Observable

Enhancing EventTarget

Observable

- Composable enhancement of Event Target
- Allows events to be coordinated in async functions

Consuming an EventTarget (ET) as an Observable

```
domElement.
  on('mousemove').
  forEach(e => console.log(e));
```

Consuming ET as Observable with Capture Options

```
domElement.
  on('mousemove', { capture: true }).
  forEach(e => console.log(e));
```

Consuming ET as Observable with Cancellation

```
const { token, cancel } = CancelToken.source();

const subscriptionPromise =
  domElement.
    on('mousemove', { capture: true }).
    forEach(e => console.log(e), token);



// unsubscribe later
cancel();
```

rejects

Composing Observables

Composing Observables

- Observables can be composed like Arrays (ex. map, filter, etc)
- Composition can be enabled with user-land libraries like lodash
- Future plan to add popular functions to Observable prototype

Contrived composition example

```
import { map, filter } from 'lodash-for-events';

function mouseMoveCoordinatesInRect(element, rect) {
  let events = element.on('mousemove');
  let coordinates = map(events, e => ({ x: e.clientX, y: e.clientY }));

  return filter(coordinates, ({ x, y }) => {
    return x >= rect.left && x <= rect.right &&
           y >= rect.top && y <= rect.bottom;
  });
}

mouseMoveCoordinatesInRect(document.body, new DOMRect(0, 0, 100, 100)).
  forEach(coords => drawPixelAt(coords));
```

If we improve Observable.prototype this becomes...

```
function mouseMoveCoordinatesInRect(element, rect) {
  return element.on('mousemove').
    map(e => ({ x: e.clientX, y: e.clientY })).
    filter(coordinates, ({ x, y }) => {
      return x >= rect.left && x <= rect.right &&
             y >= rect.top && y <= rect.bottom;
    });
}
```

Composition Use Case: Draw Signature on Canvas

```
async function drawSignature(signatureCanvas, cancelToken) {
  await.cancelToken = cancelToken;











  // snip...

}
```

[illegible]

Composition with user-land libraries

```
import { _ } from 'lodash-for-events';

async function drawSignature(signatureCanvas, cancelToken) {
  await.cancelToken = cancelToken;
  const sigMouseDowns = _(signatureCanvas.on('mousedown'));









  // snip...

}
```

[illegible]

Composition: Map Function

```
import { _ } from 'lodash-for-events';

async function getSignature(signatureCanvas, cancelToken) {
  await.cancelToken = cancelToken;
  const toPoint = e => ({ x: e.offsetX, y: e.offsetY });
  const sigMouseDowns = _(signatureCanvas.on('mousedown')).map(toPoint);











  // snip...

}
```

Composition: Await Events with First

```
import { _ } from 'lodash-for-events';

async function getSignature(signatureCanvas, cancelToken) {
  await.cancelToken = cancelToken;
  const toPoint = e => ({ x: e.offsetX, y: e.offsetY });
  const sigMouseDowns = _(signatureCanvas.on('mousedown')).map(toPoint);



  let lastPointClicked = await sigMouseDowns.first(cancelToken);







  // snip...

}
```

[illegible]

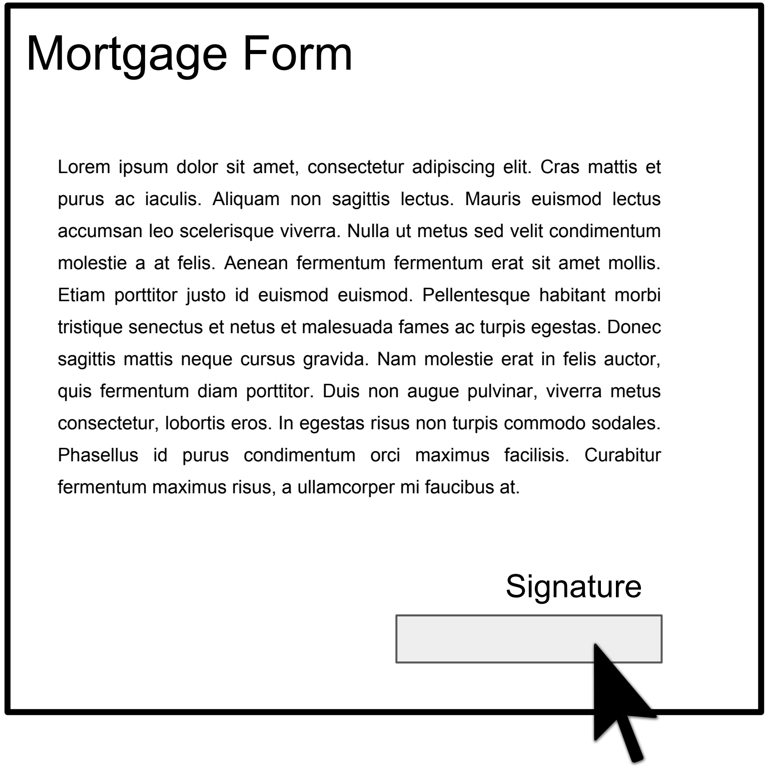
Composition: Handle Event 'til another Event Occurs

```
import { _ } from 'lodash-for-events';

async function getSignature(signatureCanvas, cancelToken) {
  await.cancelToken = cancelToken;
  const toPoint = e => ({ x: e.offsetX, y: e.offsetY });
  const sigMouseDowns = _(signatureCanvas.on('mousedown')).map(toPoint);
  const sigMouseMoves = _(signatureCanvas.on('mousemove')).map(toPoint);
  const sigMouseUps   = _(signatureCanvas.on('mouseup')).map(toPoint);

  let lastPointClicked = await sigMouseDowns.first(cancelToken);

  await sigMouseMoves.takeUntil(sigMouseUps).
    forEach(
      point => {
        strokeLine(signatureCanvas, lastPointClicked.x, lastPointClicked.y, point.x, point.y);
        lastPointClicked = point;
      },
      cancelToken);

}
```

[illegible]

Using Events in Async Workflows

Example: Form that collects e-signature



Mortgage Form

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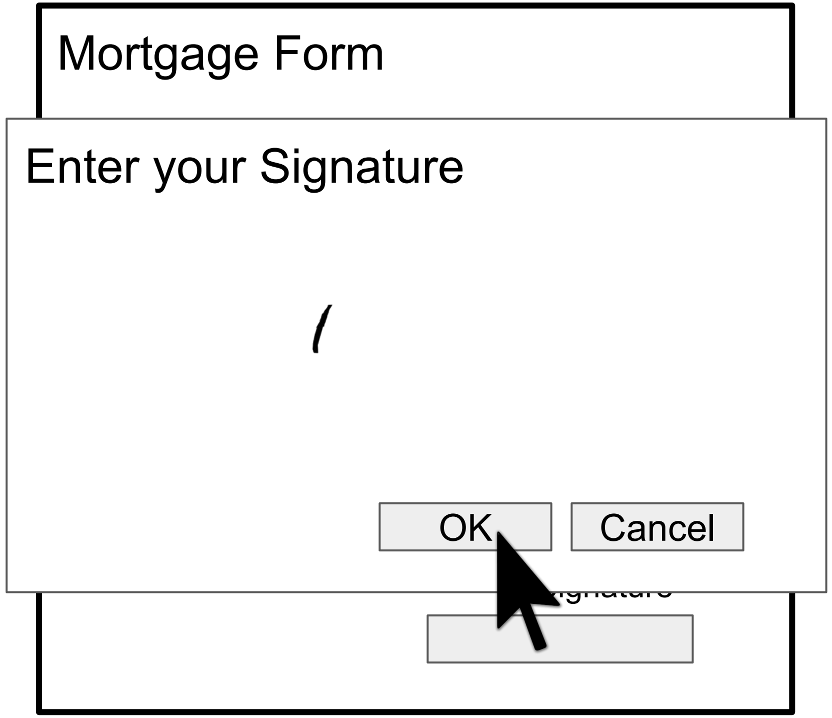
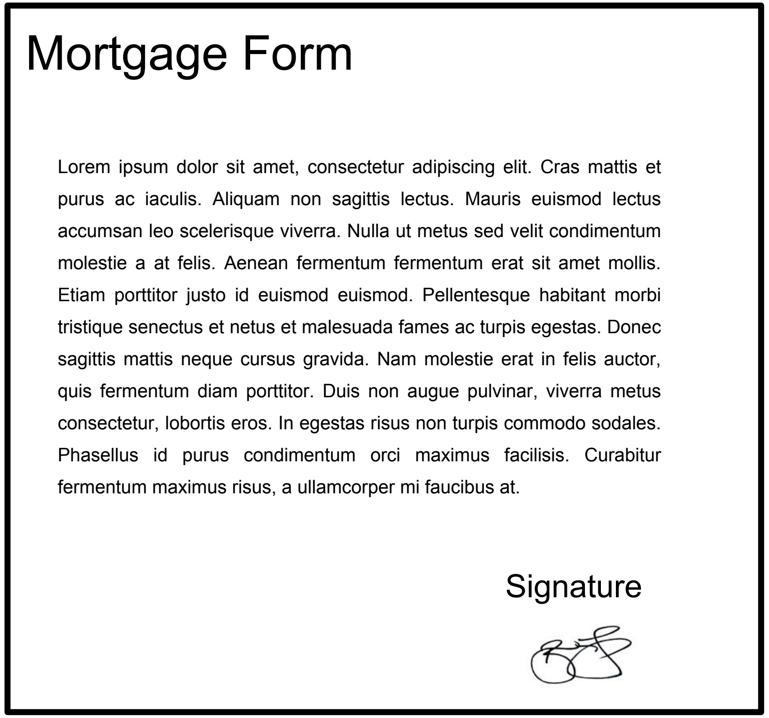
Signature

Example: Form that collects e-signature



Example: Form that collects e-signature



Mortgage Form

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Signature

[illegible]

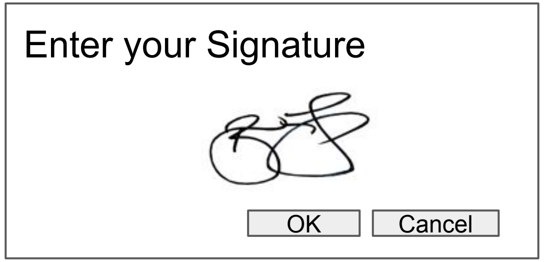
Async Function: getSignature

```
import { _ } from 'lodash-for-events';

async function getSignature(token) {
  const signatureDialog = createAndDisplaySignatureDialog();
  try {
    const signatureCanvas = signatureDialog.querySelector('.signatureCanvas');

    const okButton = signatureDialog.querySelector('.okbutton');
    const cancelButton = signatureDialog.querySelector('.cancelbutton');
    const ok = _(okButton.on('click')).first(token);
    const cancel = _(cancelButton.on('click')).first(token);

    // concurrently handle signature draws, an ok click, and a cancel click
    return await Promise.race([
      drawSignature(signatureCanvas, okButton, token),
      ok.then(() => signatureCanvas.toDataURL()),
      cancel.then(() => undefined))
    ]);
  }
  finally {
    signatureDialog.remove();
  }
}
```



Using Events in Async Functions: drawSignature

```
import { _ } from 'lodash-for-events';

async function drawSignature(signatureCanvas, okButton, token) {
  await.cancelToken = cancelToken;
  const context = signatureCanvas.getContext('2d');
  const toPoint = e => ({ x: e.offsetX, y: e.offsetY });
  const sigMouseDowns = _(signatureCanvas.on('mousedown')).map(toPoint);
  const sigMouseMoves = _(signatureCanvas.on('mousemove')).map(toPoint);
  const sigMouseUps   = _(signatureCanvas.on('mouseup')).map(toPoint);

  while(true) {
    let lastPoint = await sigMouseDowns.first(token);

    await sigMouseMoves.takeUntil(sigMouseUps).
      forEach(
        point => {
          strokeLine(context, lastPoint.x, lastPoint.y, point.x, point.y);
          okButton.disabled = false;
          lastPoint = point;
        },
        token);
  }
}
```

Benefits of Observable

- Coordinate event streams in async functions
- takeUntil: combine multiple infinite event streams into a finite stream which can be **awaited**
- Can be adapted into Asynchronous Iterators

Appendix

Observable Class

```
class Observable<T> {
    constructor(subscribeDefn: Function)

    subscribe(observer: Observer, token: CancelToken): void

   forEach(nextFn: Function, token: CancelToken): Promise

    [Symbol.observable](): Observable

    static of(...items): Observable

    static from(ObservableLike: Object): Observable
}
```

Observer Interface

```
interface Observer {

    next(value),

   // try/else equivalent
    else(error),

    complete(value)

    // receives object sent during unsubscription/cancellation
   // try/catch equivalent
    catch(cancel)
}
```

Adapting EventTarget to Observable

```
EventTarget.prototype.on = function(name, options) {
    // constructor passed Observable.prototype.subscribe(observer, token) defn
    return new Observable((observer, token) => {
        const handler = e => {
            if (token.reason === undefined) {
                observer.next(e);
            }
        };

        this.addEventListener(name, handler, options);

        token.promise.then(cancel => {
            this.removeEventListener(name, handler, options);
            observer.catch(cancel);
        });
    });
}
```