Web Assembly

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February 8, 2018

Mines Linux Users Group

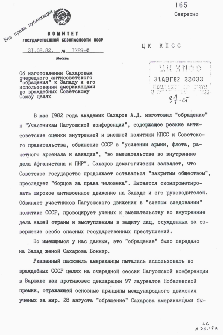
Client Code

What is a website?

A website is really just a fancy document, temporarily downloaded from some remote computer system.

Indeed, Sir Tim Berners-Lee created the world-wide-web as a way of sharing research papers.

These documents contain text, images, and styling information.



165
Секретно

Без права публикации

КОМИТЕТ
ГОСУДАРСТВЕННОЙ БЕЗОПАСНОСТИ СССР
31.08.82. № 1789-Ф
Москва

ЦК КПСС

ЦК КПСС
31.АВГ82 23033
37-ст

Об изготовлении Сахаровым
очередного антисоветского
"обращения" к Западу и его
использовании американцами
во враждебных Советскому
Союзу целях

В мае 1982 года академик Сахаров А.Д. изготовил "обращение" к "Участникам Пагуошской конференции", содержащее резкие антисоветские оценки внутренней и внешней политики КПСС и Советского правительства, обвинение СССР в "усилении армии, флота, ракетного арсенала и авиации", "во вмешательстве во внутренние дела Афганистана и ПНР". Сахаров демагогически заявляет, что Советское государство продолжает оставаться "закрытым обществом", преследует "борцов за права человека". Пытается скомпрометировать широкое антивоенное движение на Западе и его руководителей. Обвиняет участников Пагуошского движения в "слепом следовании" политике СССР, провоцирует ученых к вмешательству во внутренние дела нашей страны и выступлениям в защиту лиц, осужденных за совершение особо опасных государственных преступлений.

По имеющимся у нас данным, это "обращение" было передано на Запад женой Сахарова Боннэр.

Указанный пасквиль американцы пытались использовать во враждебных СССР целях на очередной сессии Пагуошской конференции в Варшаве как противовес декларации 97 лауреатов Нобелевской премии, отражающей основные принципы международного движения ученых за мир. 28 августа "обращение" Сахарова американцами бы-

LC

Interactive Websites

Is it possible to make websites interactive?

We would have to include some instructions along with the document. We need some kind of scripting language for webpages.

JavaScript

On a dark and stormy night ...

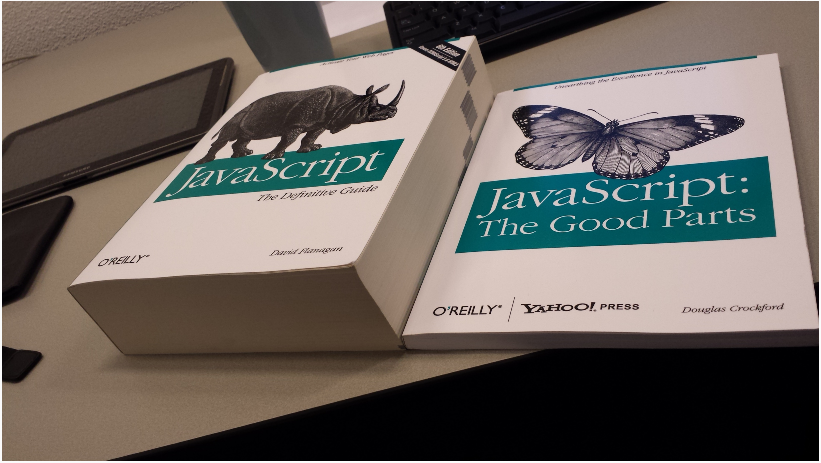
The year is 1995. Netscape Communications Corporation is dying. In a frantic attempt to one-up Microsoft, the company decides to embed a scripting language into the Netscape browser.

They give **Brendan Eich** 10 days to make a prototype.

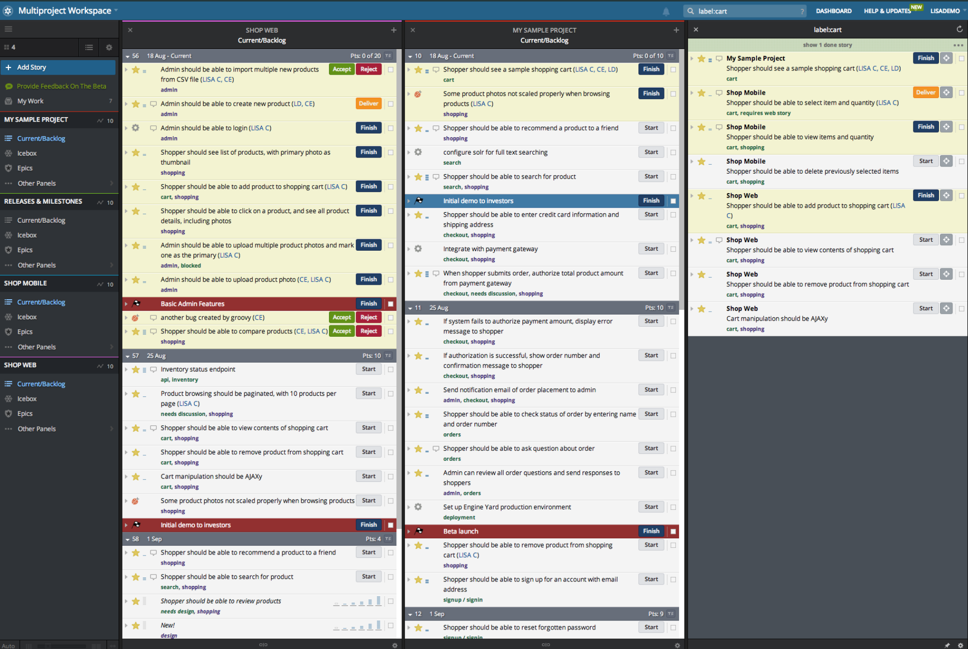
Eich dreams of Scheme. He wants his new language to be elegant, fast, and pure. **But it is too late.** The lawyers at Netscape have made a deal with Sun Microsystems.

It will be known as **JavaScript**.

The Result


Activate Your Web Pages
6th Edition
Covers ECMAScript 5 & HTML5
JavaScript
The Definitive Guide
O'REILLY®
David Flanagan
Unearthing the Excellence in JavaScript
JavaScript:
The Good Parts
O'REILLY®
YAHOO! PRESS
Douglas Crockford

This page uses 800 thousand lines of JavaScript



Multiproject Workspace

label:cart

DASHBOARD HELP & UPDATES NEW LISADEMO

4

Add Story

Provide Feedback On The Beta

My Work 7

MY SAMPLE PROJECT 10

- Current/Backlog
- Icebox
- Epics
- Other Panels

RELEASES & MILESTONES 10

- Current/Backlog
- Icebox
- Epics
- Other Panels

SHOP MOBILE 10

- Current/Backlog
- Icebox
- Epics
- Other Panels

SHOP WEB 10

- Current/Backlog
- Icebox
- Epics
- Other Panels

SHOP WEB
Current/Backlog

56 18 Aug - Current Pts: 0 of 20

- Admin should be able to import multiple new products from CSV file (LISA C, CE) — admin — Accept Reject
- Admin should be able to create new product (LD, CE) — admin — Deliver
- Admin should be able to login (LISA C) — admin — Finish
- Shopper should see list of products, with primary photo as thumbnail — shopping — Finish
- Shopper should be able to add product to shopping cart (LISA C) — cart, shopping — Finish
- Shopper should be able to click on a product, and see all product details, including photos — shopping — Finish
- Admin should be able to upload multiple product photos and mark one as the primary (LISA C) — admin, blocked — Finish
- Admin should be able to upload product photo (CE, LISA C) — admin — Finish
- Basic Admin Features — Finish
- another bug created by groovy (CE) — Accept Reject
- Shopper should be able to compare products (CE, LISA C) — shopping — Accept Reject

57 25 Aug Pts: 10

- Inventory status endpoint — api, inventory — Start
- Product browsing should be paginated, with 10 products per page (LISA C) — needs discussion, shopping — Start
- Shopper should be able to view contents of shopping cart — cart, shopping — Start
- Shopper should be able to remove product from shopping cart — cart, shopping — Start
- Cart manipulation should be AJAXy — cart, shopping — Start
- Some product photos not scaled properly when browsing products — shopping — Start
- Initial demo to investors — Finish

58 1 Sep Pts: 4

- Shopper should be able to recommend a product to a friend — shopping — Start
- Shopper should be able to search for product — search, shopping — Start
- *Shopper should be able to review products* — *needs design, shopping*
- *New!* — *design*

MY SAMPLE PROJECT
Current/Backlog

10 18 Aug - Current Pts: 0 of 10

- Shopper should see a sample shopping cart (LISA C, CE, LD) — cart — Finish
- Some product photos not scaled properly when browsing products (LISA C) — shopping — Finish
- Shopper should be able to recommend a product to a friend — shopping — Start
- configure solr for full text searching — search — Start
- Shopper should be able to search for product — search, shopping — Start
- Initial demo to investors — Finish
- Shopper should be able to enter credit card information and shipping address — checkout, shopping — Start
- Integrate with payment gateway — checkout, shopping — Start
- When shopper submits order, authorize total product amount from payment gateway — checkout, needs discussion, shopping — Start

11 25 Aug Pts: 10

- If system fails to authorize payment amount, display error message to shopper — checkout, shopping — Start
- If authorization is successful, show order number and confirmation message to shopper — checkout, shopping — Start
- Send notification email of order placement to admin — admin, checkout, shopping — Start
- Shopper should be able to check status of order by entering name and order number — orders — Start
- Shopper should be able to ask question about order — orders — Start
- Admin can review all order questions and send responses to shoppers — admin, orders — Start
- Set up Engine Yard production environment — deployment — Start
- Beta launch — Finish
- Shopper should be able to remove product from shopping cart (LISA C) — shopping — Start
- Shopper should be able to sign up for an account with email address — signup / signin — Start

12 1 Sep Pts: 9

- Shopper should be able to reset forgotten password — signup / signin — Start

label:cart

show 1 done story

- **My Sample Project** Shopper should see a sample shopping cart (LISA C, CE, LD) — cart — Finish
- **Shop Mobile** Shopper should be able to select item and quantity (LISA C) — cart, requires web story — Deliver
- **Shop Mobile** Shopper should be able to view items and quantity — cart, shopping — Finish
- **Shop Mobile** Shopper should be able to delete previously selected items — cart, shopping — Start
- **Shop Web** Shopper should be able to add product to shopping cart (LISA C) — cart, shopping — Finish
- **Shop Web** Shopper should be able to view contents of shopping cart — cart, shopping — Start
- **Shop Web** Shopper should be able to remove product from shopping cart — cart, shopping — Start
- **Shop Web** Cart manipulation should be AJAXy — cart, shopping — Start

Emscripten

We need C

- People start writing games in JavaScript
- Why can't we use the Unity game engine?
- It's written in C
- Browsers don't run C
- Browsers only run JavaScript
- What if we compiled C to JavaScript?

Emscripten

Introducing...

It compiles things to JavaScript!

asm.js Example

C

```c
int factorial(int n) {
  if (n == 0)
    return 1;
  else
    return n *
   ↪  factorial(n-1);
}
```

asm.js

```javascript
function __Z9factoriali($0) {
  $0 = $0|0;
  var $1 = 0, $10 = 0, $2 = 0, $3 = 0, $4 = 0, $5 = 0, $6
 ↪  = 0, $7 = 0, $8 = 0, $9 = 0, label = 0, sp = 0;
  sp = STACKTOP;
  STACKTOP = STACKTOP + 16|0; if ((STACKTOP|0) >=
 ↪  (STACK_MAX|0)) abortStackOverflow(16|0);
  $2 = $0;
  $3 = $2;
  $4 = ($3|0)==(0);
  if ($4) {
   $1 = 1;
  } else {
   $5 = $2;
   $6 = $2;
   $7 = (($6) - 1)|0;
   $8 = (__Z9factoriali($7)|0);
   $9 = Math_imul($5, $8)|0;
   $1 = $9;
  }
  $10 = $1;
  STACKTOP = sp;return ($10|0);
 }
```

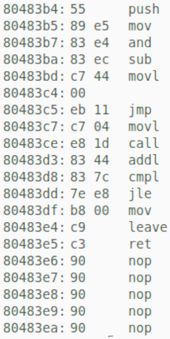
That was a Bad Idea

JavaScript was designed for...

- ✓ Crazy people
- ● Humans
- × Computers

Why compile low-level → high-level?

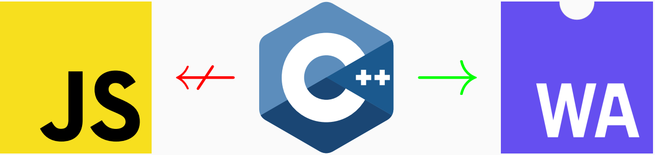
Why don't we have *machine code for the web?*



```
80483b4: 55       push
80483b5: 89 e5    mov
80483b7: 83 e4    and
80483ba: 83 ec    sub
80483bd: c7 44    movl
80483c4: 00
80483c5: eb 11    jmp
80483c7: c7 04    movl
80483ce: e8 1d    call
80483d3: 83 44    addl
80483d8: 83 7c    cmpl
80483dd: 7e e8    jle
80483df: b8 00    mov
80483e4: c9       leave
80483e5: c3       ret
80483e6: 90       nop
80483e7: 90       nop
80483e8: 90       nop
80483e9: 90       nop
80483ea: 90       nop
```

Web Asssembly

Which Direction?



emscripten can compile your code to *Web Assembly*!

WASM Example

C

```c
int factorial(int n) {
  if (n == 0)
    return 1;
  else
    return n *
   ↪  factorial(n-1);
}
```

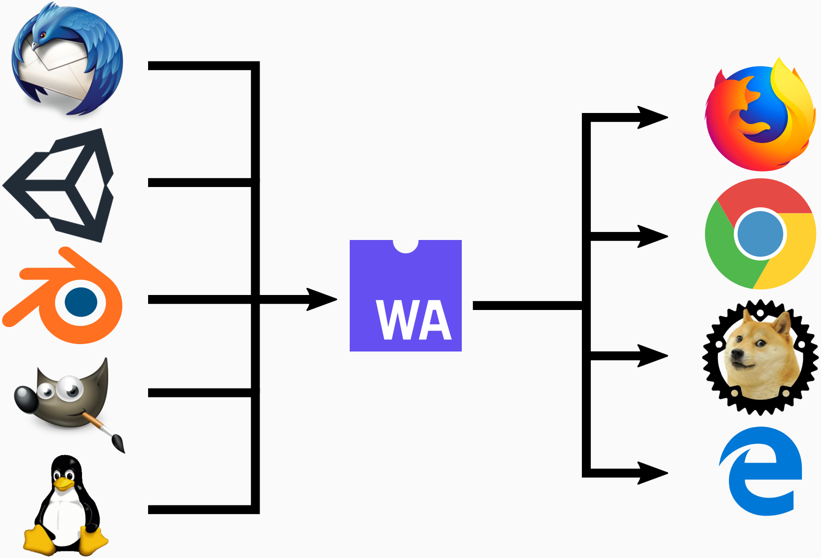
WASM Text

```
get_local 0
i64.eqz
if i64
    i64.const 1
else
    get_local 0
    get_local 0
    i64.const 1
    i64.sub
    call 0
    i64.mul
end
```

WASM Binary

```
20 00
50
04 7E
42 01
05
20 00
20 00
42 01
7D
10 00
7E
0B
```

Software in the Browser



✖

JAVASCRIPT
DISABLED

Practical WASM

C/C++

Rust

stdweb

parcel

Bundeling JS and Rust

In `main.js`:

```
import {add} from './add.rs';
console.log(add(2, 3));
```

In `add.rs`:

```
#[no_mangle]
pub fn add(a: i32, b: i32) -> i32 {
    return a + b
}
```

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