

Lens Crash Course

Introduction

Application Structure

API Overview

Core

Vision

Touches

Networking

Reactivity

Databases

Templates

Other

Components

LAF

Conclusion

Lens Crash Course

What is Lens?

Lens Crash
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Conclusion

- Javascript library
- Unopinionated
- Broad

Follow Along

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`https://github.com/luminar-mit/lens-crash-course`

- `out` → `main.pdf` → View Raw

- `http://tinyurl.com/LCC-slides`

`http://luminar.media.mit.edu/lens-docs/api`

- `http://tinyurl.com/LCC-docs`

Directory Structure

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- apps/my_awesome_app
 - app.json
 - index.html
 - templates/

app.json

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```
{  
  "name": "Count",  
  "group": "Apps",  
  "visible": true,  
  "sizes": {  
    "icon": {  
      "frame": "icon.png",  
      "width": 100,  
      "height": 100  
    },  
    "full": {  
      "frame": "index.html"  
    }  
  },  
  "default_size": "full"  
}
```

index.html

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```
<!doctype html>
<html>
  <head>
    <title>Capabilities</title>
    <script type="text/javascript"
      src="http://lens2.lens/dist/latest/lens.js"
    </script>
    <script type="text/javascript"
      src="app.js">
    </script>
    <link rel="stylesheet"
      type="text/css"
      href="styles.css" />
  </head>
  <body> <!-- ... --> </body>
</html>
```

Lens Namespace

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- Javascript: Lens namespace
- CSS variables: `lens-` prefix

Freezing

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- No modifications
- `"use strict";`

Argument Checking

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- Run-time
- `Lens.disableArgChecking`
- `Lens.warnForArgChecking`

Factories, Not Constructors

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Conclusion

- Don't use `new`
- `Lens.Coordinate()`, not `new Lens.Coordinate()`

Internal Methods & Properties

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Conclusion

- Don't use things that start with `_`
- Don't use undocumented constructors; use factories (`Lens.Snapshot.fromImageUrl`)

Core

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Conclusion

- Core platform capabilities
- Always loaded
- Vision capabilities, networking, data storage

Data Structures

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Conclusion

- Passed to clients by the Lens API
- Can't instantiate any of these classes

Components

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Conclusion

- Optional user interface components
- Unstyled
- Non-intrusive

Look-and-Feel (LAF)

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- Overall visual design
- Intrusive

Lens.init

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```
Lens.init(function() {  
    "use strict";  
    //...  
})  
  
Lens.init(["Components/draggable"], function() {  
    //...  
})  
  
Lens.init(["Components"], function() {  
    //...  
})  
  
Lens.init(["LAF"], function() {  
    //...  
})
```

Lens.ContourSearch Basics

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```
var search = Lens.ContourSearch({  
  x: [100, 300],  
  y: [200, 400]  
})
```

```
var search = Lens.ContourSearch({  
  el: "#some_element",  
  threshold: 3  
})
```

Lens.ContourSearch Callbacks

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```
search.appeared(function(contour) {  
    console.log("Got contour");  
});
```

```
search.disappeared(function(contour) {  
    console.log("Lost contour");  
})
```

Lens.ContourSearch Movement

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```
search.moved(function(contour) {  
    console.log("Contour moved");  
});
```

// OR //

```
search.appeared(function(contour) {  
    contour.moved(function() {  
        console.log("Contour moved");  
    });  
});
```

Lens.ContourSearch Contours

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```
contour.points
```

```
// => [[12, 34], [23, 67], ...]
```

```
contour.center
```

```
// => {x: 50, y: 100}
```

```
contour.simplifiedPoints()
```

```
// => [[12, 34], [23, 67], ...]
```

Lens.Snapshot Basics

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Full snapshot:

```
Lens.Snapshot.capture(function(snapshot) {  
    //...  
})
```

Snapshot of an element:

```
Lens.Snapshot.capture("#el", function(snapshot) {  
    //...  
})
```

Lens.Snapshot Output

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```
Lens.Snapshot.capture(function(snapshot) {  
    console.log(snapshot.toBase64());  
    document.body.appendChild(snapshot.toCanvas());  
    document.body.appendChild(snapshot.toImage());  
})
```

Lens.Marker Basics

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```
var marker1 = Lens.Marker.fromImageData(base64);  
var marker2 = Lens.Marker.fromImageURL("foo.png");  
var marker3 = Lens.Marker.fromSnapshot("#el");
```

Lens.Marker Callbacks

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```
marker.appeared(function() {  
    console.log("Marker appeared");  
});
```

```
marker.disappeared(function() {  
    console.log("Marker disappeared");  
});
```

```
marker.moved(function() {  
    console.log(marker.getX(), marker.getY());  
});
```

Lens.Marker Pinning

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Conclusion

```
marker.pin("#myEl");
```

Lens.Coordinate Basics

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```
var c1 = Lens.Coordinate(Lens.Coordinate.WINDOW,
                          10, 20);

c1.convert(Lens.Coordinate.PROJECTOR,
           function(newCoord) {

    console.log(newCoord.x, newCoord.y);

}))
```

Lens.Coordinate Systems

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System

DEPTH

WORLD

PROJECTOR

WINDOW

Origin

Depth camera top-left

Depth camera top-left,
at height of sensor

Projector top-left

Window or iFrame top-left

Units

depth camera
pixels

millimeters

projector pixels

projector pixels

Lens.Conversions

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Conclusion

- Synchronous
- Approximate
- CSS and Javascript

Lens.Conversions in Javascript

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Conclusion

```
var threeInches = 3 * Lens.Conversions.dpi;
```

Lens.Conversions in CSS

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Conclusion

```
#threeInchWideEl {  
    width: calc(3px * -webkit-var(lens-dpi));  
}
```

Touches Overview

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Conclusion

- Based on the W3C Touch Events Specification draft
- Events fired on DOM elements
- Additional features added on top of W3C spec

Touch Events

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Conclusion

- `lens:touchstart`

- `lens:touchend`

- `lens:touchmove`

Touch Properties

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Conclusion

- `touches`
- `targetTouches`
- `changedTouches`
- `touch`

MultiTouch Objects

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Conclusion

- `touches`, `targetTouches`, and `changedTouches` are MultiTouch objects
- Work like arrays of touches
- Extra properties: `pageX` and `pageY` for center, rotation and scale for gestures; many others.

Touch Objects

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Conclusion

- `touch` is a `Touch` object
- Items of `MultiTouch` objects are `Touch` objects.
- Properties: `pageX` and `pageY` for location, `moved()` for event binding.

Example: Drawing

```
document.getElementById("canvas")
    .addEventListener("lens:touchstart",
        function(evt) {

    evt.changedTouches.forEach(function(t) {
        var color = randomColor();
        var prevX = t.pageX;
        var prevY = t.pageY;
        t.moved(function() {
            drawLine(prevX, prevY, t.pageX, t.pageY);
            prevX = t.pageX;
            prevY = t.pageY;
        });
    });
});
```

Nearby

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Conclusion

- ZeroConf
- Capabilities
- RPCs

Lens.Machines

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Conclusion

```
// all machines
```

```
Lens.Machines.all();
```

```
// -> [Machine, Machine, Machine...]
```

```
// by host name
```

```
Lens.Machines.machine("luminar-asparagus");
```

```
// -> Machine or null
```

```
// by id
```

```
Lens.Machines.id("some-uuid");
```

```
// -> Machine or null
```

Machine

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Conclusion

```
machine.id
    // => UUID string
machine.hostname
    // => string or null
machine.capabilities()
    // => [Capability, ...]
machine.capability("SnapshotModule").request()
```

RPCs: Provider

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Conclusion

```
var loc = Lens.Machines.localhost;
loc.registerValuedRPC("foo", function(one, two) {
    return one + two;
})
```

RPCs: Consumer

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Conclusion

```
var machine = Lens.Machines.findByRPC("foo")[0];  
var rpc = machine.rpc("foo");
```

```
rpc.valued // => true  
rpc.params // => ["one", "two"]
```

```
rpc.call(5, 6, function(result) {  
    console.log(result); // => 11  
})
```

Reactive Programming

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Conclusion

- Alternative to publish/subscribe
- Map data to display
- Automatically re-run appropriate code when data changes
- Data-driven, not event-driven
- Cooperation between reactive data sources and reactive contexts

Reactivity in Lens

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- Reactive data sources: `Lens.Machines`, `Lens.Session`, `Lens.DB`
- Reactive contexts: `Lens.autorun`, templates

Example

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Conclusion

```
Lens.autorun(function() {  
    var score = Lens.Session.get("score");  
    $("#score_display").text(score);  
});  
  
Lens.Session.set("score", 12);
```

Databases: Six Types

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Conclusion

- In-memory
- App-local
- Machine-local
- Published
- Shared
- Server

Databases: Usage

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```
var blogDB = Lens.DB.inMemory();  
var Posts = blogDB.Collection("posts");  
Posts.insert({title: "hello", body: "world"});  
Posts.find().fetch()  
    // -> [{title: "hello", body: "world"}]
```

Databases: Published

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Conclusion

```
// publisher
```

```
var fooDB = Lens.DB.published("fooDB");
```

```
var Posts = fooDB.Collection("posts");
```

```
Posts.insert({title: "hello", body: "world"});
```

```
// client
```

```
var machine = Lens.Machines.findByDB("fooDB")[0];
```

```
var fooDB = machine.db("fooDB");
```

```
var Posts = fooDB.Collection("posts");
```

```
Posts.find().fetch()
```

```
// -> [{title: "hello", body: "world"}]
```

Databases: Shared

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```
// both machines  
Lens.DB.shared("sharedDB", function(db) {  
    // do stuff with db  
});
```

Databases: Peers

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Conclusion

```
// both machines
Lens.DB.shared("sharedDB", function(db) {
    Lens.autorun(function() {
        if(db.peers.length >= 5) {
            console.log("Got 5 peers");
        }
    });
});
```

Databases: More Info

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`http://docs.meteor.com/#collections`

Templates in Lens

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Conclusion

- Reactive
- Based on Meteor Templates:
<http://docs.meteor.com/#templates>

Templates folder

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Conclusion

- Place HTML files in `templates/` in your app
- `templates/foo.html` available as `Lens.Template.foo`

Run-time templates

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```
Lens.Templates.define("runtime_template",  
    "Value: <b>{{some_value}}</b>")
```

Example

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Conclusion

```
<!-- templates/score.html -->
```

```
<div id="score">
```

```
    Your score is: <b>{{player_score}}</b>
```

```
</div>
```

```
// demo.js
```

```
Lens.Template.score.player_score = function() {
```

```
    return Lens.Session.get("score");
```

```
}
```

```
var frag = Lens.Templates.render(Lens.Template.score)
```

```
document.body.appendChild(frag);
```

Embed

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```
// parent
var widget = Lens.Embed.app("widget-app");
document.body.appendChild(widget.iframe);

widget.dispatcher.fireEvent("foo");

// widget-app
Lens.Embed.parentDispatcher
    .subscribe("foo", function() {
    // ...
})
```

Libs

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```
window.$ = Lens.Libs.jQuery;  
window._ = Lens.Libs.Underscore;  
window.Pixastic = Lens.Libs.Pixastic;  
window.Sylvester = Lens.Libs.Sylvester;
```

Scrollable

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```
// 3 finger scroll:
```

```
Lens.Components.Scrollable("#myEl", 3);
```

Draggable

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```
// move, rotate, and scale:
```

```
Lens.Components.Draggabke("#myEl");
```

```
// move only:
```

```
Lens.Components.Draggabke("#myEl", false);
```

Modal

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Conclusion

- Alert
- Confirm
- Custom Buttons
- Select
- Text Entry
- Custom Modal

- Input Elements
- Fonts
- Scrollable Body
- Icons (Ligature Icons)
- Touch Indicators

Summary

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LAF

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- Lens Core
 - Contours
 - Snapshots
 - Markers
 - Coordinates and Conversions
 - Touches
 - Machines, Networking, and RPCs
 - Reactivity
 - Databases
 - Templates
- Components
 - Scrollable
 - Draggable
 - Modals
- LAF