

Web Assembly

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Mines Linux Users Group



Client Code

Introduction



JavaScript

On a dark and stormy night ...

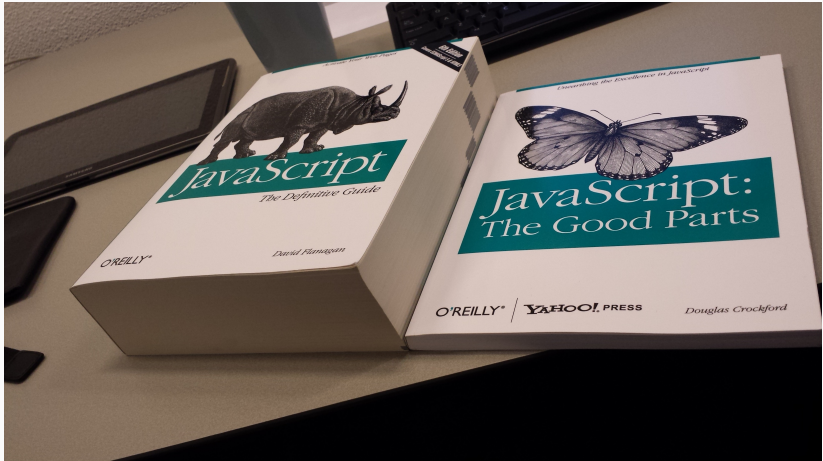
The year is 1995. Netscape Communications Corporation is dying. In a frantic attempt to one-up Microsoft, the company decides to embed a scripting language into the Netscape browser.

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



This page uses 800 thousand lines of JavaScript

Multiproject Workspace

label cart

DASHBOARD HELP & UPDATES LISA DEMO

SHOP WEB Current/Backlog

18 Aug - Current Pts: 0 of 20

- Admin should be able to import multiple new products from CSV file (USA C, CE) **Accept** **Reject**
- Admin should be able to create new product (LD, CE) **Deliver**
- Admin should be able to login (USA C) **Finish**
- Shopper should see list of products, with primary photo as thumbnail shopping **Finish**
- Shopper should be able to add product to shopping cart (USA 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 (USA C) admin, blocked **Finish**
- Admin should be able to upload product photo (CE, USA C) admin **Finish**

Basic Admin Features **Finish**

- another bug created by groovy (CE) **Accept** **Reject**
- Shopper should be able to compare products (CE, USA C) shopping **Accept** **Reject**

25 Aug Pts: 10

- Inventory status endpoint api, inventory **Start**
- Product browsing should be paginated, with 10 products per page (USA 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**

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 **Start**
- Shopper should be able to reset forgotten password **Start**

MY SAMPLE PROJECT Current/Backlog

18 Aug - Current Pts: 0 of 10

- Shopper should see a sample shopping cart (USA C, CE, LD) cart **Finish**
- Some product photos not scaled properly when browsing products (USA C) shopping **Finish**
- Shopper should be able to recommend a product to a friend shopping **Start**
- configure solr for full text searching **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**

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 **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 (USA C) shopping **Start**
- Shopper should be able to sign up for an account with email address signup / signin **Start**

1 Sep Pts: 9

- Shopper should be able to reset forgotten password **Start**

labelcart show 1 done story

My Sample Project

- Shopper should see a sample shopping cart (USA C, CE, LD) cart **Finish**
- Shopper should be able to select item and quantity (USA C) cart, requires web story **Deliver**
- Shopper should be able to view items and quantity cart, shopping **Finish**
- Shopper should be able to delete previously selected items cart, shopping **Start**
- Shopper should be able to add product to shopping cart (USA C) cart, shopping **Finish**
- 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**



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?



Introducing...



emscripten

It compiles things to JavaScript!

asm.js Example

C

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

asm.js

```
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 Assembly

Which Direction?



emscripten can compile your code to *Web Assembly*!

WASM Example

C

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

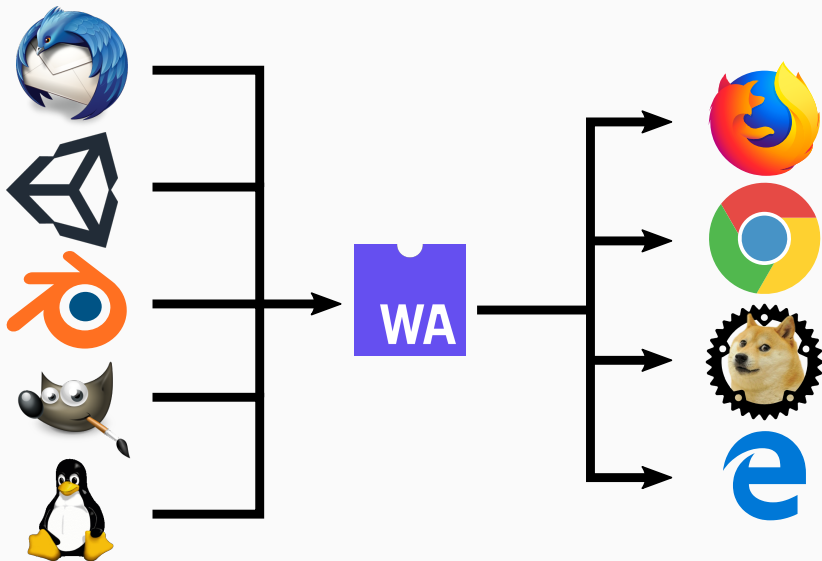
WASM Text

```
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

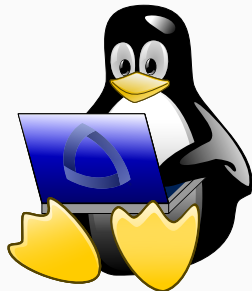


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