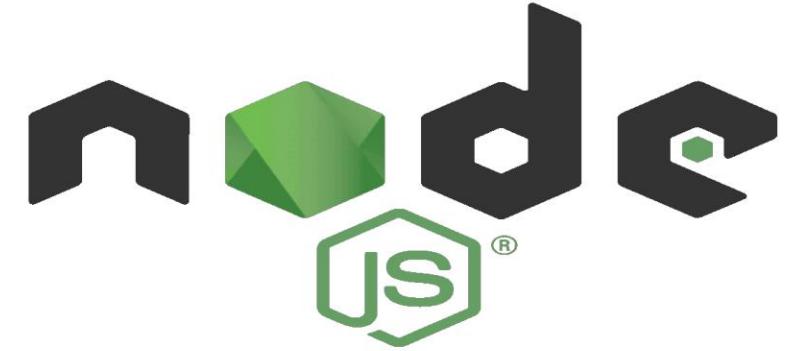
Back end – Backups

- Periodicity
- Save them in different places
 - Both devices and locations
 - Amount of data



Back end – Technologies

- Scripting:
 - PHP
 - Python
 - Ruby
 - Node.js
- Compiled:
 - C#
 - Java
 - Go
- Databases



Doubts



Take risks. Ask big questions. Don't be afraid to make mistakes; if you don't make mistakes, you're not reaching far enough.

— *David Packard* —

AZ QUOTES



References

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