



ECMAScript 6

The Future of JavaScript is Now!

Tom Van Cutsem

JOIN '15

 @tvcutsem

My involvement in JavaScript



- PhD on programming language technology



- 2010: Visiting Faculty at Google, Caja team



- Joined ECMA TC39
- Actively contributed to ECMAScript 6 spec

Talk Outline

- Part I: JavaScript's origins, and the long road to ECMAScript 6
- Part II: a brief tour of ECMAScript 6
- Part III: using ECMAScript 6 today
- Wrap-up

Part I

JavaScript's origins, and the road to ECMAScript 6

JavaScript's origins

- Invented by Brendan Eich in 1995, then an intern at Netscape, to support client-side scripting in Netscape navigator
- First called *LiveScript*, then *JavaScript*, then standardized as *ECMAScript*
- Microsoft “copied” JavaScript in IE JScript, “warts and all”



*Brendan Eich,
Inventor of JavaScript*



The world's most misunderstood language



*Douglas Crockford,
Inventor of JSON*

See also: “JavaScript: The World's Most Misunderstood Programming Language” by Doug Crockford at <http://www.crockford.com/javascript/javascript.html>

The Good Parts



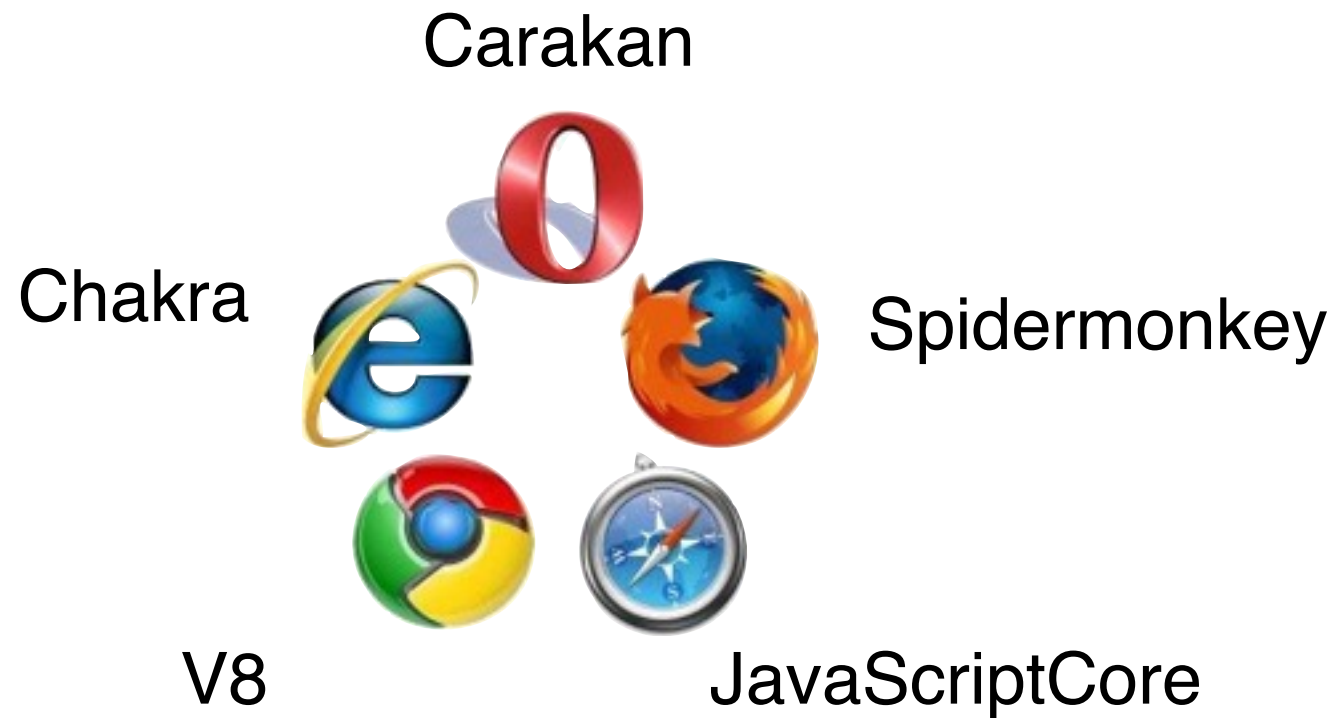
- Functions as first-class objects
- Dynamic objects with prototype-based inheritance
- Object literals
- Array literals

The Bad Parts

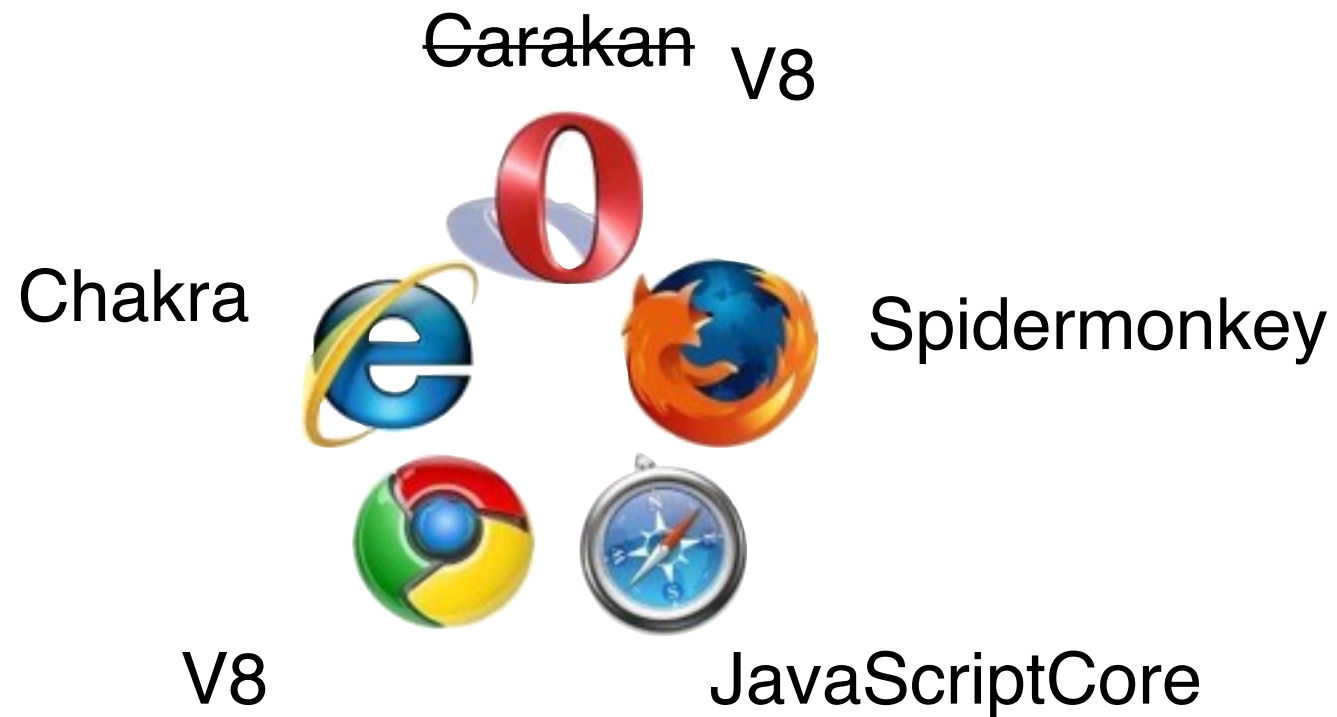


- Global variables (no modules)
- `with` statement
- Implicit type coercion
- Var hoisting (no block scope)
- ...

ECMAScript: “Standard” JavaScript



ECMAScript: “Standard” JavaScript



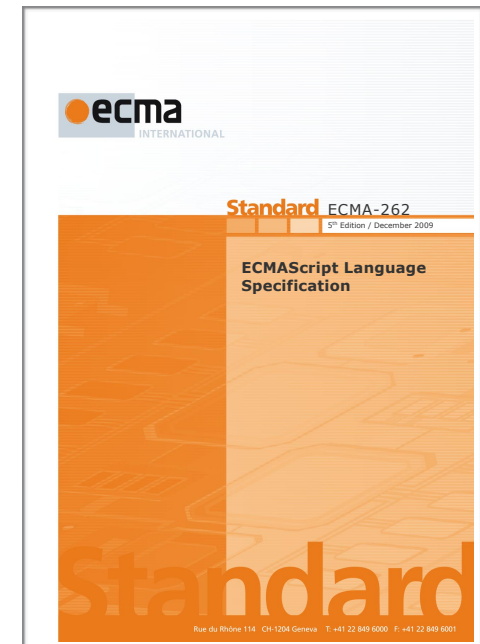
(170.000+ npm packages!)

TC39: the JavaScript “standardisation committee”

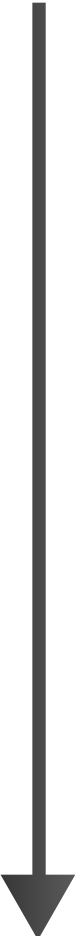
- Representatives from major Internet companies, browser vendors, web organisations, popular JS libraries and academia
- Maintains the ECMA-262 specification.
- The spec is a handbook mainly intended for language implementors. Extremely detailed to minimize incompatibilities.

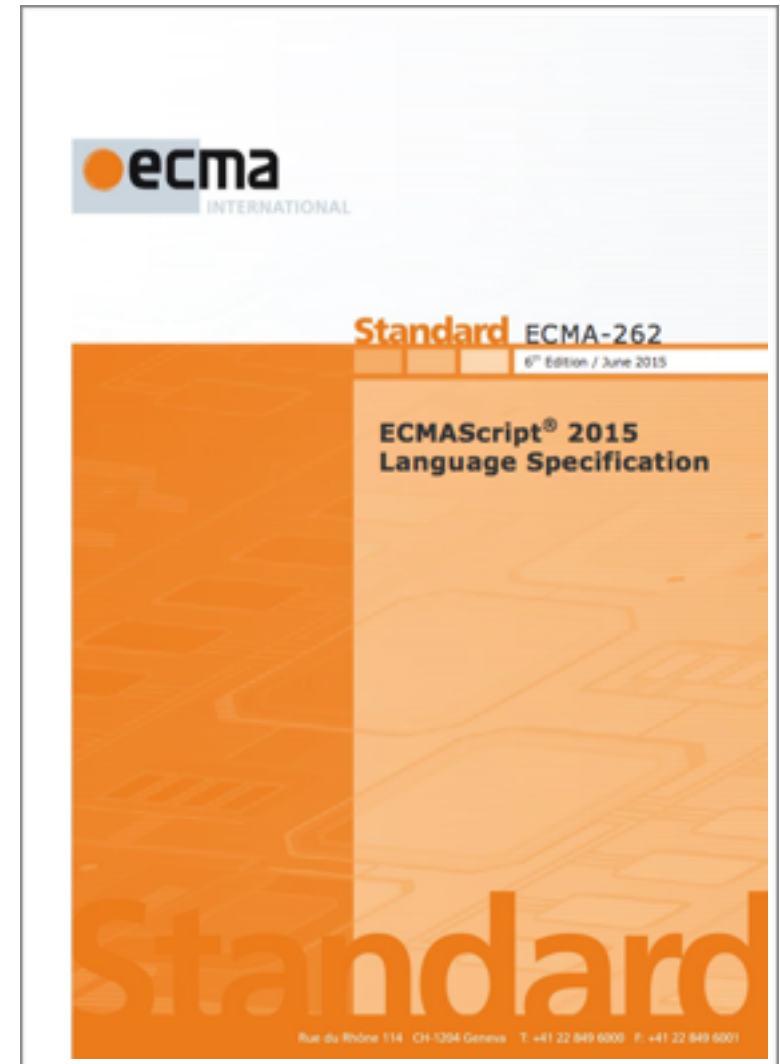


*Allen Wirfs-Brock,
ECMA-262 technical editor*



ECMAScript specification: history

- 
- 1st ed. 1997
 - 2nd ed. 1998
 - 3rd ed. 1999
 - 4th ed.
 - 5th ed. 2009
(introduced “strict mode”)
 - 6th ed. June 2015
(aka *ECMAScript 2015*)



TC39

- Meets bi-monthly, mostly in the SF bay area. **Meetings** are technical, not political in nature
- **Discussions** held in the open on es-discuss@mozilla.org
- Committee very much aware of the dangers of “design-by-committee”.
 - **Champion** model to combat this (each feature led by handful of experts)
- Important **decisions** made by global consensus

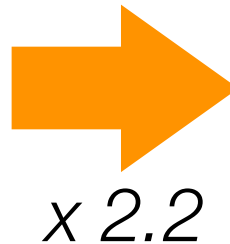
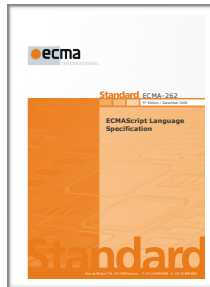
Part II

A brief tour of ECMAScript 6

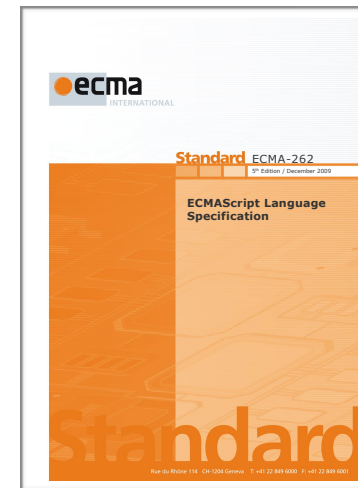
ECMAScript 6

- Major update: many new features (too many to list here)
- Point-in-case:

ES5.1



ES6



258-page pdf

566-page pdf

ECMAScript 6: shortlist

- Arrow functions
- Classes
- Control flow Goodness:
 - Iterators
 - Generators
 - Promises
 - async/await [tentative, ECMAScript 7 sneak peak]

ECMAScript 6: shortlist

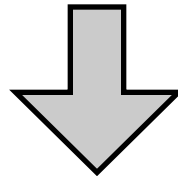
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 - **Promises**
 - **async/await [tentative, ECMAScript 7 sneak peak]**

ECMAScript 6: arrow functions

- Shorter, and also automatically captures current value of `this`
No more `var that = this;`

ES5

```
function sum(array) {  
  return array.reduce(  
    function(x, y) { return x + y; }, 0);  
}
```



ES6

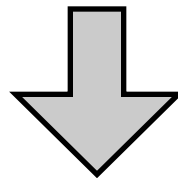
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function sum(array) {  
  return array.reduce((x, y) => x + y, 0);  
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ECMAScript 6: arrow functions

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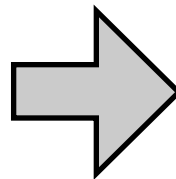
ECMAScript 6: classes

- All code inside a class is implicitly opted into strict mode!

```
function Point(x, y) {  
  this.x = x;  
  this.y = y;  
}
```

```
Point.prototype = {  
  toString: function() {  
    return "[Point...]";  
  }  
}
```

```
var p = new Point(1,2);  
p.x;  
p.toString();
```



```
class Point {  
  constructor(x, y) {  
    this.x = x;  
    this.y = y;  
  }  
  
  toString() {  
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```

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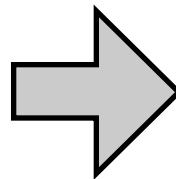
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  }  
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```

```
var p = new Point(1,2);  
p.x;  
p.toString();
```

ECMAScript 6: classes

- Single-inheritance, super-calls, static members

```
class Point3D extends Point {  
  constructor(x, y, z) {  
    super(x,y);  
    this.z = z;  
  }  
  
  static getOrigin() {  
    return new Point3D(0,0,0);  
  }  
}
```

ECMAScript 6: shortlist

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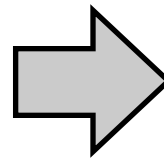
ECMAScript 6 Iterators

```
function fibonacci() {  
  var pre = 0, cur = 1;  
  return {  
    next: function() {  
      var temp = pre;  
      pre = cur;  
      cur = cur + temp;  
      return { done: false, value: cur }  
    }  
  }  
}
```

ES5

ES6

```
var iter = fibonacci();  
var nxt = iter.next();  
while (!nxt.done) {  
  var n = nxt.value;  
  if (n > 100)  
    break;  
  print(n);  
  nxt = iter.next();  
}
```



```
for (var n of fibonacci()) {  
  if (n > 100)  
    break;  
  print(n);  
}
```

// generates 1, 1, 2, 3, 5, 8, 13, 21, ...

ECMAScript 6 Iterators

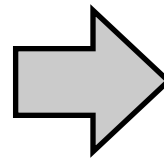
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ES6

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ECMAScript 6: shortlist

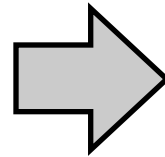
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ECMAScript 6 Generators

- A generator function implicitly creates and returns an iterator

ES5

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function fibonacci() {  
  var pre = 0, cur = 1;  
  return {  
    next: function() {  
      var tmp = pre;  
      pre = cur;  
      cur = cur + tmp;  
      return { done: false, value: cur }  
    }  
  }  
}
```



ES6

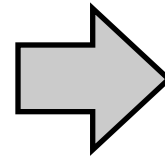
```
function* fibonacci() {  
  var pre = 0, cur = 1;  
  for (;;) {  
    var tmp = pre;  
    pre = cur;  
    cur = cur + tmp;  
    yield cur;  
  }  
}
```

ECMAScript 6 Generators

- A generator function implicitly creates and returns an iterator

ES5

```
function fibonacci() {  
  var pre = 0, cur = 1;  
  return {  
    next: function() {  
      var tmp = pre;  
      pre = cur;  
      cur = cur + tmp;  
      return { done: false, value: cur }  
    }  
  }  
}
```



ES6

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function* fibonacci() {  
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    yield cur;  
  }  
}
```

ECMAScript 6: shortlist

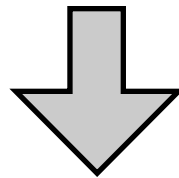
- Arrow functions
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 - async/await [tentative, ECMAScript 7 sneak peak]

ECMAScript 6 Promises

- A promise is a placeholder for a value that may only be available in the future

ES5

```
readFile("hello.txt", function (err, content) {  
  if (err) {  
    // handle error  
  } else {  
    // use content  
  }  
})
```



ES6

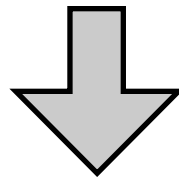
```
var pContent = readFile("hello.txt");  
pContent.then(function (content) {  
  // use content  
}, function (err) {  
  // handle error  
});
```

ECMAScript 6 Promises

- A promise is a placeholder for a value that may only be available in the future

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```
readFile("hello.txt", function (err, content) {  
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  }  
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```



ES6

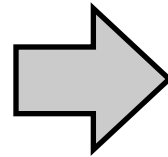
```
var pContent = readFile("hello.txt");  
var p2 = pContent.then(function (content) {  
  // use content  
}, function (err) {  
  // handle error  
});
```


ECMAScript 6 Promises

- Promises can be *chained* to avoid callback hell

```
// step2(value, callback) -> void
```

```
step1(function (value1) {  
  step2(value1, function(value2) {  
    step3(value2, function(value3) {  
      step4(value3, function(value4) {  
        // do something with value4  
      });  
    });  
  });  
});
```



```
// promisedStep2(value) -> promise
```

```
Q.fcall(promisedStep1)  
  .then(promisedStep2)  
  .then(promisedStep3)  
  .then(promisedStep4)  
  .then(function (value4) {  
    // do something with value4  
  })  
  .catch(function (error) {  
    // handle any error here  
  })  
  .done();
```

ECMAScript 6 Promises

- Promises already exist as a library in ES5
- Personal favorite on npm: q (<https://github.com/kriszowal/q>)
- Then why standardize?
 - Wide disagreement on a single Promise API. ES6 settled on an API called “Promises/A+”. See promisesaplus.com
 - Standard API allows platform APIs to use Promises as well
 - W3C’s latest DOM APIs already use promises



then

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 - **async/await [tentative, ECMAScript 7 sneak peak]**

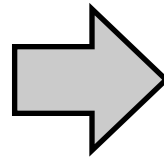
ECMAScript **7**: async/await

- async/await is a C# 5.0 feature that enables asynchronous programming using “direct style” control flow (i.e. no callbacks)

ES6

```
// promisedStep2(value) -> promise
```

```
Q.fcall(promisedStep1)
  .then(promisedStep2)
  .then(promisedStep3)
  .then(promisedStep4)
  .then(function (value4) {
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  })
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  })
  .done();
```



ES7

```
// step2(value) -> promise
```

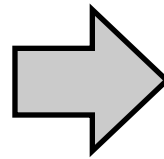
```
(async function() {
  try {
    var value1 = await step1();
    var value2 = await step2(value1);
    var value3 = await step3(value2);
    var value4 = await step4(value3);
    // do something with value4
  } catch (error) {
    // handle any error here
  }
})();
```

async/await in ECMAScript 6

- Generators can be used as async functions, with some tinkering
- `co` npm library in `iojs` (no flags) or `node` (`>= 0.11.x`, `--harmony` flag)

ES7

```
(async function() {  
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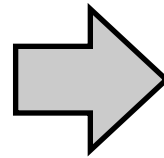
```
co(function*() {  
  try {  
    var value1 = yield step1();  
    var value2 = yield step2(value1);  
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ECMAScript 6: longlist

- Luke Hoban has an excellent overview of all ES6 features at git.io/es6features



*Luke Hoban,
Microsoft representative on TC39*

- arrows
- classes
- enhanced object literals
- template strings
- destructuring
- default + rest + spread
- let + const
- iterators + for..of
- generators
- unicode
- modules
- module loaders
- map + set + weakmap + weakset
- proxies
- symbols
- subclassable built-ins
- promises
- math + number + string + array + object APIs
- binary and octal literals
- reflect api
- tail calls

Part III

Using ECMAScript 6 today

ECMAScript 6: timeline

- ECMAScript 6 spec was officially ratified in June 2015
- However: browsers do not support full ES6 overnight
- Parts of ES6 already supported on some browsers today

ECMAScript 6 support (july 2015)

octal and binary literals	4/4	2/4	4/4	2/4	0/4	4/4	0/4	0/4	0/4	4/4	3/4	4/4	4/4	4/4	4/4	4/4	0/4	0/4	4/4	0/4	0/4	4/4	4/4	0/4	0/4		
template strings	3/3	3/3	3/3	3/3	3/3	3/3	0/3	0/3	0/3	3/3	0/3	3/3	3/3	3/3	3/3	3/3	0/3	0/3	3/3	0/3	0/3	0/3	3/3	3/3	0/3	0/3	
BigInt "u" and "n" flags	0/2	1/2	1/2	0/2	0/2	0/2	0/2	0/2	0/2	1/2	1/2	1/2	1/2	1/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	1/2	0/2	0/2		
destructuring	0/02	26/02	29/02	16/02	12/02	22/02	0/02	0/02	0/02	0/02	13/02	23/02	23/02	24/02	0/02	0/02	0/02	0/02	16/02	26/02	0/02	0/02	0/02	12/02	0/02	16/02	
Unicode code point escapes	0/2	1/2	1/2	1/2	0/2	1/2	0/2	0/2	0/2	2/2	0/2	0/2	1/2	1/2	0/2	3/2	3/2	0/2	0/2	3/2	0/2	0/2	0/2	1/2	0/2	0/2	
new.target	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	3/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	0/2	
Bindings																											
const	5/8	6/8	6/8	6/8	0/8	8/8	0/8	0/8	8/8	8/8	8/8	8/8	8/8	8/8	5/8	5/8	5/8	1/8	1/8	1/8	3/8	1/8	1/8	5/8	6/8	1/8	1/8
let	5/10	8/10	8/10	8/10	0/10	8/10	0/10	0/10	8/10	8/10	0/10	0/10	0/10	0/10	5/10	5/10	5/10	0/10	0/10	0/10	0/10	0/10	5/10	10/10	0/10	0/10	
block-level function declaration ^[14]	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No	No	No	No	Flag	Yes	No	No	No
Functions																											
arrow functions	0/11	9/11	9/11	8/11	7/11	8/11	0/11	0/11	0/11	5/11	7/11	8/11	8/11	9/11	0/11	0/11	9/11	0/11	0/11	4/11	0/11	0/11	0/11	0/11	7/11	0/11	0/11
class	0/23	16/23	19/23	7/23	15/23	15/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	0/23	15/23	0/23	0/23	0/23	0/23	16/23	0/23	0/23
super	0/7	6/7	6/7	4/7	5/7	5/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	6/7	0/7	0/7	0/7	0/7	6/7	0/7	0/7
generators	16/02	20/02	21/02	15/02	0/02	0/02	0/02	0/02	0/02	0/02	11/02	17/02	17/02	17/02	15/02	16/02	16/02	0/02	0/02	0/02	0/02	0/02	0/02	15/02	11/02	0/02	0/02
Built-ins																											
typed arrays	23/44	0/44	0/44	0/44	0/44	0/44	0/44	15/44	15/44	41/44	18/44	40/44	40/44	40/44	23/44	23/44	40/44	18/44	18/44	18/44	8/44	18/44	23/44	23/44	34/44	18/44	18/44
Map	15/18	13/18	18/18	0/18	0/18	18/18	14/18	0/18	7/18	15/18	11/18	14/18	14/18	15/18	15/18	15/18	15/18	0/18	10/18	13/18	0/18	0/18	12/18	15/18	13/18	0/18	10/18
Set	15/18	13/18	18/18	0/18	0/18	18/18	14/18	0/18	7/18	15/18	11/18	14/18	14/18	15/18	15/18	15/18	15/18	0/18	10/18	13/18	0/18	0/18	12/18	15/18	13/18	0/18	10/18
WeakMap	9/10	0/10	10/10	0/10	0/10	10/10	1/10	0/10	4/10	8/10	4/10	7/10	7/10	7/10	9/10	9/10	9/10	0/10	5/10	10/10	0/10	0/10	6/10	9/10	8/10	5/10	5/10
WeakSet	8/9	0/9	8/9	0/9	0/9	3/9	1/9	0/9	0/9	6/9	0/9	3/9	3/9	3/9	8/9	8/9	8/9	0/9	0/9	9/9	0/9	0/9	5/9	8/9	5/9	0/9	0/9
Proxy	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	21/21	13/21	18/21	18/21	18/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0/21	14/21	0/21	0/21
Reflect	0/16	0/16	13/16	0/16	0/16	13/16	13/16	0/16	0/16	14/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	0/16	15/16	0/16	0/16
Promise	6/7	3/7	7/7	0/7	0/7	7/7	6/7	0/7	0/7	5/7	3/7	6/7	6/7	6/7	6/7	6/7	6/7	0/7	3/7	5/7	0/7	0/7	3/7	4/7	3/7	0/7	3/7
Symbol	8/9	3/9	5/9	0/9	0/9	6/9	0/9	0/9	0/9	9/9	0/9	5/9	5/9	5/9	8/9	8/9	8/9	0/9	0/9	9/9	0/9	0/9	7/9	8/9	0/9	0/9	
well-known symbols ^[20]	5/15	1/15	4/15	1/15	0/15	4/15	0/15	0/15	0/15	3/15	0/15	1/15	1/15	2/15	3/15	3/15	3/15	0/15	0/15	3/15	0/15	0/15	3/15	3/15	4/15	0/15	0/15
Built-in extensions																											
Object static methods	3/4	3/4	3/4	0/4	0/4	3/4	2/4	0/4	1/4	4/4	2/4	4/4	4/4	4/4	3/4	3/4	4/4	0/4	0/4	4/4	1/4	0/4	3/4	4/4	0/4	0/4	
function "name" property	5/17	0/17	10/17	0/17	0/17	3/17	0/17	0/17	0/17	8/17	3/17	6/17	6/17	6/17	5/17	5/17	6/17	3/17	3/17	6/17	3/17	2/17	4/17	3/17	3/17	0/17	0/17
String static methods	2/2	2/2	2/2	0/2	0/2	2/2	2/2	0/2	0/2	2/2	1/2	2/2	2/2	2/2	2/2	2/2	2/2	0/2	0/2	2/2	0/2	0/2	0/2	2/2	2/2	0/2	0/2
String prototype methods	7/8	3/8	3/8	0/8	0/8	7/8	5/8	0/8	0/8	7/8	5/8	6/8	3/8	3/8	7/8	3/8	8/8	0/8	0/8	7/8	0/8	0/8	1/8	6/8	0/8	0/8	
BigInt prototype properties	0/6	0/6	2/6	0/6	0/6	2/6	1/6	0/6	0/6	0/6	0/6	1/6	1/6	1/6	0/6	0/6	0/6	0/6	0/6	1/6	0/6	0/6	0/6	5/6	0/6	0/6	
Array static methods	0/11	10/11	11/11	0/11	0/11	9/11	7/11	0/11	0/11	5/11	1/11	9/11	9/11	9/11	0/11	0/11	9/11	0/11	0/11	8/11	0/11	0/11	0/11	0/11	7/11	0/11	0/11
Array prototype methods	4/10	8/10	10/10	0/10	0/10	10/10	7/10	0/10	0/10	9/10	5/10	7/10	7/10	7/10	4/10	4/10	8/10	0/10	5/10	10/10	0/10	0/10	5/10	3/10	8/10	0/10	5/10

See Juriy Zaytsev's (a.k.a. kangax) excellent compatibility tables
<http://kangax.github.io/es5-compat-table/es6/> for current status

ECMAScript 5 support (july 2015)

[illegible]

ECMAScript 6 compilers

- Compile ECMAScript 6 to ECMAScript 5
- **Babel**: focus on producing readable (as-if hand-written) ES5 code. Supports JSX as well.
- Microsoft **TypeScript**: technically not ES6 but roughly a superset of ES6. Bonus: type inference and optional static typing.

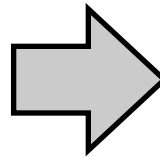


async/await in ECMAScript **5** (!)

- BabelJS async functions plug-in based on Facebook Regenerator
facebook.github.io/regenerator
- Works in browsers too!
github.com/lukehoban/ecmascript-asyncawait

ES7

```
(async function() {  
  try {  
    var value1 = await step1();  
    var value2 = await step2(value1);  
    var value3 = await step3(value2);  
    var value4 = await step4(value3);  
    // do something with value4  
  } catch (error) {  
    // handle any error here  
  }  
}())
```



ES5

```
(function callee$0$0() {  
  var value1, value2, value3, value4;  
  return regeneratorRuntime.async(function callee$0$0$1(context$1$0) {  
    while (1) switch (context$1$0.prev = context$1$0.next) {  
      case 0:  
        context$1$0.prev = 0;  
        context$1$0.next = 3;  
        return regeneratorRuntime.awrap(step1());  
      case 3:  
        value1 = context$1$0.sent;  
        context$1$0.next = 6;  
        return regeneratorRuntime.awrap(step2(value1));  
      case 6:  
        value2 = context$1$0.sent;  
        context$1$0.next = 9;  
        return regeneratorRuntime.awrap(step3(value2));  
      case 9:  
        value3 = context$1$0.sent;  
        context$1$0.next = 12;  
        return regeneratorRuntime.awrap(step4(value3));  
      case 12:  
        value4 = context$1$0.sent;  
        context$1$0.next = 17;  
        break;  
      case 15:  
        context$1$0.prev = 15;  
        context$1$0.t0 = context$1$0["catch"]($0);  
      case 17:  
        while case "end":  
          return context$1$0.stop();  
    }, null, this, [[0, 15]]);  
    }  
  }());  
}());
```

ECMAScript 6 server-side support

- `node --harmony`
- **iojs**: node.js fork that more closely tracks latest developments in V8
 - supports major features out-of-the-box, such as classes, collections, generators, promises
 - the future of node: developed by core node contributors, community-driven



ECMAScript & the JVM ecosystem

- **Nashorn** on JDK8. ES6 is on their roadmap.
- **RingoJS**: what node.js is to v8, RingoJS aims to be to Rhino. Developer server-side JS apps on the JVM (Jetty-based I/O)
- **Rhino** development itself appears largely abandoned (Rhino 1.7 has partial ES5 support, no ES6 roadmap)



Image courtesy of dzone.com

Wrap-up

Take-home messages



ES6 is a *major* upgrade

ECMA-262	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	5.10	5.11	5.12	5.13	5.14	5.15	5.16	5.17	5.18	5.19	5.20	5.21	5.22	5.23	5.24	5.25	5.26	5.27	5.28	5.29	5.30	5.31	5.32	5.33	5.34	5.35	5.36	5.37	5.38	5.39	5.40	5.41	5.42	5.43	5.44	5.45	5.46	5.47	5.48	5.49	5.50	5.51	5.52	5.53	5.54	5.55	5.56	5.57	5.58	5.59	5.60	5.61	5.62	5.63	5.64	5.65	5.66	5.67	5.68	5.69	5.70	5.71	5.72	5.73	5.74	5.75	5.76	5.77	5.78	5.79	5.80	5.81	5.82	5.83	5.84	5.85	5.86	5.87	5.88	5.89	5.90	5.91	5.92	5.93	5.94	5.95	5.96	5.97	5.98	5.99	6.00	6.01	6.02	6.03	6.04	6.05	6.06	6.07	6.08	6.09	6.10	6.11	6.12	6.13	6.14	6.15	6.16	6.17	6.18	6.19	6.20	6.21	6.22	6.23	6.24	6.25	6.26	6.27	6.28	6.29	6.30	6.31	6.32	6.33	6.34	6.35	6.36	6.37	6.38	6.39	6.40	6.41	6.42	6.43	6.44	6.45	6.46	6.47	6.48	6.49	6.50	6.51	6.52	6.53	6.54	6.55	6.56	6.57	6.58	6.59	6.60	6.61	6.62	6.63	6.64	6.65	6.66	6.67	6.68	6.69	6.70	6.71	6.72	6.73	6.74	6.75	6.76	6.77	6.78	6.79	6.80	6.81	6.82	6.83	6.84	6.85	6.86	6.87	6.88	6.89	6.90	6.91	6.92	6.93	6.94	6.95	6.96	6.97	6.98	6.99	7.00	7.01	7.02	7.03	7.04	7.05	7.06	7.07	7.08	7.09	7.10	7.11	7.12	7.13	7.14	7.15	7.16	7.17	7.18	7.19	7.20	7.21	7.22	7.23	7.24	7.25	7.26	7.27	7.28	7.29	7.30	7.31	7.32	7.33	7.34	7.35	7.36	7.37	7.38	7.39	7.40	7.41	7.42	7.43	7.44	7.45	7.46	7.47	7.48	7.49	7.50	7.51	7.52	7.53	7.54	7.55	7.56	7.57	7.58	7.59	7.60	7.61	7.62	7.63	7.64	7.65	7.66	7.67	7.68	7.69	7.70	7.71	7.72	7.73	7.74	7.75	7.76	7.77	7.78	7.79	7.80	7.81	7.82	7.83	7.84	7.85	7.86	7.87	7.88	7.89	7.90	7.91	7.92	7.93	7.94	7.95	7.96	7.97	7.98	7.99	8.00	8.01	8.02	8.03	8.04	8.05	8.06	8.07	8.08	8.09	8.10	8.11	8.12	8.13	8.14	8.15	8.16	8.17	8.18	8.19	8.20	8.21	8.22	8.23	8.24	8.25	8.26	8.27	8.28	8.29	8.30	8.31	8.32	8.33	8.34	8.35	8.36	8.37	8.38	8.39	8.40	8.41	8.42	8.43	8.44	8.45	8.46	8.47	8.48	8.49	8.50	8.51	8.52	8.53	8.54	8.55	8.56	8.57	8.58	8.59	8.60	8.61	8.62	8.63	8.64	8.65	8.66	8.67	8.68	8.69	8.70	8.71	8.72	8.73	8.74	8.75	8.76	8.77	8.78	8.79	8.80	8.81	8.82	8.83	8.84	8.85	8.86	8.87	8.88	8.89	8.90	8.91	8.92	8.93	8.94	8.95	8.96	8.97	8.98	8.99	9.00	9.01	9.02	9.03	9.04	9.05	9.06	9.07	9.08	9.09	9.10	9.11	9.12	9.13	9.14	9.15	9.16	9.17	9.18	9.19	9.20	9.21	9.22	9.23	9.24	9.25	9.26	9.27	9.28	9.29	9.30	9.31	9.32	9.33	9.34	9.35	9.36	9.37	9.38	9.39	9.40	9.41	9.42	9.43	9.44	9.45	9.46	9.47	9.48	9.49	9.50	9.51	9.52	9.53	9.54	9.55	9.56	9.57	9.58	9.59	9.60	9.61	9.62	9.63	9.64	9.65	9.66	9.67	9.68	9.69	9.70	9.71	9.72	9.73	9.74	9.75	9.76	9.77	9.78	9.79	9.80	9.81	9.82	9.83	9.84	9.85	9.86	9.87	9.88	9.89	9.90	9.91	9.92	9.93	9.94	9.95	9.96	9.97	9.98	9.99	10.00	10.01	10.02	10.03	10.04	10.05	10.06	10.07	10.08	10.09	10.10	10.11	10.12	10.13	10.14	10.15	10.16	10.17	10.18	10.19	10.20	10.21	10.22	10.23	10.24	10.25	10.26	10.27	10.28	10.29	10.30	10.31	10.32	10.33	10.34	10.35	10.36	10.37	10.38	10.39	10.40	10.41	10.42	10.43	10.44	10.45	10.46	10.47	10.48	10.49	10.50	10.51	10.52	10.53	10.54	10.55	10.56	10.57	10.58	10.59	10.60	10.61	10.62	10.63	10.64	10.65	10.66	10.67	10.68	10.69	10.70	10.71	10.72	10.73	10.74	10.75	10.76	10.77	10.78	10.79	10.80	10.81	10.82	10.83	10.84	10.85	10.86	10.87	10.88	10.89	10.90	10.91	10.92	10.93	10.94	10.95	10.96	10.97	10.98	10.99	11.00	11.01	11.02	11.03	11.04	11.05	11.06	11.07	11.08	11.09	11.10	11.11	11.12	11.13	11.14	11.15	11.16	11.17	11.18	11.19	11.20	11.21	11.22	11.23	11.24	11.25	11.26	11.27	11.28	11.29	11.30	11.31	11.32	11.33	11.34	11.35	11.36	11.37	11.38	11.39	11.40	11.41	11.42	11.43	11.44	11.45	11.46	11.47	11.48	11.49	11.50	11.51	11.52	11.53	11.54	11.55	11.56	11.57	11.58	11.59	11.60	11.61	11.62	11.63	11.64	11.65	11.66	11.67	11.68	11.69	11.70	11.71	11.72	11.73	11.74	11.75	11.76	11.77	11.78	11.79	11.80	11.81	11.82	11.83	11.84	11.85	11.86	11.87	11.88	11.89	11.90	11.91	11.92	11.93	11.94	11.95	11.96	11.97	11.98	11.99	12.00	12.01	12.02	12.03	12.04	12.05	12.06	12.07	12.08	12.09	12.10	12.11	12.12	12.13	12.14	12.15	12.16	12.17	12.18	12.19	12.20	12.21	12.22	12.23	12.24	12.25	12.26	12.27	12.28	12.29	12.30	12.31	12.32	12.33	12.34	12.35	12.36	12.37	12.38	12.39	12.40	12.41	12.42	12.43	12.44	12.45	12.46	12.47	12.48	12.49	12.50	12.51	12.52	12.53	12.54	12.55	12.56	12.57	12.58	12.59	12.60	12.61	12.62	12.63	12.64	12.65	12.66	12.67	12.68	12.69	12.70	12.71	12.72	12.73	12.74	12.75	12.76	12.77	12.78	12.79	12.80	12.81	12.82	12.83	12.84	12.85	12.86	12.87	12.88	12.89	12.90	12.91	12.92	12.93	12.94	12.95	12.96	12.97	12.98	12.99	13.00	13.01	13.02	13.03	13.04	13.05	13.06	13.07	13.08	13.09	13.10	13.11	13.12	13.13	13.14	13.15	13.16	13.17	13.18	13.19	13.20	13.21	13.22	13.23	13.24	13.25	13.26	13.27	13.28	13.29	13.30	13.31	13.32	13.33	13.34	13.35	13.36	13.37	13.38	13.39	13.40	13.41	13.42	13.43	13.44	13.45	13.46	13.47	13.48	13.49	13.50	13.51	13.52	13.53	13.54	13.55	13.56	13.57	13.58	13.59	13.60	13.61	13.62	13.63	13.64	13.65	13.66	13.67	13.68	13.69	13.70	13.71	13.72	13.73	13.74	13.75	13.76	13.77	13.78	13.79	13.80	13.81	13.82	13.83	13.84	13.85	13.86	13.87	13.88	13.89	13.90	13.91	13.92	13.93	13.94	13.95	13.96	13.97	13.98	13.99	14.00	14.01	14.02	14.03	14.04	14.05	14.06	14.07	14.08	14.09	14.10	14.11	14.12	14.13	14.14	14.15	14.16	14.17	14.18	14.19	14.20	14.21	14.22	14.23	14.24	14.25	14.26	14.27	14.28	14.29	14.30	14.31	14.32	14.33	14.34	14.35	14.36	14.37	14.38	14.39	14.40	14.41	14.42	14.43	14.44	14.45	14.46	14.47	14.48	14.49	14.50	14.51	14.52	14.53	14.54	14.55	14.56	14.57	14.58	14.59	14.60	14.61	14.62	14.63	14.64	14.65	14.66	14.67	14.68	14.69	14.70	14.71	14.72	14.73	14.74	14.75	14.76	14.77	14.78	14.79	14.80	14.81	14.82	14.83	14.84	14.85	14.86	14.87	14.88	14.89	14.90	14.91	14.92	14.93	14.94	14.95	14.96	14.97	14.98	14.99	15.00	15.01	15.02	15.03	15.04	15.05	15.06	15.07	15.08	15.09	15.10	15.11	15.12	15.13	15.14	15.15	15.16	15.17	15.18	15.19	15.20	15.21	15.22	15.23	15.24	15.25	15.26	15.27	15.28	15.29	15.30	15.31	15.32	15.33	15.34	15.35	15.36	15.37	15.38	15.39	15.40	15.41	15.42	15.43	15.44	15.45	15.46	15.47	15.48	15.49	15.50	15.51	15.52	15.53	15.54	15.55	15.56	15.57	15.58	15.59	15.60	15.61	15.62	15.63	15.64	15.65	15.66	15.67	15.68	15.69	15.70	15.71	15.72	15.73	15.74	15.75	15.76	15.77	15.78	15.79	15.80	15.81	15.82	15.83	15.84	15.85	15.86	15.87	15.88	15.89	15.90	15.91	15.92	15.93	15.94	15.95	15.96	15.97	15.98	15.99	16.00	16.01	16.02	16.03	16.04	16.05	16.06	16.07	16.08	16.09	16.10	16.11	16.12	16.13	16.14	16.15	16.16	16.17	16.18	16.19	16.20	16.21	16.22	16.23	16.24	16.25	16.26	16.27	16.28	16.29	16.30	16.31	16.32	16.33	16.34	16.35	16.36	16.37	16.38	16.39	16.40	16.41	16.42	16.43	16.44	16.45	16.46	16.47	16.48	16.49	16.50	16.51	16.52	16.53	16.54	16.55	16.56	16.57	16.58	16.59	16.60	16.61	16.62	16.63	16.64	16.65	16.66	16.67	16.68	16.69	16.70	16.71	16.72	16.73	16.74	16.75	16.76	16.77	16.78	16.79	16.80	16.81	16.82	16.83	16.84	16.85	16.86	16.87	16.88	16.89	16.90	16.91	16.92	16.93	16.94	16.95	16.96	16.97	16.98	16.99	17.00	17.01	17.02	17.03	17.04	17.05	17.06	17.07	17.08	17.09	17.10	17.11	17.12	17.13	17.14	17.15	17.16	17.17	17.18	17.19	17.20	17.21	17.22	17.23	17.24	17.25	17.26	17.27	17.28	17.29	17.30	17.31	17.32	17.33	17.34	17.35	17.36	17.37	17.38	17.39	17.40	17.41	17.42	17.43	17.44	17.45	17.46	17.47	17.48	17.49	17.50	17.51	17.52	17.53	17.54	17.55	17.56	17.57	17.58	17.59	17.60	17.61
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Take-home messages



ES6 is a *major* upgrade

BABEL **TypeScript**

Use ES6 to ES5 compilers
to bridge the gap

Access and binary literals	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	50.0	50.1	50.2	50.3	50.4	50.5	50.6	50.7	50.8	50.9	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9	54.0	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0	55.1	55.2	55.3	55.4	55.5	55.6	55.7	55.8	55.9	56.0	56.1	56.2	56.3	56.4	56.5	56.6	56.7	56.8	56.9	57.0	57.1	57.2	57.3	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.1	59.2	59.3	59.4	59.5	59.6	59.7	59.8	59.9	60.0	60.1	60.2	60.3	60.4	60.5	60.6	60.7	60.8	60.9	61.0	61.1	61.2	61.3	61.4	61.5	61.6	61.7	61.8	61.9	62.0	62.1	62.2	62.3	62.4	62.5	62.6	62.7	62.8	62.9	63.0	63.1	63.2	63.3	63.4	63.5	63.6	63.7	63.8	63.9	64.0	64.1	64.2	64.3	64.4	64.5	64.6	64.7	64.8	64.9	65.0	65.1	65.2	65.3	65.4	65.5	65.6	65.7	65.8	65.9	66.0	66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2	70.3	70.4	70.5	70.6	70.7	70.8	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.6	71.7	71.8	71.9	72.0	72.1	72.2	72.3	72.4	72.5	72.6	72.7	72.8	72.9	73.0	73.1	73.2	73.3	73.4	73.5	73.6	73.7	73.8	73.9	74.0	74.1	74.2	74.3	74.4	74.5	74.6	74.7	74.8	74.9	75.0	75.1	75.2	75.3	75.4	75.5	75.6	75.7	75.8	75.9	76.0	76.1	76.2	76.3	76.4	76.5	76.6	76.7	76.8	76.9	77.0	77.1	77.2	77.3	77.4	77.5	77.6	77.7	77.8	77.9	78.0	78.1	78.2	78.3	78.4	78.5	78.6	78.7	78.8	78.9	79.0	79.1	79.2	79.3	79.4	79.5	79.6	79.7	79.8	79.9	80.0	80.1	80.2	80.3	80.4	80.5	80.6	80.7	80.8	80.9	81.0	81.1	81.2	81.3	81.4	81.5	81.6	81.7	81.8	81.9	82.0	82.1	82.2	82.3	82.4	82.5	82.6	82.7	82.8	82.9	83.0	83.1	83.2	83.3	83.4	83.5	83.6	83.7	83.8	83.9	84.0	84.1	84.2	84.3	84.4	84.5	84.6	84.7	84.8	84.9	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.7	85.8	85.9	86.0	86.1	86.2	86.3	86.4	86.5	86.6	86.7	86.8	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	88.0	88.1	88.2	88.3	88.4	88.5	88.6	88.7	88.8	88.9	89.0	89.1	89.2	89.3	89.4	89.5	89.6	89.7	89.8	89.9	90.0	90.1	90.2	90.3	90.4	90.5	90.6	90.7	90.8	90.9	91.0	91.1	91.2	91.3	91.4	91.5	91.6	91.7	91.8	91.9	92.0	92.1	92.2	92.3	92.4	92.5	92.6	92.7	92.8	92.9	93.0	93.1	93.2	93.3	93.4	93.5	93.6	93.7	93.8	93.9	94.0	94.1	94.2	94.3	94.4	94.5	94.6	94.7	94.8	94.9	95.0	95.1	95.2	95.3	95.4	95.5	95.6	95.7	95.8	95.9	96.0	96.1	96.2	96.3	96.4	96.5	96.6	96.7	96.8	96.9	97.0	97.1	97.2	97.3	97.4	97.5	97.6	97.7	97.8	97.9	98.0	98.1	98.2	98.3	98.4	98.5	98.6	98.7	98.8	98.9	99.0	99.1	99.2	99.3	99.4	99.5	99.6	99.7	99.8	99.9	100.0
Access and binary literals	15.4	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	50.0	50.1	50.2	50.3	50.4	50.5	50.6	50.7	50.8	50.9	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9	54.0	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0	55.1	55.2	55.3	55.4	55.5	55.6	55.7	55.8	55.9	56.0	56.1	56.2	56.3	56.4	56.5	56.6	56.7	56.8	56.9	57.0	57.1	57.2	57.3	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.1	59.2	59.3	59.4	59.5	59.6	59.7	59.8	59.9	60.0	60.1	60.2	60.3	60.4	60.5	60.6	60.7	60.8	60.9	61.0	61.1	61.2	61.3	61.4	61.5	61.6	61.7	61.8	61.9	62.0	62.1	62.2	62.3	62.4	62.5	62.6	62.7	62.8	62.9	63.0	63.1	63.2	63.3	63.4	63.5	63.6	63.7	63.8	63.9	64.0	64.1	64.2	64.3	64.4	64.5	64.6	64.7	64.8	64.9	65.0	65.1	65.2	65.3	65.4	65.5	65.6	65.7	65.8	65.9	66.0	66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9																																																																																																																																																																																																																																																																																																																																	

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