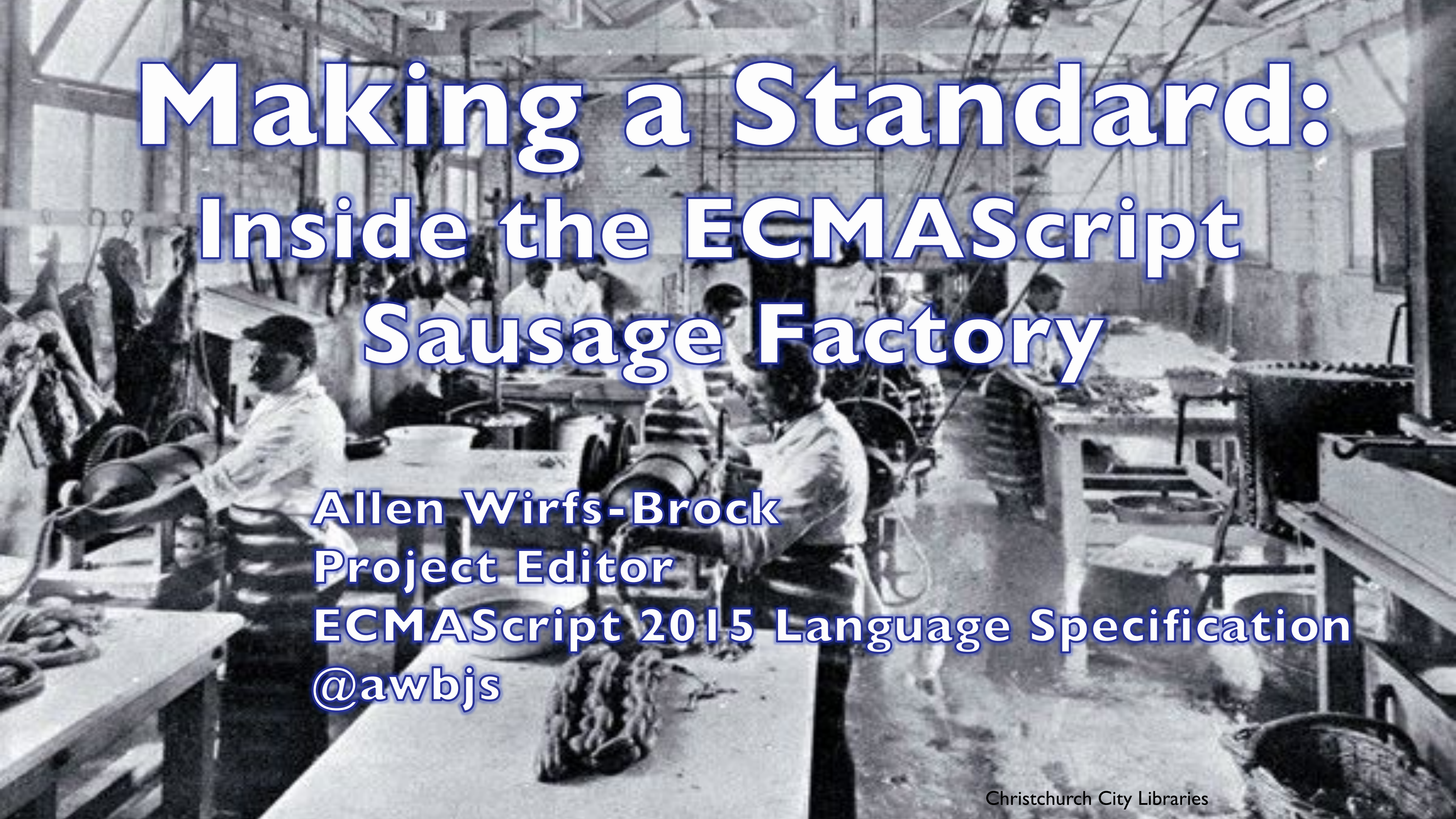
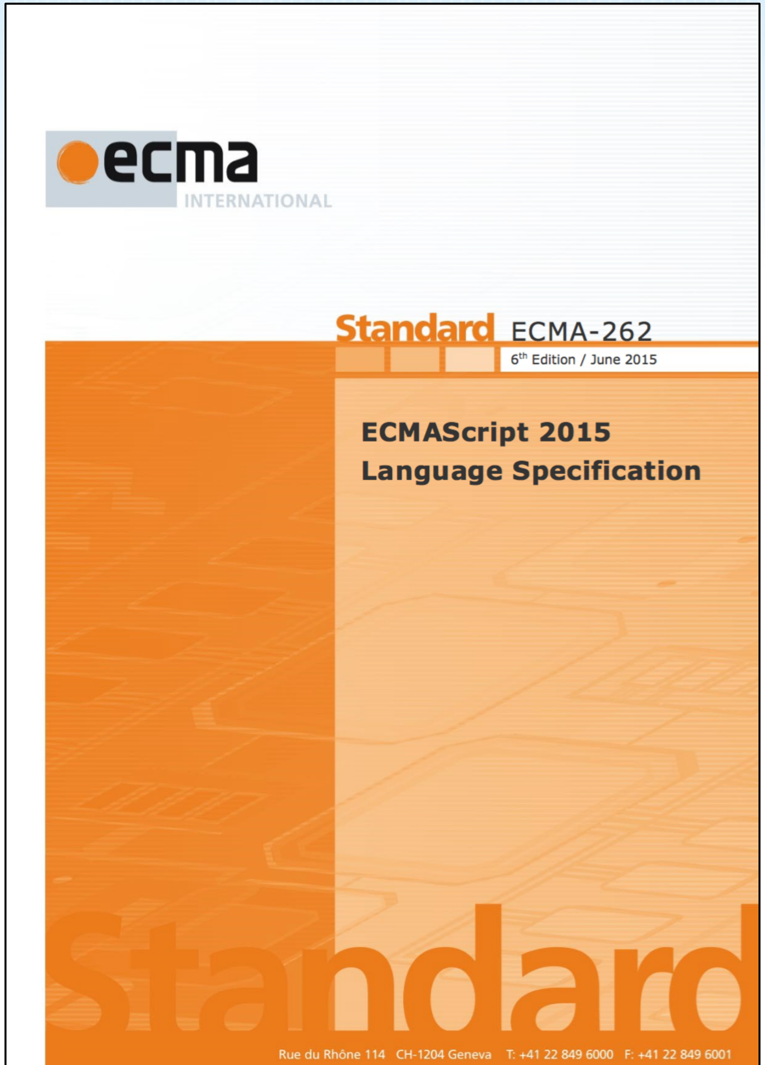


Making a Standard: Inside the ECMAScript Sausage Factory

Allen Wirfs-Brock
Project Editor
ECMAScript 2015 Language Specification
@awbjs

Christchurch City Libraries

ECMAScript 2015



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Standard ECMA-262

6th Edition / June 2015

ECMAScript 2015 Language Specification

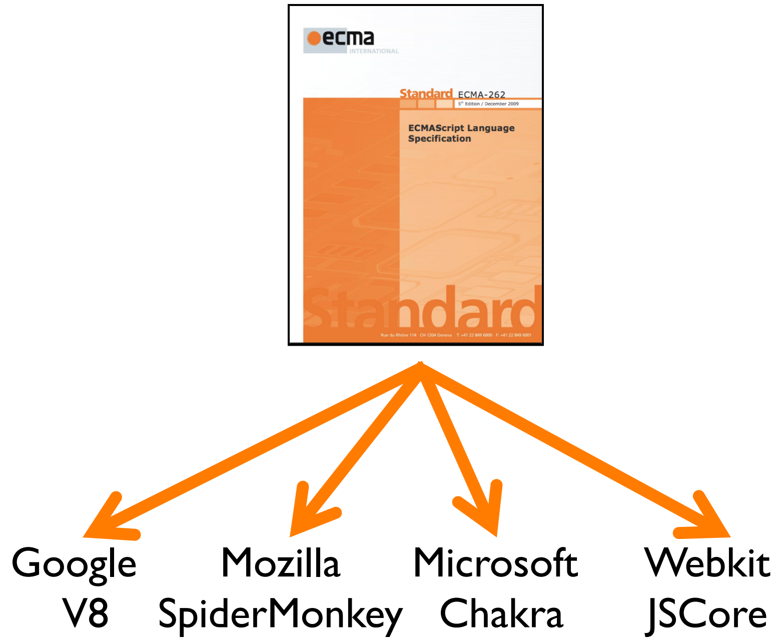
Standard

Rue du Rhône 114 CH-1204 Geneva T: +41 22 849 6000 F: +41 22 849 6001

“ES6”

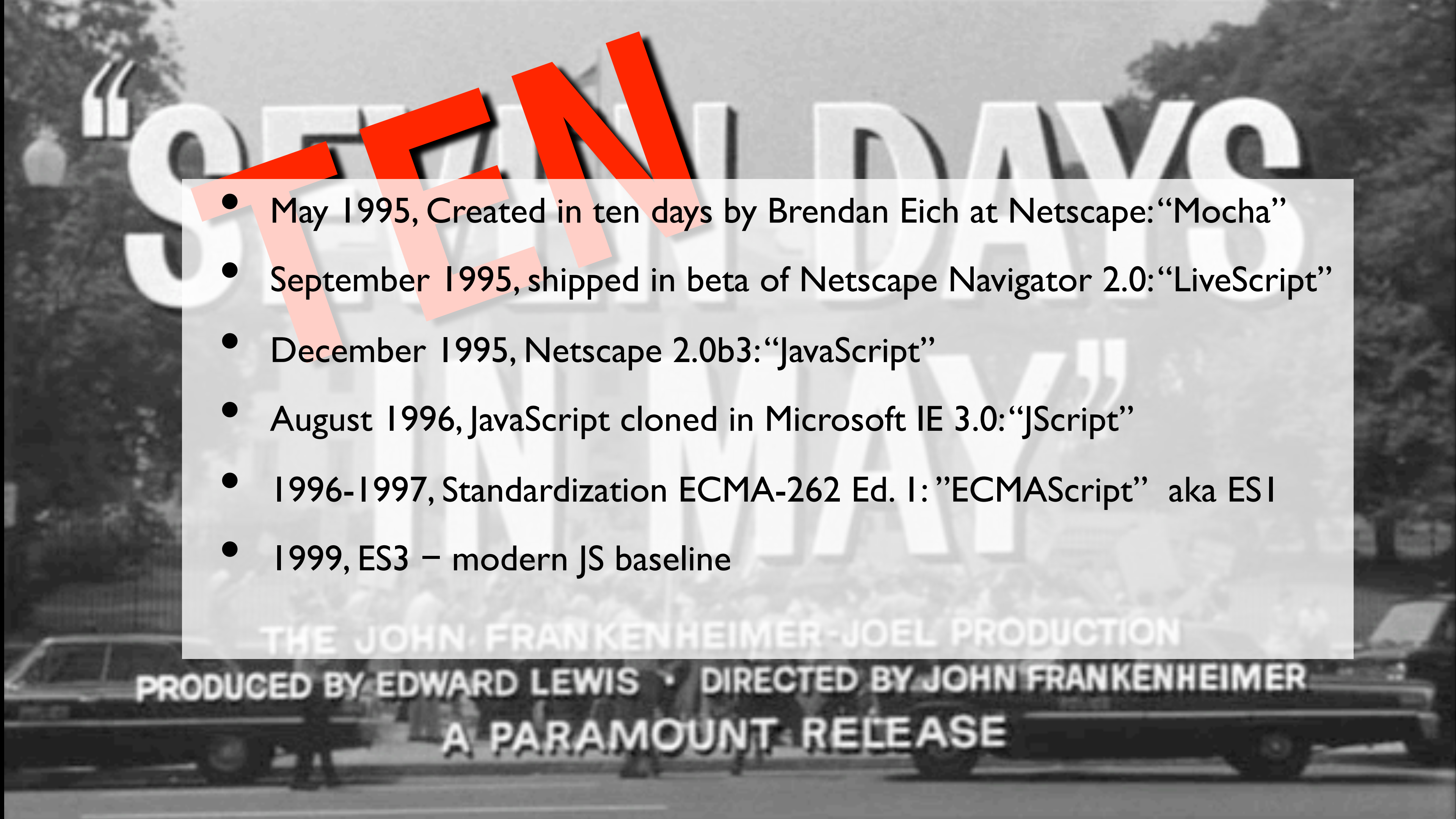
What is ECMAScript?

- ECMAScript is the name of the international standard that defines the JavaScript programming language
- Developed by Technical Committee 39 (TC-39) of Ecma International
- Issued as document ECMA-262
- Not part of W3C



JavaScript Implementations

TEN
“SEVEN DAYS IN MAY”
THE JOHN FRANKENHEIMER-JOEL PRODUCTION
PRODUCED BY EDWARD LEWIS · DIRECTED BY JOHN FRANKENHEIMER
A PARAMOUNT RELEASE

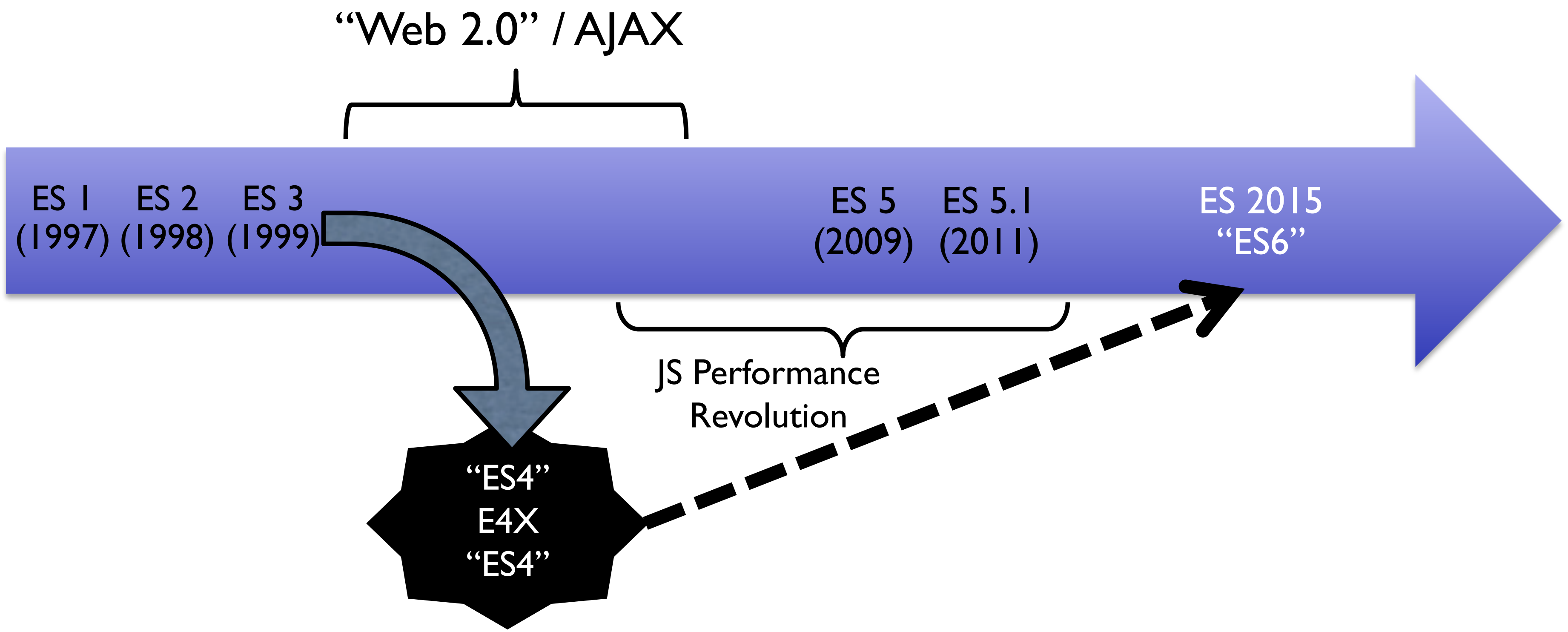

"SEVEN DAYS IN MAY"
TEN
THE JOHN FRANKENHEIMER-JOEL PRODUCTION
PRODUCED BY EDWARD LEWIS · DIRECTED BY JOHN FRANKENHEIMER
A PARAMOUNT RELEASE

- May 1995, Created in ten days by Brendan Eich at Netscape: "Mocha"
- September 1995, shipped in beta of Netscape Navigator 2.0: "LiveScript"
- December 1995, Netscape 2.0b3: "JavaScript"
- August 1996, JavaScript cloned in Microsoft IE 3.0: "JScript"
- 1996-1997, Standardization ECMA-262 Ed. 1: "ECMAScript" aka ES1
- 1999, ES3 − modern JS baseline

ECMAScript: Troubled Adolescence

- 2000: ES4, attempt 1
- 2003-4: E4X, XML extensions for ECMAScript
- 2005-8: ES4, attempt 2
- 2007: Work on ES 3.1 starts as TC39 side-project
- 2008: ES4 abandoned
- 2009: ES5: “use strict”, JSON, Object.create, etc.

The ECMAScript Standard Timeline



First Comprehensive Revision Since 1999

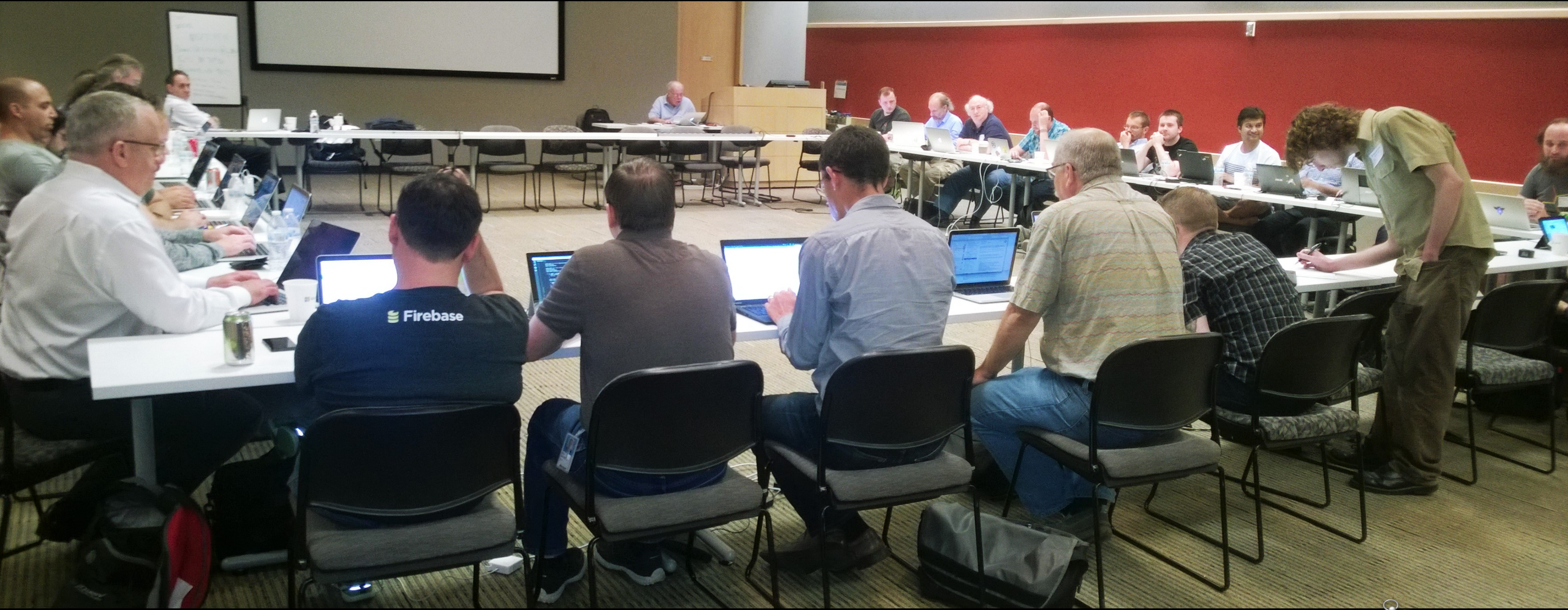
Some ECMAScript 2015 Enhancements

- More concise and expressive syntax
- Modules
- Class Declarations
- Block scoped declarations
- Control abstraction via iterators and generators
- Promises
- String interpolation/Internal DSL support
- Subclassable built-ins
- Binary Array Objects with Array methods
- Built-in hash Maps and Sets + weak variants.
- More built-in Math and String functions
- Improved Unicode support, Unicode RegExp

ES 2015 (June 2015):	566 pages
ES 5 (Dec. 2009):	252 pages
ES 3 (Dec. 1999):	188 pages
ES 2 (Aug 1998):	117 pages
ES 1 (June 1997):	110 pages

TC-39 isn't like either of these

METEOR jQuery salesforce intel PayPal™



Google NETFLIX YAHOO!®

Things TC-39 focused on for ES 2015

- Modularity
- Better Abstraction Capability
  - Better functional programming support
  - Better OO Support
- Expressiveness and Clarity
- Better Compilation Target
- Things that nobody else can do

What Kind of Language Is JavaScript?

- Functional?
- Object-oriented?
  - Class-based?
  - Prototype-based?
- Permissive?
- Secure?

Photo by crazybarefootpoet @ flickr (CC BY-NC-SA 2.0)

Don’t Break the Web

Don’t Create a Franken-language

http://www.flickr.com/photos/benledbetter-architect/sets/72157594338948430/

A common meta-tweet

ES6 <insert some feature> is based on <insert some other language>.

What language had the most influence on the design of ECMAScript class declarations?

a) Java

b) C++

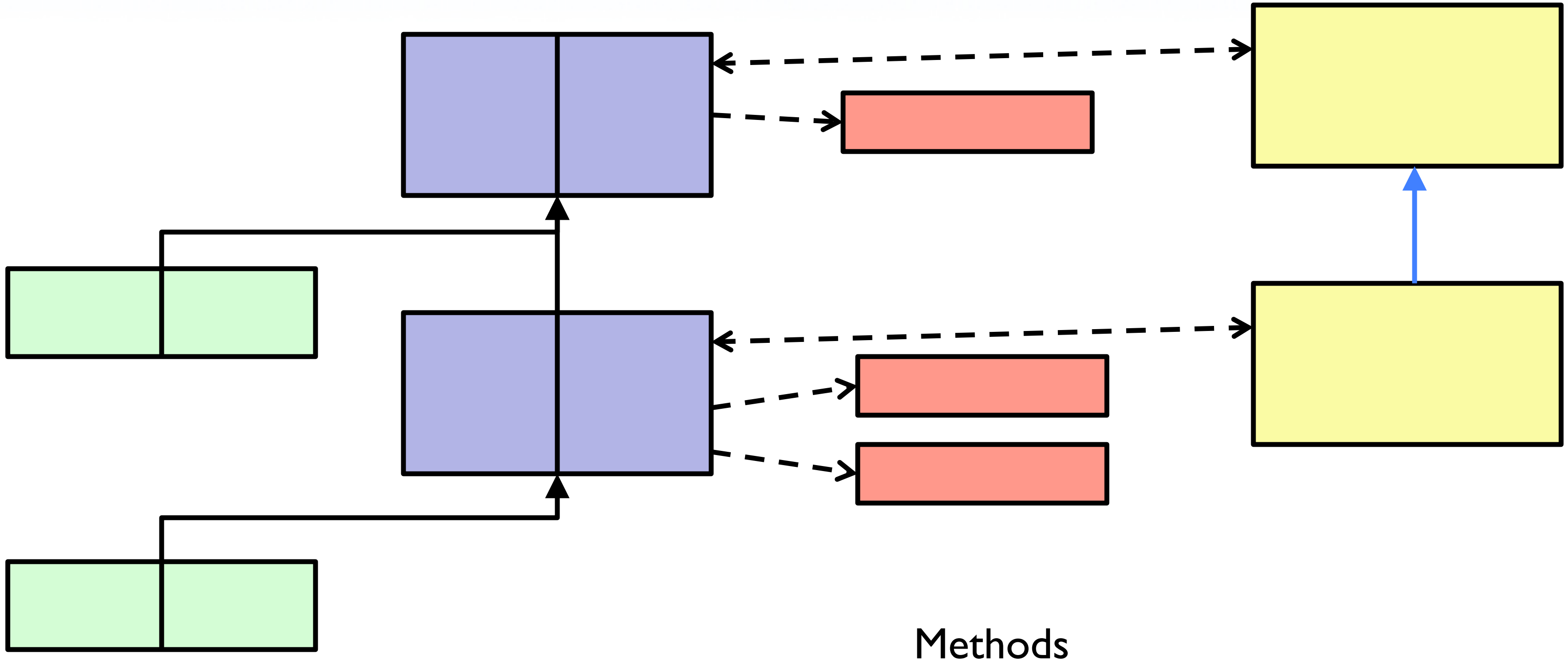
c) Ruby

d) Dart

e) Smalltalk

[✓ f) Something else: JavaScript]

JavaScript Class “Constructor” Pattern



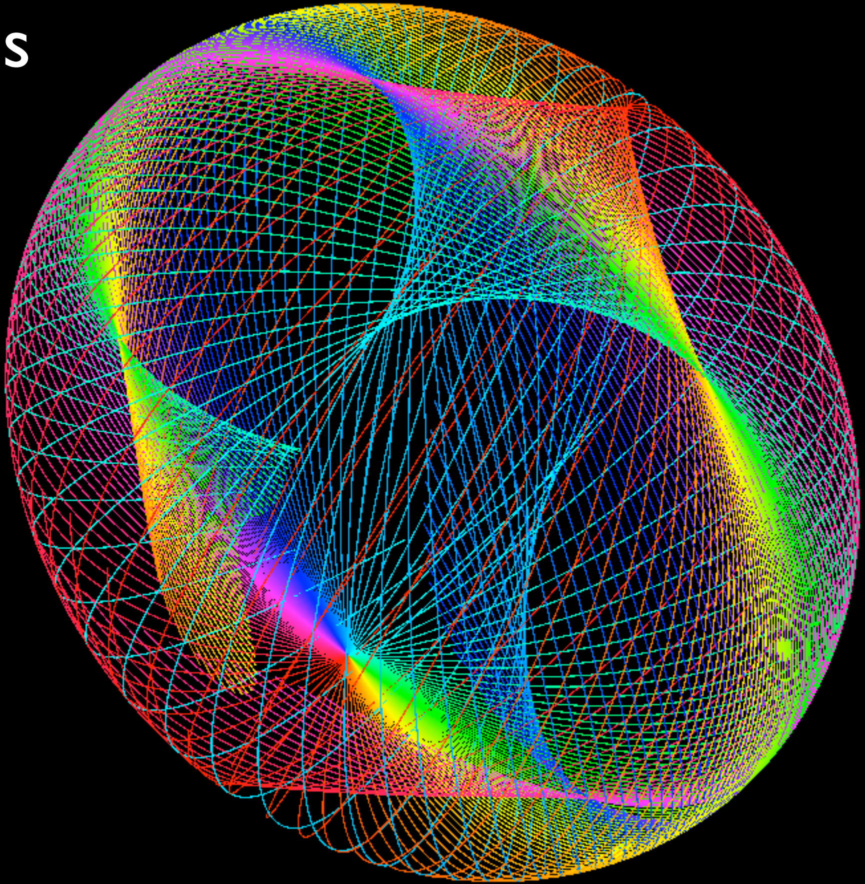
Classes ES5 vs ES 2015

```
//ES5 define Employee as subclass of Person

function Employee(name,id) {
   Person.call(name);
   this.id = id;
}
Employee.prototype=Object.create(Person.prototype);
Object.defineProperty(Employee.prototype, “constructor”,
  {value:Employee,enumerable:false,configurable: true});
Employee.__proto__ = Person;
Employee.withId = function (id) {…}
Employee.prototype.hire = function() {…};
Employee.prototype.fire = function () {…};


…
```

```
//ES2015 define Employee as subclass of Person

class Employee extends Person {
   constructor(name,id) {
     super(name);
     this.id = id;
   }
   hire () {…}
   fire () {…}
   static withId (id) {…}
   …
}
```

Both create the same object structure

Interconnections



Interactions

The closure in loop problem

```
function f(x) {
    for (var p in x) {
        var v = doSomething(x, p);
        obj.addCallback(
            function(args){
                handle(v, p, args)}
        );
    }
}
…
obj.runCallbacks();
```

Every callback uses the same value for v and p

var hoisting causes the problem

```
function f(x) {
    var p;
    var v;
    for (~~var~~ p in x) {
        ~~var~~ v = doSomething(x, p);
        obj.setCallback(
                function(args){
                        handle(v, p, args)}
        );
     }
}
…
obj.runCallbacks();
```

ES6 can't redefine the scoping of `var`

```
function f(x) {
    for (var p in x) {
        var v = doSomething(x, p);
        if (v === somethingSpecial) break;
    }
    if (v === somethingSpecial) ...
}
```

Fixing closure in loop problem: Add a new block scoped declaration

```
function f(x) {
    for (~~var~~ let p in x) {
        ~~var~~ let v = doSomething(x, p);
        obj.setCallback(
                function(args){
                        handle(v, p, args)
        )};
    }
}
...
obj.runCallbacks();
```

Every callback uses a distint binding for v and p

Other local scoping WTFs

```
function f(x,x) {
    var x;
    for (var x in obj) {
        if (obj[x] === somethingSpecial) {
            var x = 0;
            ...
        }
    }
    function x() { doSomething()}
    x();
}
```

Want to avoid new `let` WTFs

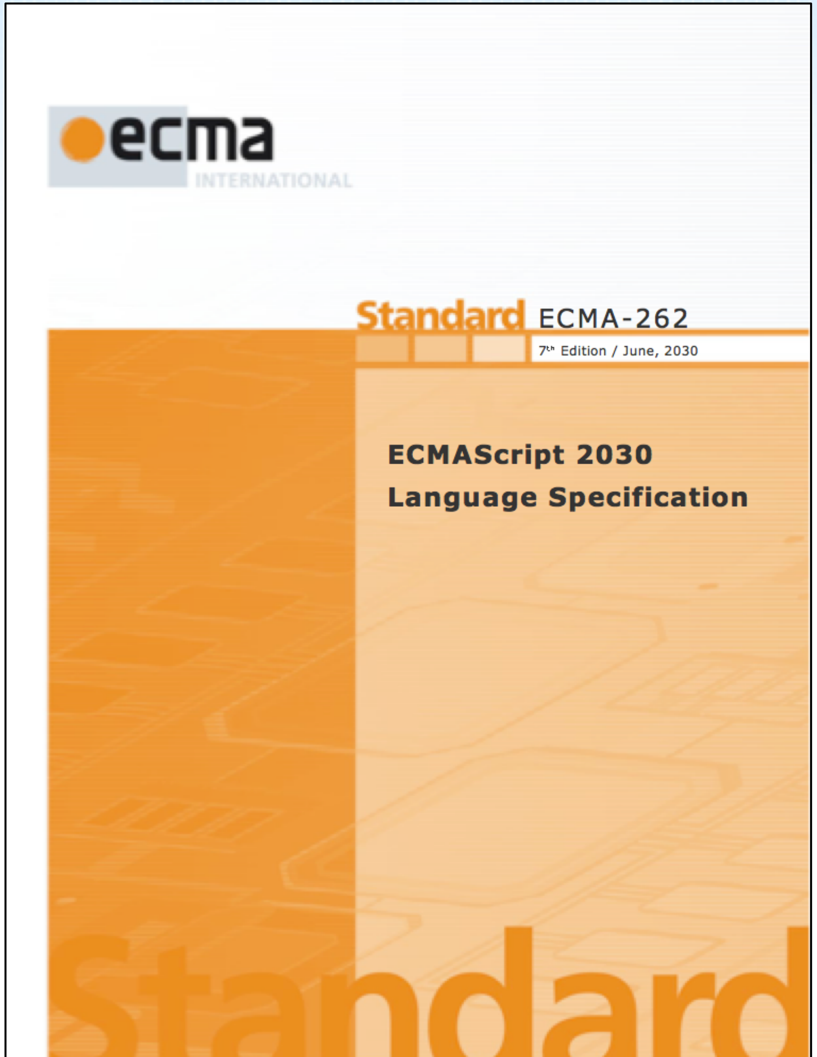
```
//duplicate declarations
function f() {
    let x = 1;
    let x = 2;
}

//duplicate let and parameter
function h(x) {
    let x = 1;
}
//duplicate let and function
function h() {
    let x = 1;
    function x() {}
}
```

```
//duplicate let and var
function g() {
    let x = 1;
    var x = 2;
}

//hoist var to/over let
function ff() {
    let x = 1;
    if (pred) {
      var x;
    }
}
```

Static Errors

Some ES6 Declaration Rules

- Single unique binding for any name in a scope.
- Multiple `var` and top-level `function` declarations for the same name are allowed. (Still one binding per name) Just like ES1-5
- All other multiple declarations are errors: var/let, let/let, let/const, class/function, etc.
- var declarations hoist to top level and auto initialized to undefined. Just like ES1-5
- Can't hoist a `var` over any other declaration of same name (except a top-level function, just like ES1-5)
- Runtime error, for accessing or assigning to an uninitialized binding
- let, const, class declarations are dead until initialized (TDZ).



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Standard ECMA-262

7th Edition / June, 2030

ECMAScript 2030

Language Specification

Standard

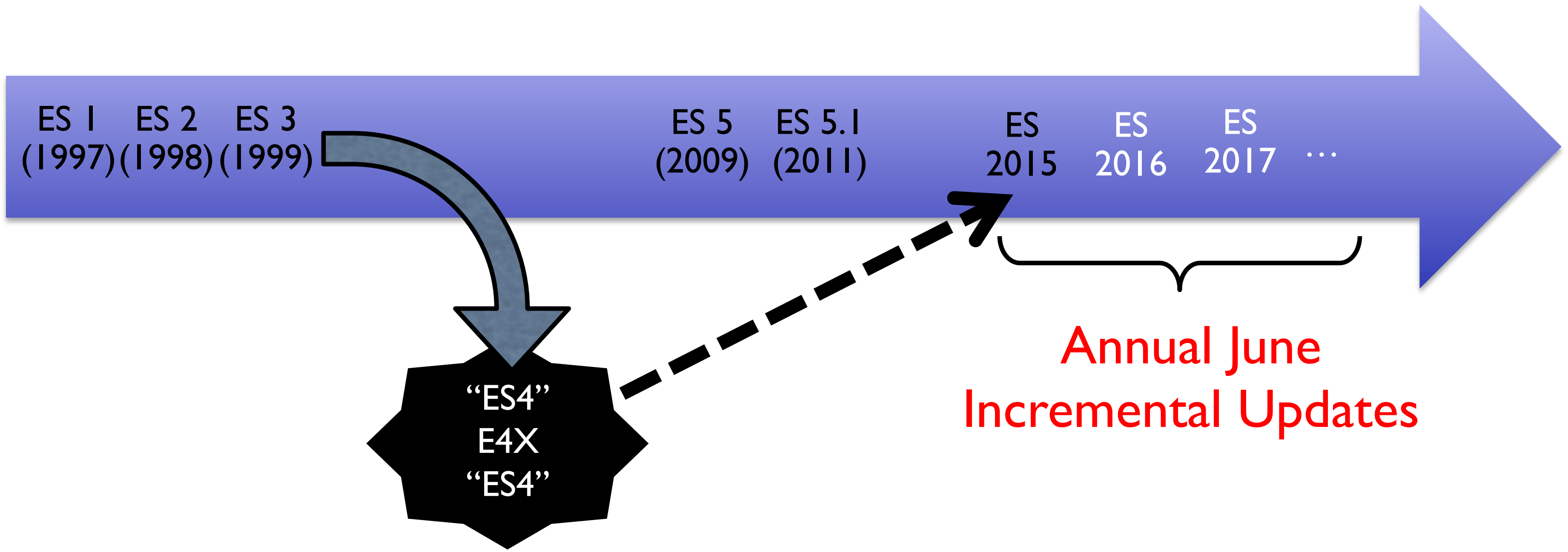
So, What’s Next?

ECMAScript 2030 ?

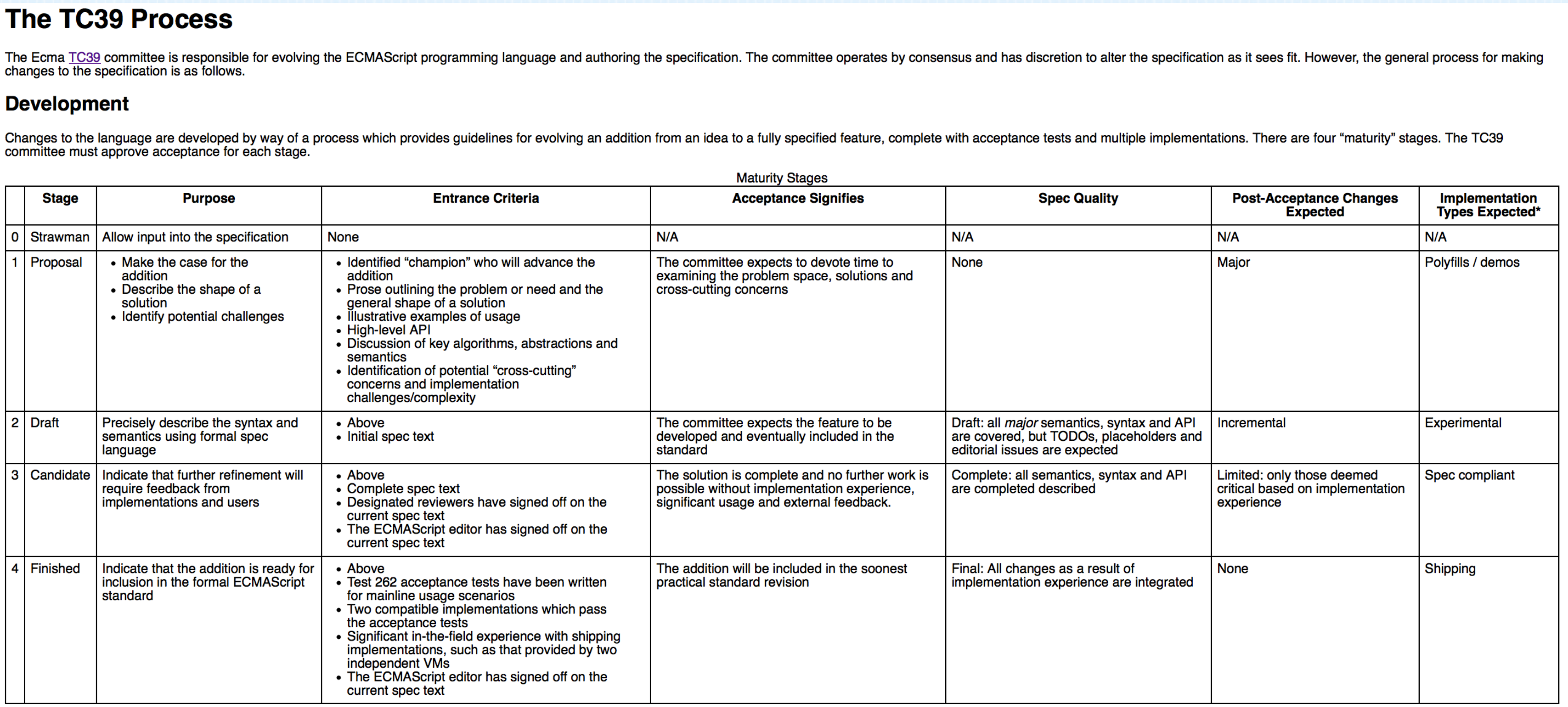
1132 pages ?

The ECMAScript Standard Timeline

Release trains are now leaving the station



Annual June
Incremental Updates



The TC39 Process

The Ecma TC39 committee is responsible for evolving the ECMAScript programming language and authoring the specification. The committee operates by consensus and has discretion to alter the specification as it sees fit. However, the general process for making changes to the specification is as follows.

Development

Changes to the language are developed by way of a process which provides guidelines for evolving an addition from an idea to a fully specified feature, complete with acceptance tests and multiple implementations. There are four "maturity" stages. The TC39 committee must approve acceptance for each stage.

Maturity Stages

	Stage	Purpose	Entrance Criteria	Acceptance Signifies	Spec Quality	Post-Acceptance Changes Expected	Implementation Types Expected*
0	Strawman	Allow input into the specification	None	N/A	N/A	N/A	N/A
1	Proposal	• Make the case for the addition • Describe the shape of a solution • Identify potential challenges	• Identified "champion" who will advance the addition • Prose outlining the problem or need and the general shape of a solution • Illustrative examples of usage • High-level API • Discussion of key algorithms, abstractions and semantics • Identification of potential "cross-cutting" concerns and implementation challenges/complexity	The committee expects to devote time to examining the problem space, solutions and cross-cutting concerns	None	Major	Polyfills / demos
2	Draft	Precisely describe the syntax and semantics using formal spec language	• Above • Initial spec text	The committee expects the feature to be developed and eventually included in the standard	Draft: all *major* semantics, syntax and API are covered, but TODOs, placeholders and editorial issues are expected	Incremental	Experimental
3	Candidate	Indicate that further refinement will require feedback from implementations and users	• Above • Complete spec text • Designated reviewers have signed off on the current spec text • The ECMAScript editor has signed off on the current spec text	The solution is complete and no further work is possible without implementation experience, significant usage and external feedback.	Complete: all semantics, syntax and API are completed described	Limited: only those deemed critical based on implementation experience	Spec compliant
4	Finished	Indicate that the addition is ready for inclusion in the formal ECMAScript standard	• Above • Test 262 acceptance tests have been written for mainline usage scenarios • Two compatible implementations which pass the acceptance tests • Significant in-the-field experience with shipping implementations, such as that provided by two independent VMs • The ECMAScript editor has signed off on the current spec text	The addition will be included in the soonest practical standard revision	Final: All changes as a result of implementation experience are integrated	None	Shipping

Process: https://tc39.github.io/process-document/
Proposals: https://github.com/tc39/ecma262/blob/master/README.md

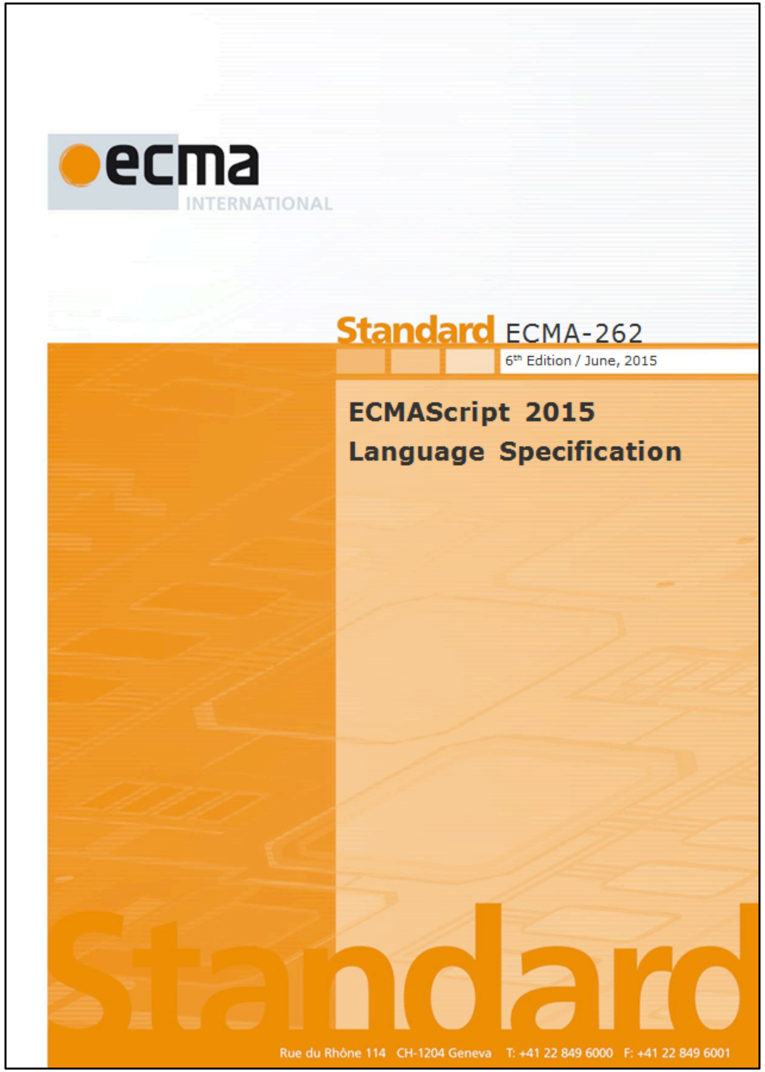
ECMAScript 2016, June 2016

New Features

- [“a”, “b”, “c”].includes(“b”)   //true
- 3 ** 2 //9, the exponentiation operator

Missed the 2016 Train

- async functions
- SIMD support
- String padStart, padEnd
- Etc.



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- It’s real
- The specification is done
- Transpilers and polyfills available today
- It’s being implemented in your favorite browers right now
- It’s the foundation for the next 10-20 years of JavaScript evolution

It Has Legs

http://www.robomargo.com/furniture.html

http://wirfs-brock.com/allen/files/forwardjs2016.pdf

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