Let's Talk JavaScript

Ynon Perek
ynon@tocode.co.il
tocode.co.il

Agenda

- JavaScript Is Awesome
- Simple Programs
- JavaScript Functions
- Arrays and Objects

JavaScript Is Awesome

- It’s everywhere
- It survives
- Everyone’s doing it
- It’s great at parties
- It’s amazingly simple

JS Is Everywhere

android

JS Survives

- Around since 1995
- Outlived Java Applets

A Short History

- 1995 Brendan Eich started developing a new language for Netscape Navigator 2.0
- Original name was LiveScript
- Announced on Dec 1995 as JavaScript
- 1996 Microsoft responded with JScript

JS Survives

- Around since 1995
- Outlived Silverlight

JS Survives

- Around since 1995
- Outlived Flash

Everyone's There

- No need to reinvent the wheel
- Plenty of libraries
- Plenty of docs

JavaScript's Really Simple

- Few key concepts
- Minimalistic Syntax
- Top-to-Bottom semantics

JavaScript Key Ideas

- Interpreter based (no compilation)
- Loosely typed language
- Objects are just hash tables

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Q & A

Running JavaScript

- Easy way: jsbin
- Completely offline using node.js
- Using a simple HTML file

Demo

JavaScript Basic Syntax

JavaScript Syntax

- Defining variables
- Loops and branches
- Defining functions

JavaScript tl;dr

- Use `var` to declare a variable
- Use MDN to find information
- Everything else works
- Lab: http://ynonperek.com/javascript-exer.html

JavaScript Core Types

- Numbers
- Strings
- Booleans
- null
- undefined
- Objects

Numbers

- JavaScript has only one number type called number
  - number is a 64-bit floating point (double)
  - Same arithmetical problems double have (0.1+0.2 !=0.3)
  - A special value NaN represents errors

Numeric Functions

- Number(string)

  converts string to number

  returns NaN on error

- parseInt(string, radix)

  converts string to number

  tries its best (so '7hello' is OK)

- Math.random()

  returns a random between 0 and 1

Numeric Functions

```
x = 3;

y = Number(7);

z = Number('9');

console.log(x + y + z);
```

Q & A

- Numbers
- Strings
- Booleans
- null
- undefined
- Objects

Strings

- Strings are unicode 16-bit chars (like in Java).
- No char class. Characters are strings of length 1
- Strings are immutable (like in Java)
- Both Single and Double quotes make a string

String Examples

```
'hello'.length                  === 5

String(10).length               === 2

'hello'.indexOf('l')     === 2

'hello'.lastIndexOf('l')=== 3

'hello'.toUpperCase()    === 'HELLO'
```

Q & A

- Numbers
- Strings
- Booleans
- null
- undefined
- Objects

Boolean Type

- JavaScript supports ‘true’ and ‘false’ as boolean values
- Boolean(value) is a function returning the truthness of a value
- returns false if value is falsy, and true if value is truthy
- !!value has the same meaning

null

- represents the "nothing" of JavaScript
- usually used to mark errors
- JavaScript will not give null to a variable. It's always the result of an assignment performed on purpose

undefined

- Not even the nothing
- JavaScript puts undefined in anything that hasn't yet been assigned a value

JavaScript False/True

- These are all falsy:
  - false, null, undefined
  - “” (the empty string)
  - 0, NaN
- Everything else is truthy

Objects & Arrays

Objects

- Everything else is an object
- An object is a collection of key/value pairs.
- Objects are fully dynamic, so new methods and fields can be added at runtime
- Objects have no classes
- Each object has a prototype. We'll talk about that later.

Objects

name	Ynon Perek
email	ynonperek@yahoo.com
web	http://ynonperek.com

```
var me = {
    name  : 'Ynon Perek',
    email : 'ynonperek@yahoo.com',
    web   : 'http://ynonperek.com'
};
```

Object Functions

```
var o = { x: 5, y: 7 };

delete o.x;

// undefined
console.log( o.x );
```

Object Iteration

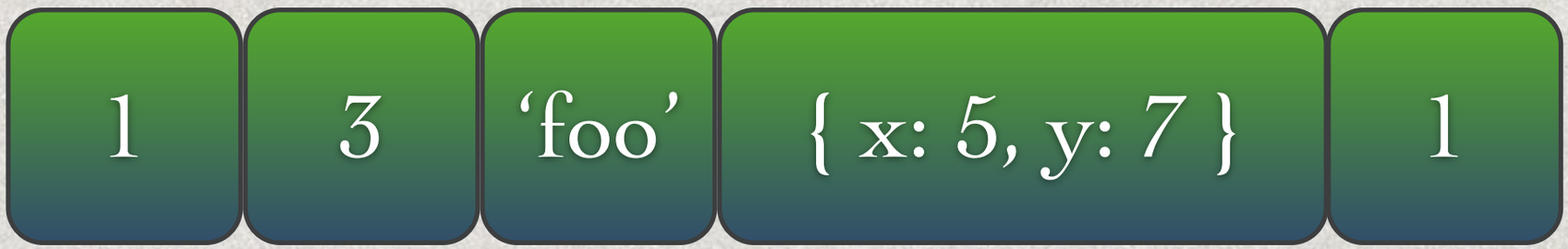
```
var o = { x: 5, y: 7 };

for ( var key in o ) {
  if ( ! o.hasOwnProperty(key) ) {
    return;
  }

  console.log(key + ' => ' + o[key] );
}
```

JavaScript Arrays

- Ordered collections of variables
- Can hold anything

JavaScript Arrays

```
var arr = [  1, 3,
             'foo',
             { x: 5, y: 7 },
             1
         ];
```



Array Functions

- Use `push` to add elements to the end
- Use `pop` to remove elements from the end

```
var a = [1, 2, 3];
a.push('foo');

// now a is [1, 2, 3, 'foo']

a.pop();
a.pop();

// now a is [1, 2]
```

Array Functions

- Use `shift` to remove the first element
- Use `unshift` to insert elements in the beginning

```
var a = [10, 20, 30];

a.shift();
// a is now [20, 30]

a.unshift('foo', 'bar');
// a is now ['foo', 'bar', 20, 30]
```

Array Splicing


```
a.splice(3, 2);
```

Array Splicing


```
a.splice(3, 2);
```

Array Splicing


```
a.splice(3, 2);
```

Array Subscripting

Array Subscripting

- Use brackets to subscript
- Can take string or number

```
arr = [1,2,10];

// prints 1
console.log(arr[0]);

// prints 10
console.log(arr[2]);

// prints 10
console.log(arr['2']);
```

Array Iteration

- Use `for` loop to iterate an array
- Note the magic `length` property

```
var arr = [10, 20, 30];

for ( var i=0; i < arr.length; i++ ) {
  console.log( arr[i] );
}
```

Arrays Are Just Refs

```
var arr = ['foo', 'bar'];
var b = arr;

b.push('buz');

console.log( arr );
```

Lab: Arrays And Objects

- In Node.JS the variable `process.argv` holds an array of all command line arguments

- Write a program that prints the unique arguments passed to it. For example running:
  `node uniq.js 10 20 20 20 30 10`
  should print:
  `10 20 30`

Arrays Combinators

- forEach(f): calls f(x) for every x in array
- every(f): returns true if for every x: f(x) is true
- some(f): returns true if f(x) is true for at least one x in array

Arrays Combinators

- filter(f):
  - Calls f(x) for every x in array.
  - Returns a new array only with the true values

```
var a = [10, 15, 17, 20];
var even = a.filter( function(el) {
  return el % 2 == 0;
});

console.log( even );
```

```
var primes = a.filter( is_prime );
```

Arrays Combinators

- map(f)
  - Calls f(x) for every x in array
  - Returns an array of the results

```
var a = [10.8, 20.17, 55.22, 77.1, 2];
var rounded = a.map(function(el) {
  return Math.round(el);
});

// Same as
var alt = a.map( Math.round );

console.log( rounded );
```

Q & A

Working With Functions

Spot The Bug

```
var a = Math.floor( Math.random() * 10000 );
var b = Math.floor( Math.random() * 10000 );
var sum_a = 0, sum_b = 0;

while (a) {
  var next = a % 10;
  sum_a += next;

  a = Math.floor( a / 10 );
}

while (b) {
  var next = a % 10;
  sum_b += next;

  b = Math.floor( b / 10 );
}
```

Why Functions

- Save us from Copy-Paste bugs
- Make cleaner code
- Easy to read => Easy to debug

Functions: How

```
var a = Math.floor( Math.random() * 10000 );
var b = Math.floor( Math.random() * 10000 );

var sum_a = sum_of_digits( a );
var sum_b = sum_of_digits( b );
```

Functions: How

```
function sum_of_digits( number ) {
  var result = 0;

  while ( number > 0 ) {
    result += number % 10;
    number = Math.floor( number / 10 );
  }
  return result;
}
```

It Gets Better

- Replace function implementation without changing outside program

```
function sum_of_digits( number ) {
  return Number(String(number).split('').reduce(
    function(a,b) { return Number(a) + Number(b); }
  ));
}
```

Function Variables

- Each variable is bound to an object
- Calling a function creates an Activation object, so var inside function is lexical
- Outside every function, the global object is used
- Demo

Function Objects

- A function in JavaScript is just an object
- Can store inside objects or arrays

Function Objects

```
var o = { x: 5, y: 7 };

o.moveRight = function( steps ) {
  o.x += steps;
};

o.moveLeft = function( steps ) {
  o.x -= steps;
};
```

Argument Validation

- Functions can take any number of arguments of any type
- Idiomatic code on the right does type checking

```
function got_2_numbers(x, y) {
  if ( typeof(x) !== 'number' ) {
    return 1;
  }

  if ( typeof(y) !== 'number' ) {
    return 1;
  }

  return x * y;
}
```

Default Arguments

- The idiomatic code on the right assigns default value to arguments

```
function print_times( text, times ) {
  if ( text == null ) {
    return;
  }

  times = times || 5;

  for ( var i=0; i < times; i++ ) {
    console.log( text );
  }
}
```

Variadic Functions

- The idiomatic JavaScript code below takes a variable number of arguments into an array (starting at the second)

```
function sum(start_value) {
  var params = Array.prototype.slice.call(arguments, 1);

  return params.reduce(function(a, b) {
    return a + b;
  });
}

// returns 14
sum(10, 5, 2, 7);
```

Q & A

Functions Lab

- Write a function that takes many strings, and prints the total number of characters

- Write a function that takes a list of numbers and prints the sum of all even numbers

- Write a function that takes a string as input and prints how many digits it has

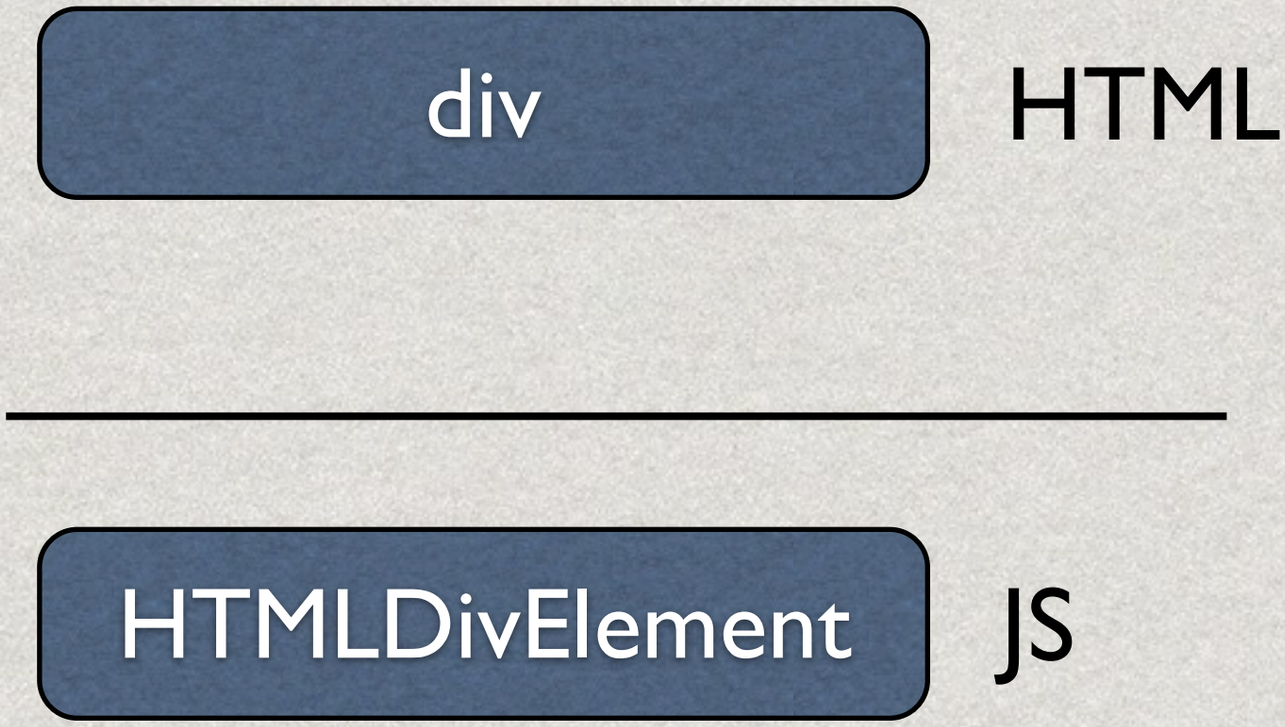
DOM Scripting

Using JS To Manipulate the web page

http://www.flickr.com/photos/jram23/3088840966/

The DOM

- Stands for Document Object Model
- Every HTML element has a JS object "bound" to it in a special bond



The DOM

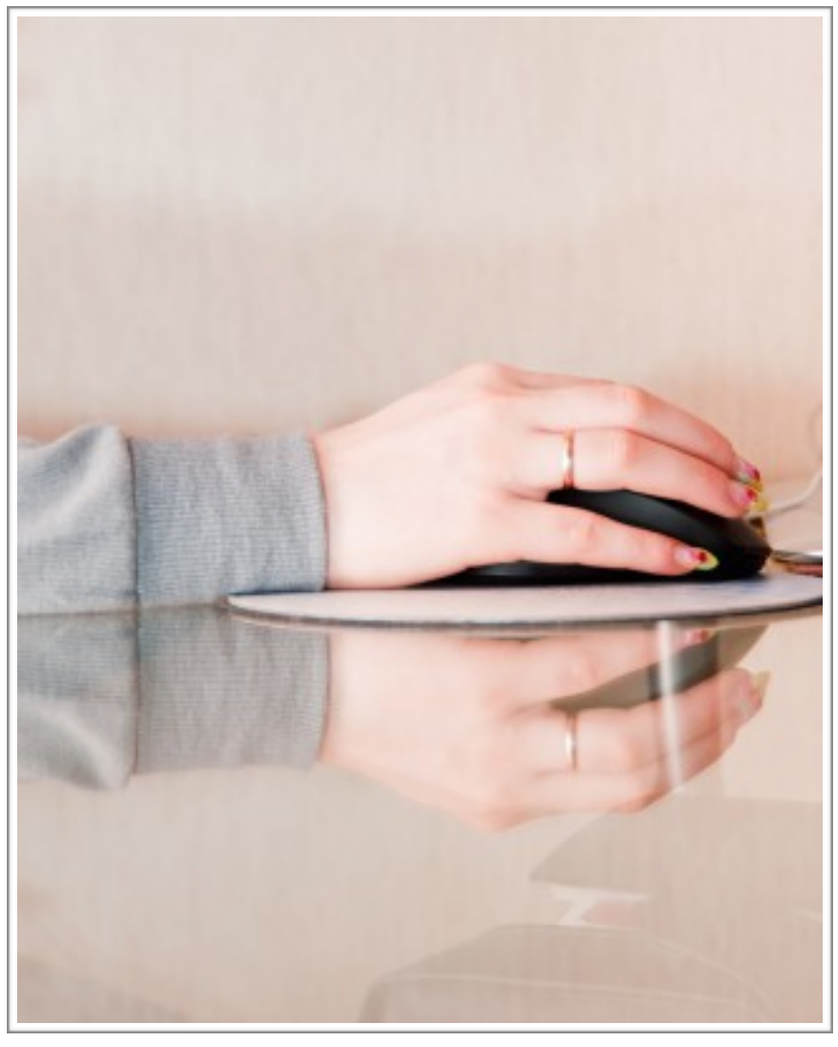
- Can use getElementById to find a specific element

```
<p id="text"></p>
```

```
var t = document.getElementById('text');

t.innerHTML = "Hello World";
```

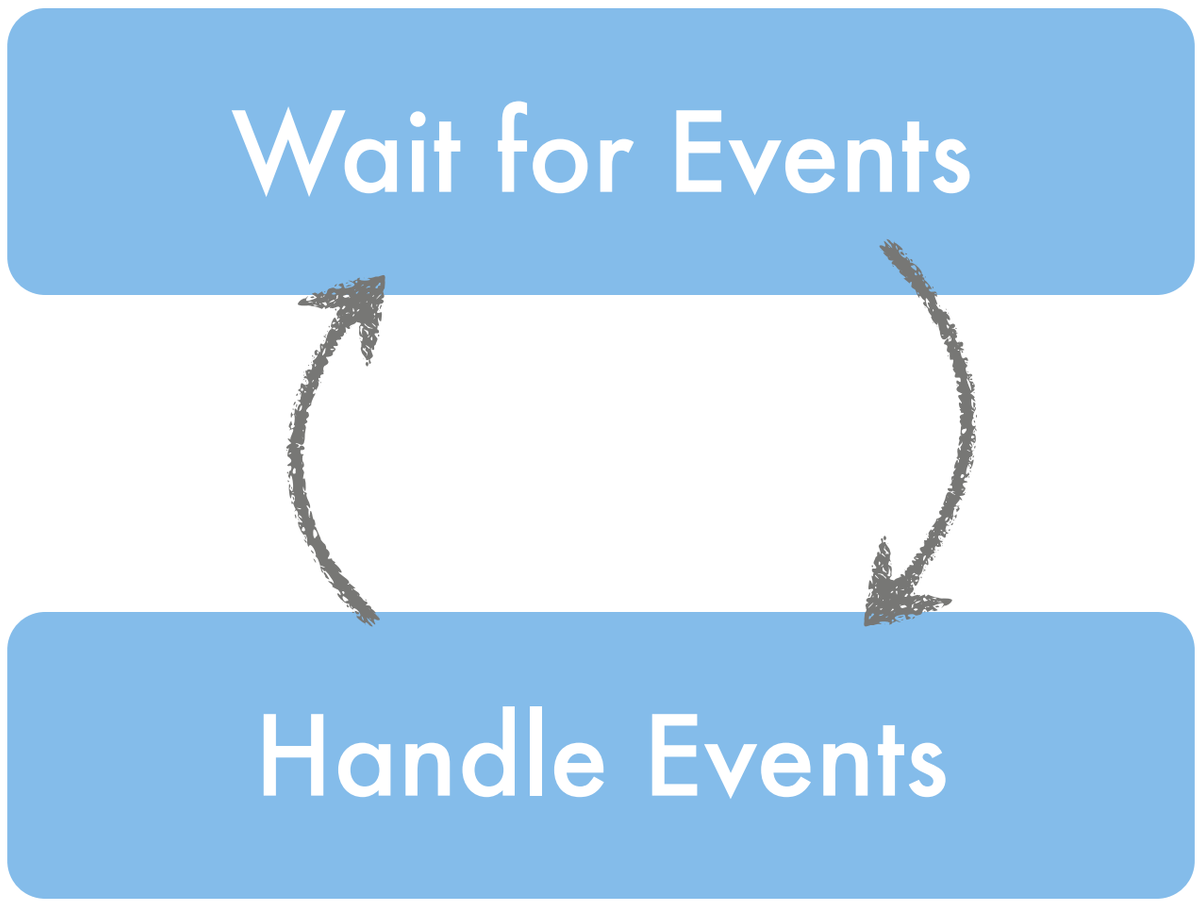
- Can use getElementsByTagName to get all elements with a specified name

Browser Events Loop

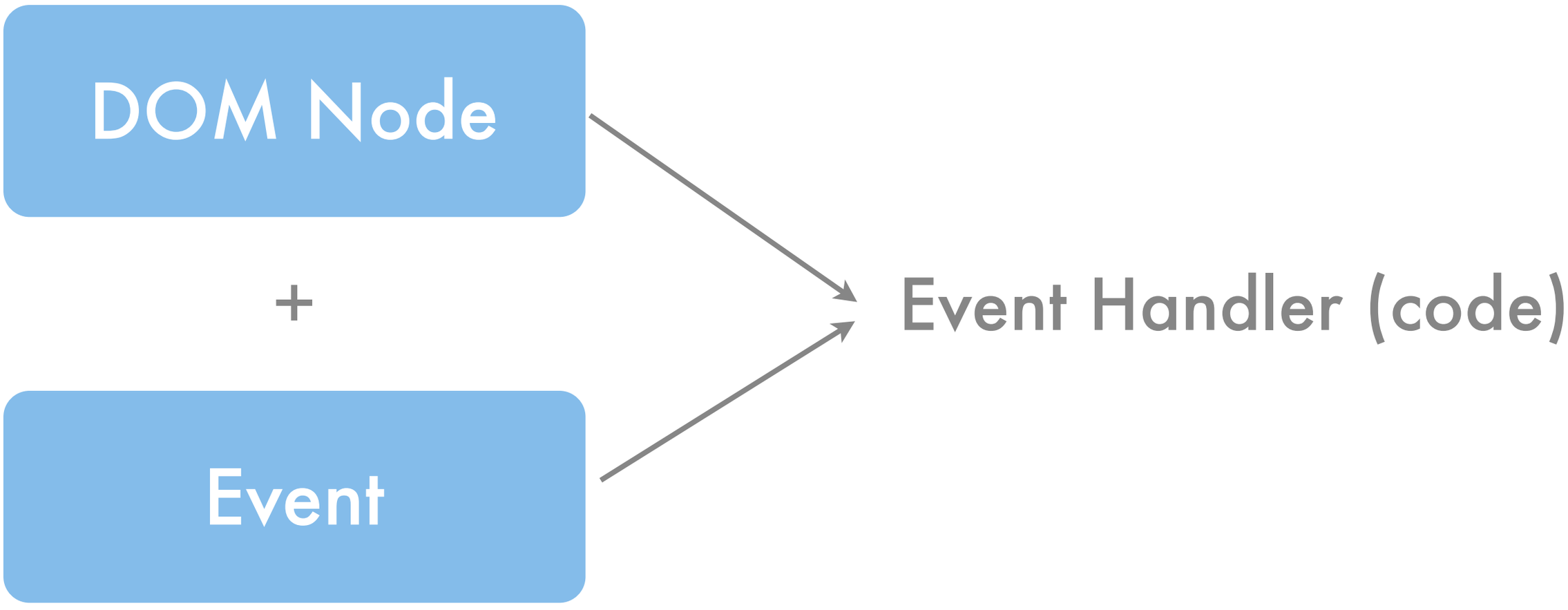


Event Queue

Event Loop



Event Handling



Code Outline

- From HTML:
  - `<a on...=”handleEvent()”>`

Code Outline

- But this can get messy

```
<a href="#" onclick="doclick"
    onblur="doblur"
    onchange="dochange"
    ondblclick="dodblclick"
    onmousemove="domove"
    onmouseover="doover">
Too many events</a>
```

Code Outline

- From JS
- Get a DOM node
- Bind event to code

Getting DOM Nodes

- `getElementById(...)`
- `getElementsByTagName(...)`
- `querySelector(...)` - IE8 and up

Demo: Events

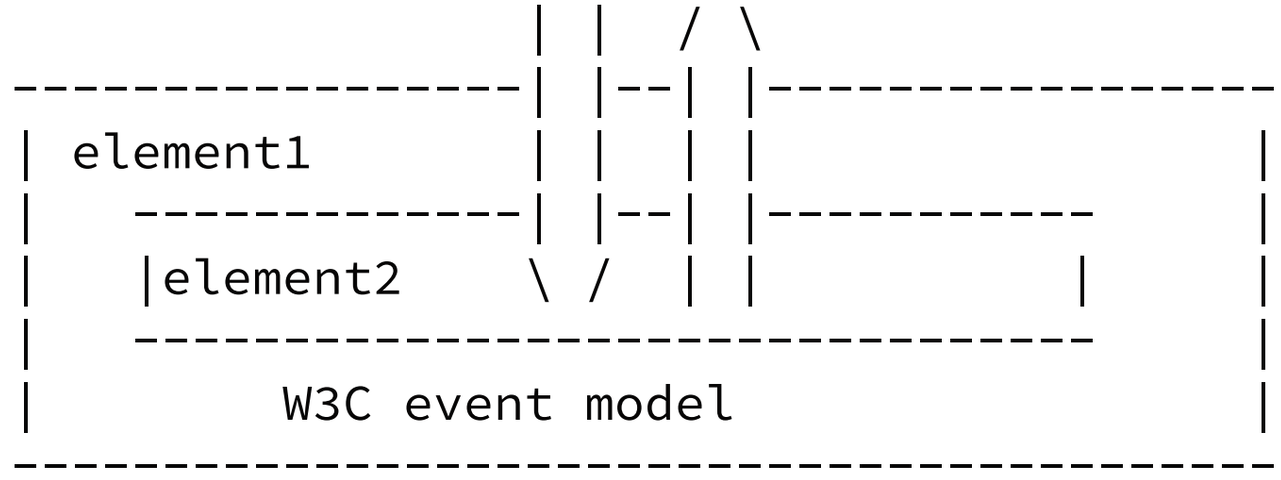
- Write a simple page that shows alert as a response to click event
- Modify to change text of element

Using the Event Object

- Event object includes info on the event

```
<button>Click Me</button>

<script>
  var btn = document.getElementsByTagName('button')[0];
  btn.onclick = function(e) {
    if ( ! e ) e = window.event;

    console.dir( e );
  };
</script>
```

Capturing vs. Bubbling



Capturing vs. Bubbling

- node.addEventListener takes a third parameter
- true means capturing
- false means bubbling
- defaults to false

Demo

- Capture all click events using `document.onclick = ...`

Event Types

Interface Events	Mouse Events	Form Events
load, unload	click, dblclick	submit
resize, scroll,	mousedown, mouseup, mousemove	reset
focus, blur	mouseover, mouseout	

Default Action

- Some events also have a "default" action
- For example: A link will take you to another page by default

Default Action

- Possible to prevent
- Demo

Events Lab

- Implement 5 duplicated input boxes
- Each input box should have the same text
- Change one -> all change automatically

Events Lab


Hello World
Hello World
Hello World
Hello World
Hello World

Q & A

Thank You

- Ynon Perek
- ynonperek@yahoo.com
- ynonperek.com