Record & Tuple

for Stage 2

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Rationale for Record & Tuple primitives

What was presented for Stage 1, and a few more reasons why this is a good idea!

Compounding primitives (with strings)

```
const grid = {
    "0:0": "player",
    "3:5": "enemy",
    "0:1": "wall",
};

console.log("at 0:0", grid["0:0"]); // player
console.log("at 0:0x0", grid["0:0x0"]); // undefined
```

Compounding primitives (with JSON strings)

```
const grid = {
   '{"x":0,"y":0}': "player",
   '{"x":3,"y":5}': "enemy",
   '{"x":0,"y":1}': "wall",
};

console.log("at 0:0x0", grid[JSON.stringify({
   x: 0,
   y: 0x0,
})]); // player

console.log("at 0:0x0", grid[JSON.stringify({
   y: 0x0,
   x: 0,
})]); // undefined
```

Compounding primitives with Tuple!

```
const grid = new Map([
    [#[0, 0], "player"],
    [#[3, 5], "enemy"],
    [#[0, 1], "wall"],
]);

console.log("at 0:0", grid.get(#[0, 0])); // player
console.log("at 0:0", grid.get(#[0, 0x0])); // player
```

All about the equality!

```
function isAtOrigin(coordinate) {
   return coordinate === #[0, 0];
}

const c1 = #[1, 2];
const c2 = #[c1[0] - 1, c1[1] * 2 - 4];
console.log("c1 at origin?", isAtOrigin(c1)); // false
console.log("c2 at origin?", isAtOrigin(c2)); // true
```

Same is possible with Record! (but keyed)

```
const grid = new Map([
   [#{x:0, y:0}, "player"],
   [#{x:3, y:5}, "enemy"],
   [#{x:0, y:1}, "wall"],
]);
console.log("at 0:0", grid.get(#{x:0, y:0x0})); // player
console.log("at 0:0", grid.get(#{y:0, x:0x0})); // player

function isAtOrigin(coordinate) {
   return coordinate === #{x:0, y:0};
}
const c1 = #{x:1, y:2};
const c2 = #{x: c1.x - 1, y: c1.y * 2 - 4 };
console.log("c1 at origin?", isAtOrigin(c1)); // false
console.log("c2 at origin?", isAtOrigin(c2)); // true
```

Deep immutability!

```
const record = #{
    a: #{
        foo: "bar",
    },
};
func(record);
// runtime guarantees that
// record is entirely unchanged
assert(record.a.foo === "bar");
```

```
const object = {
    a: {
        foo: "bar",
    },
};
Object.freeze(object);
func(object);
// func is able to mutate object's
// keys even if object is frozen
//
// side effects make the state
// of the program after func()
// harder to reason about
```

Deep immutability!

```
const record = #{
    a: #{
        foo: "bar",
    },
};
func(record);
// runtime guarantees that
// record is entirely unchanged
assert(record.a.foo === "bar");
```

```
const clonedObject = JSON.parse(
  JSON.stringify(object)
);
func(clonedObject);
// now func can have side effects on
// clonedObject, object is untouched
// but at what cost?
assert(object.a.foo === "bar");
```

Why not frozen objects and/or userland classes?

- **Equality!**
  - Objects & Arrays have equality by **identity**
  - Record & Tuple have equality by **value**
  - Equality is not only about == and === but also about Map keys/Set values
- **Deep immutability**
  - Guaranteed immutable data structures
  - Trustworthy (deep) equality
  - No need for deep cloning with `JSON.parse(JSON.stringify(obj))`
- **Accessed the same as Objects & Arrays**
  - Write functions that can access both Objects/Arrays and Record & Tuple
  - Unlike userland immutable libraries, access Record & Tuple using the same notations as Object/Array instead of functions

Ecosystem split issue

```
const ProfileRecord = Immutable.Record({
    name: "Anonymous User",
    githubHandle: null,
});

function getGithubUrl(profile) {
    if (Immutable.Record.isRecord(profile)) {
        return `https://github.com/${
            profile.get("githubHandle")
        }`;
    }
    return `https://github.com/${
        profile.githubHandle
    }`;
}
```

```
const jobResult = Immutable.fromJS(
    ExternalLib.processJob(
        jobDescription.toJS()
    )
);
```

Equality Semantics

Going with intermediary semantics for ==/===:

- The one used for Map keys/Set values comparison.
- A unification of +0 and -0.

Object.is compares to see if they are identical:
In that case +0 and -0 are different.

```
const s = new Set();
s.add(#[+0]);
s.has(#[-0]) === true;
s.add(#[NaN]);
s.has(#[NaN]) === true;

#[-0]  === #[+0]  // => true
#[NaN] === #[NaN] // => true

#[-0]  ==  #[+0]  // => true
#[NaN] ==  #[NaN] // => true

Object.is(#[-0],  #[+0])  === false
Object.is(#[NaN], #[NaN]) === true
```

Avoids “black-holing” structures if a NaN appears in any of them.

```
const measure = 42;

const computed = #{
    name: "Computed Measurement",
    value: pureComputeValue(measure),
};

assert(computed === computed);
// What if pureComputeValue returns NaN?
```

Avoids failing comparisons when the structure potentially has a -0 in it.

```
function isAtOrigin(c) {
    return c === #{x: 0, y: 0};
}

const coord = #{x: 0, y: 3};
const coord2 = #{
    x: coord.x * -4,
    y: coord.y - 3,
};

assert(isAtOrigin(coord));
// We expect this one to be true!
```

In general, we’re trying to make comparing records and tuples “trustworthy” for users and avoiding those subtle equality breakages helps in establishing this.

Still open for discussion!

- This is the equality we have in the Stage 2 spec
- This can change before we get to Stage 3
- The right decision will appear through more research:
  - Experimental implementations
  - Interviewing and surveying developers
  - Performance implications in implementations

State of the proposal

Open Github Issues

- Names and exact semantics of Tuple.prototype methods (e.g. pushed) (#121)
- Syntax still open with a possibility to move to {| } and [|] (#10)
- Should the wrapper objects be extensible (#137)
- Should Record have a null prototype? (#71)
- Exact ToString behavior (#136)
- … and more

Highlights

We have initial conclusions for all of these issues checked into the spec-text, and have sketched out alternatives in draft PRs.

Let’s walk through the highlights!

Desire: Guarantee that accesses to the Record wrapper reflect what's in the underlying Record

Solution: Make the Record wrapper frozen

```
const wrapper = Object(#{ a: 1 });

wrapper.foo = "bar";

wrapper.foo // undefined
wrapper.a   // 1
```

Desire: String property access on Records always accesses Record entries, not strings on the prototype.

Current: Record wrappers have a null prototype.

```
assert(Record.prototype === null);
```

Option: Make Record.prototype an Object with no prototype, rather than null, and only forward symbol properties to prototype

```
Record.prototype.foo = "bar";
const sym = Symbol();
Record.prototype[sym] = "sym";

const record = #{ a: 1 };
record.foo // undefined
record[sym] // "sym"
```

draft of records using non-null prototype, with only symbol-forwarding #145

Draft **rickbutton** wants to merge 1 commit into `master` from `rb/record-prototype-forward-symbols-draft`

Conversation 8 | Commits 1 | Checks 0 | Files changed 2

rickbutton commented 7 days ago • edited

Member

In response to issue #142, this is a draft of the changes for a Record prototype who's prototype is `null` and has `Symbol.toStringTag`, `Symbol.toPrimitive` etc, and the `Record` wrapper object only forwards symbol properties to the prototype.

we don't necessarily intend to land this, this PR is useful for demonstrative purposes (unless of course we choose these semantics).

Reviewers

ljharb

littledan

At least 1 appro
pull request.

Record toString: useful or useless? #136

Open **ljharb** opened this issue 18 days ago · 7 comments

ljharb commented 18 days ago

Member

per #135 (comment)

At the very least, I'd expect Records to have a `Symbol.toStringTag` of `"Record"`, which would `Object.prototype.toString.call(record)` produce `[object Record]`.

However, `String(record)`, `` `${record}` ``, etc, according to #135, will produce `"[record]"`. This doesn't seem particularly useful at all; if someone wants to know it's a record, they'll typeof it.

Objects have always had a useless toString, but since everything inherits from Object, it's a tough sell to come up with something broadly useful for it to do. Arrays' toString has problems, and could be much better if legacy didn't hold it back, but is still useful since it stringifies its contents. I would hope that Records can have a better user story around stringification than objects.

👍 1

```
// Q: What should ToString produce?
const record = #{
   a: 1,
   b: #{
       foo: "bar",
   },
   c: #[1,2,3],
};

// Currently:
const current = String(record);
assert(current === "[object Record]");

// Alternative:
const alt = String(record);
assert(alt === '#{ "a": 1, "b": #{ "foo": "bar" }, "c": #[1, 2, 3] }');
```

Draft of 'useful ToString' for Records #156

Draft **rickbutton** wants to merge 2 commits into `master` from `rb/useful-tostring`

Conversation 7 | Commits 2 | Checks 0 | Files changed 1

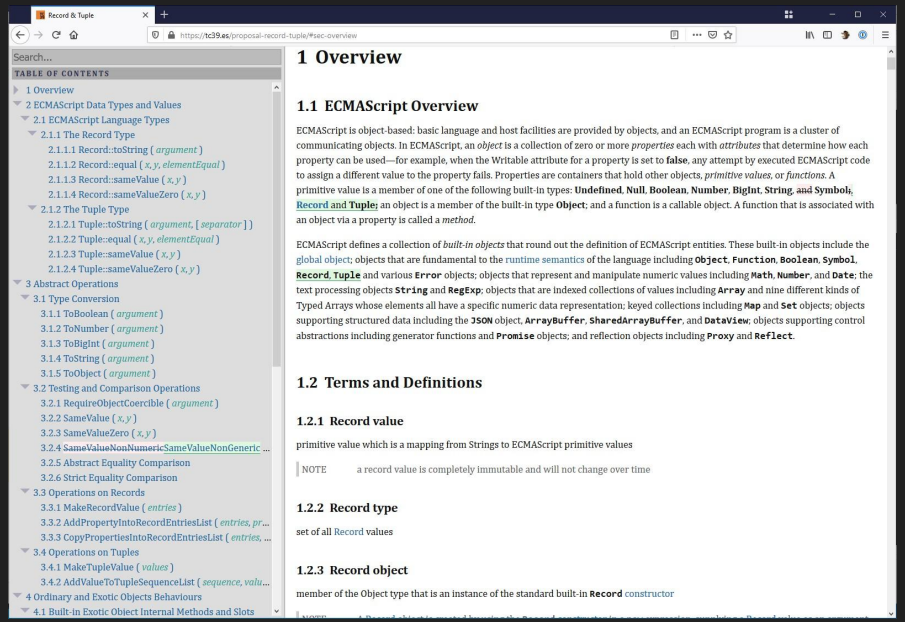
rickbutton commented 2 days ago • edited

Member

In response to #136 , I've drafted "what it would look like" if we went with a "useful" output for `RecordToString` .

Record and Tuple Spec Text

https://tc39.es/proposal-record-tuple



Notable sections:

- RecordEqual and TupleEqual
- Abstract Operations updated
- Record object wrapper
- Tuple object wrapper
- Record initializer syntax & semantics
- Tuple initializer syntax & semantics
- typeof unary expression
- Record & Tuple objects...
- … with the Tuple prototype

Record and Tuple Toy Implementation & Playground

https://github.com/bloomberg/record-tuple-polyfill

https://rickbutton.github.io/record-tuple-playground/

https://rickbutton.github.io/reco

rickbutton.github.io/record-tuple-playground/#eyJjb250ZW50IjoiaW1wb3J0IHsgUmVjb3JkLCBUdXBsZSB9IGZyb20gXCJyZWNvcmQtYW5kLXR1cGxlLXBvbHlmaWxsXCI7XG5jb25zdCBsb2cgPSBjb25zb2xlLmxvZztcblxuY29uc3QgcmVjb...

Record and Tuple Playground Proposal Polyfill

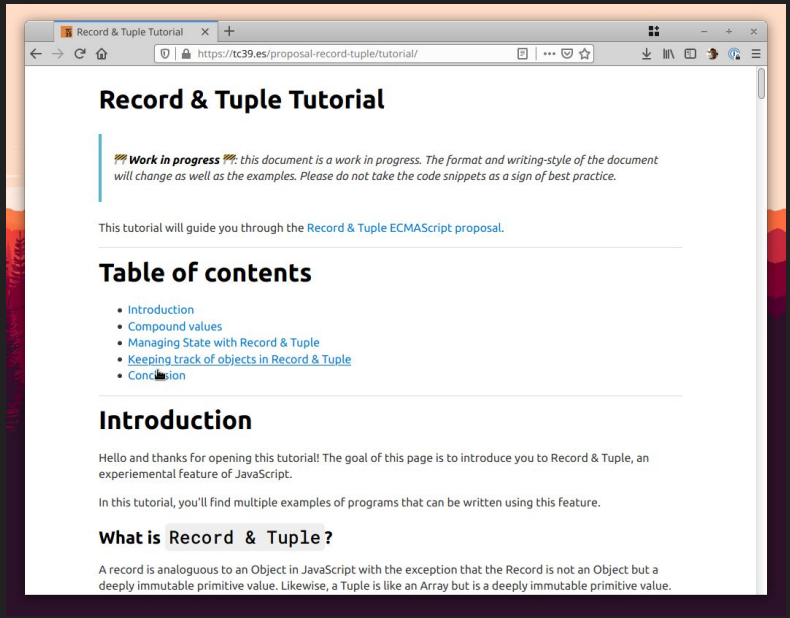
```
import { Record, Tuple } from "record-and-tuple-polyfill";
const log = console.log;

const record = #{ prop: 1 };
const tuple = #[1, 2, 3];

log("isRecord", Record.isRecord(record));
log("isRecord", Record.isRecord({ prop: 1 }));

// Simple Equality
log("simple",
    #{ a: 1 } === #{ a:1 },
    #[1] === #[1]);

// Nested Equality
log("nested", #{ a: #{ b: 123 }} === #{ a: #{ b: 123 }});

// Order Independent
log("!order", #{ a: 1, b: 2 } === #{ b: 2, a: 1});

// -0, +0
log("-0 === +0", -0 === +0);
log("#[-0] === #[+0]", #[-0] === #[+0]);

// NaN
log("NaN === NaN", NaN === NaN);
log("#[NaN] === #[NaN]", #[NaN] === #[NaN]);
```

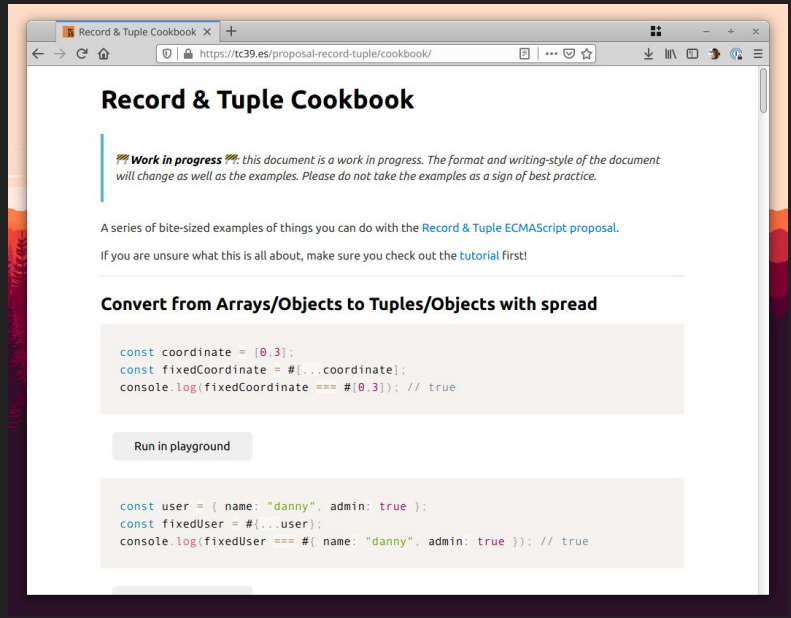
```
▸(2) ["isRecord", true]
▸(2) ["isRecord", false]
▸(3) ["simple", true, true]
▸(2) ["nested", true]
▸(2) ["!order", true]
▸(2) ["-0 === +0", true]
▸(2) ["#[-0] === #[+0]", false]
▸(2) ["NaN === NaN", false]
▸(2) ["#[NaN] === #[NaN]", true]
```

NEW!
No browser with
WeakRef needed!

Record and Tuple Documentation Bits

https://tc39.es/proposal-record-tuple/tutorial/
https://tc39.es/proposal-record-tuple/cookbook/





We also started reaching out to the W3C TAG for a preliminary review. The review is now approved.

https://github.com/w3ctag/design-reviews/issues/518

Seeking Stage 2

- Last meeting’s open questions are now solved.
- Toy Implementation & Spec Text written.
- Positive feedback in framework outreach calls.

We are now seeking for Stage 2 and reviewers.

Stage 2?