



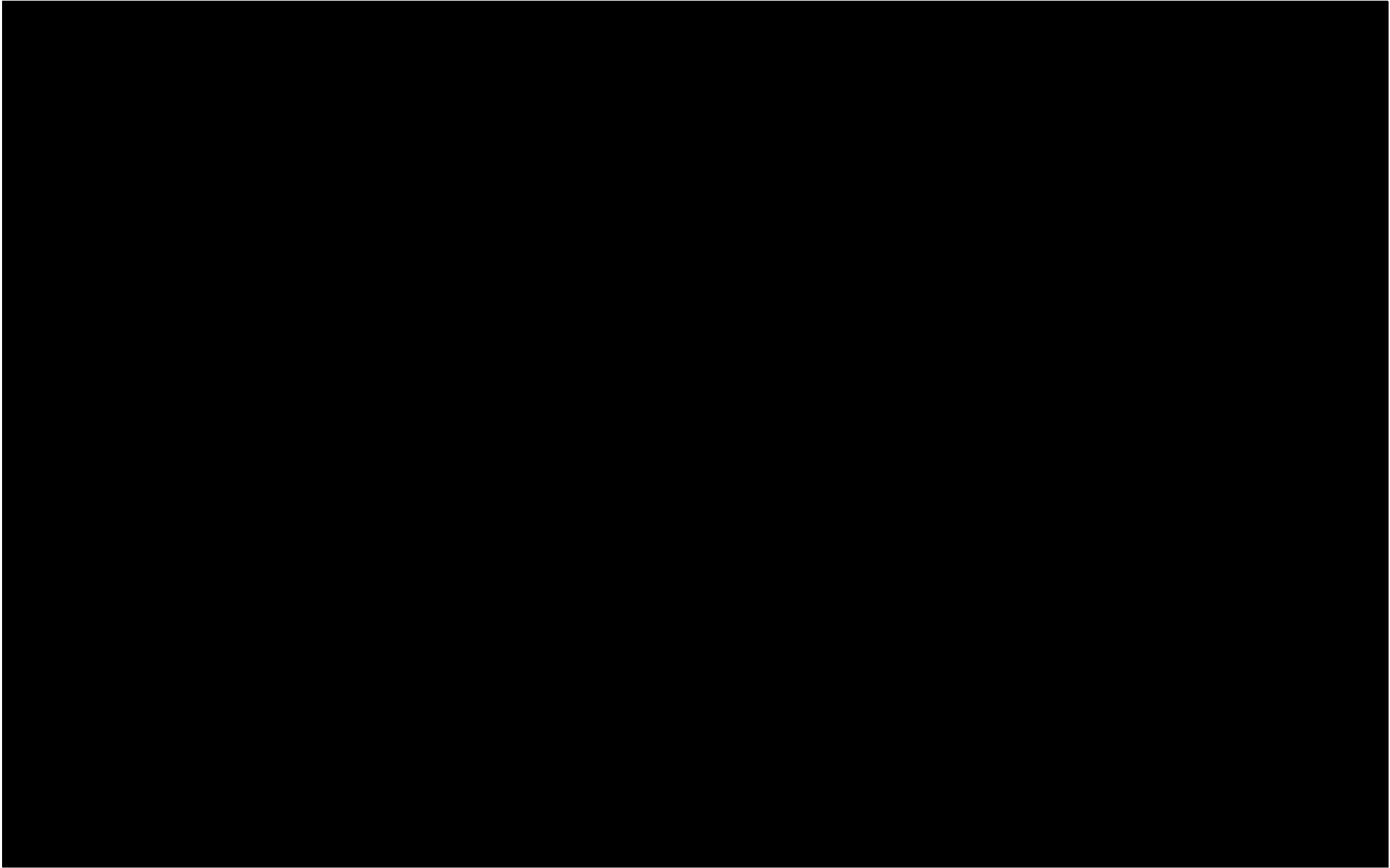
Creating Info Graphics with Standard Web Technologies

Sam Weinig
Safari and WebKit Engineer

Chris Marrin
Safari and WebKit Engineer

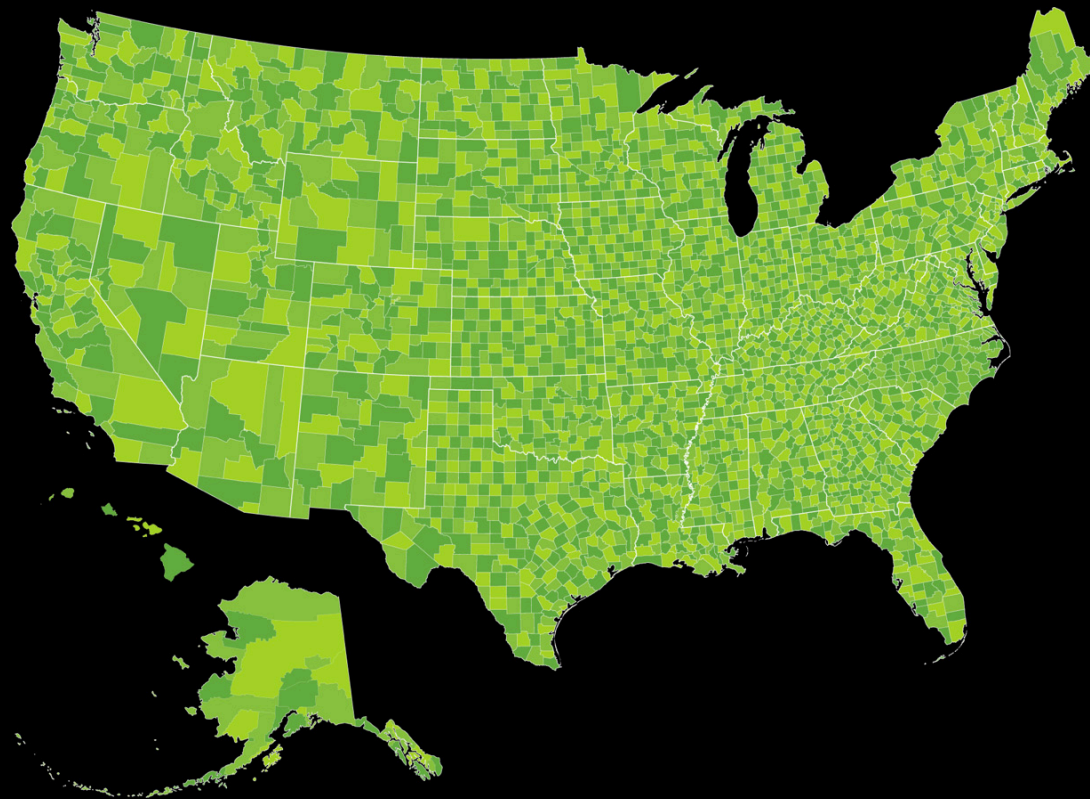
Why Info Graphics?

Data!



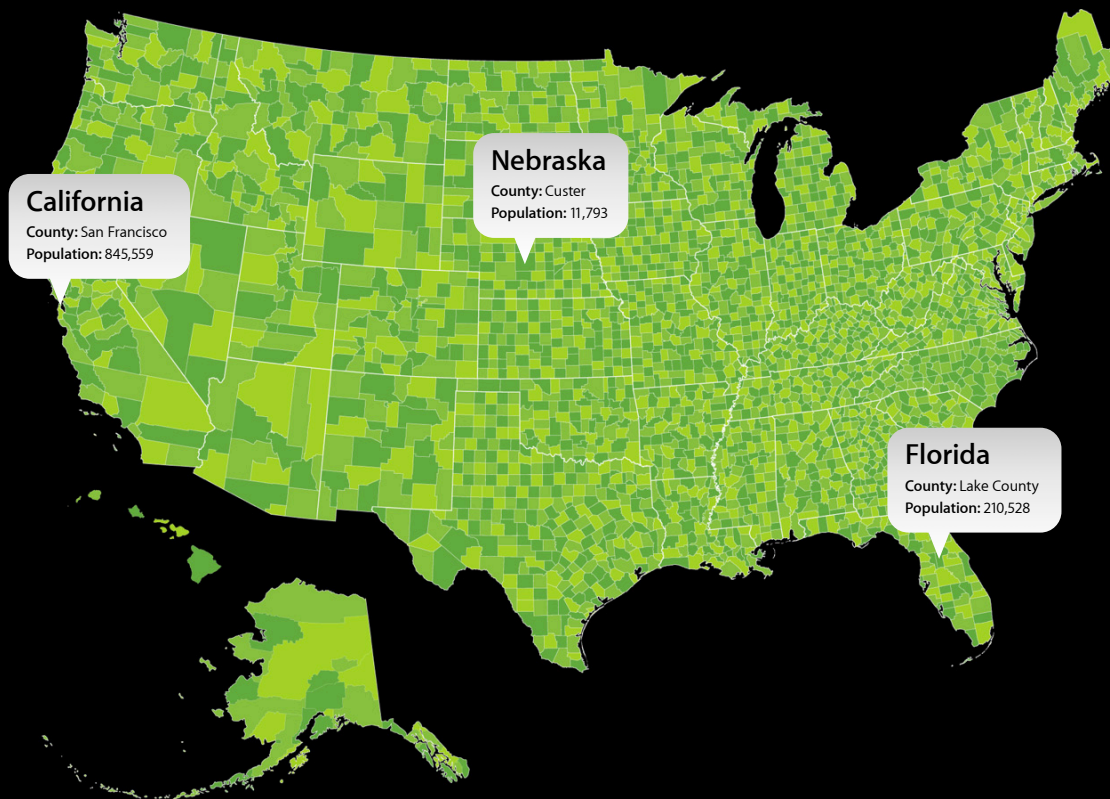
Why Info Graphics?

Simple presentation of complex data



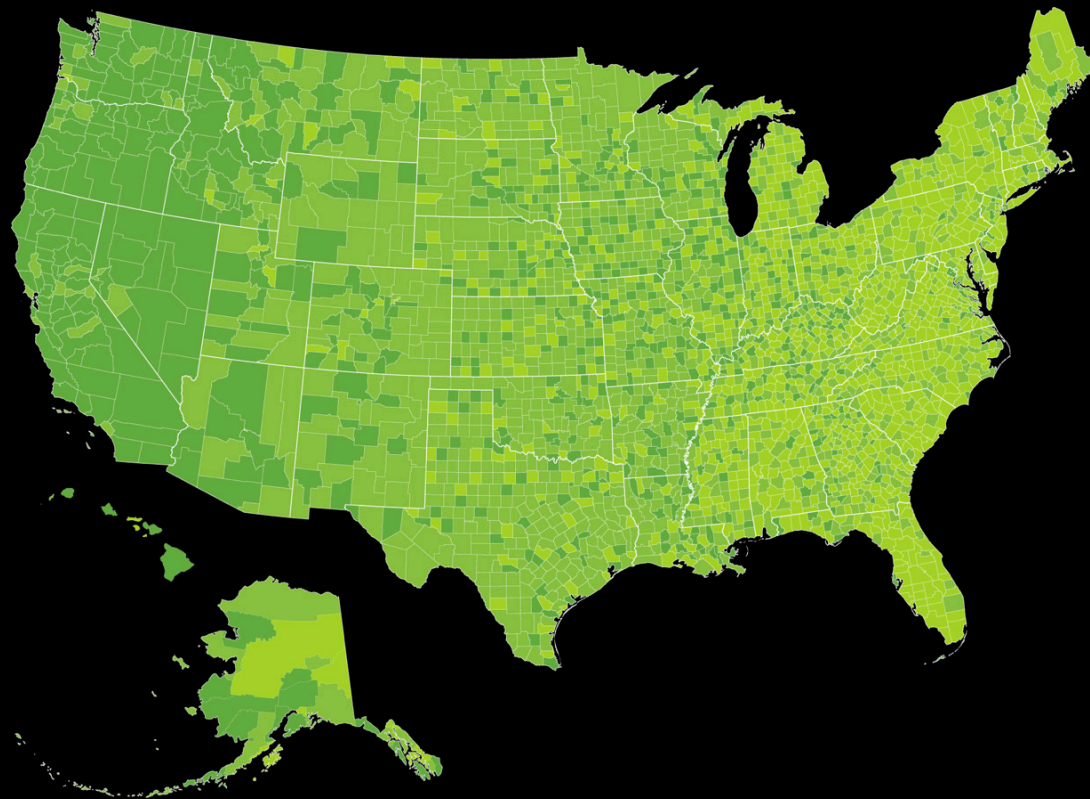
Why Info Graphics on a Web Page?

Graphs can be interactive

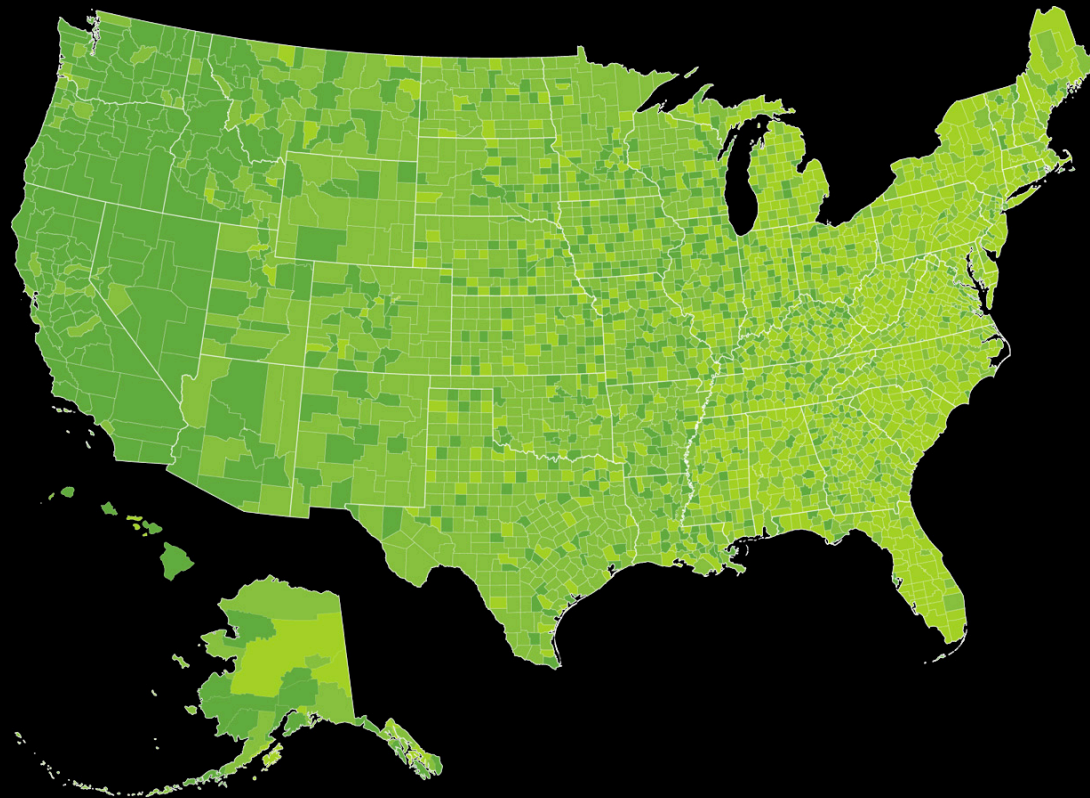


Why Info Graphics on a Web Page?

Graphs can be dynamic



Why Standard Web Technologies?



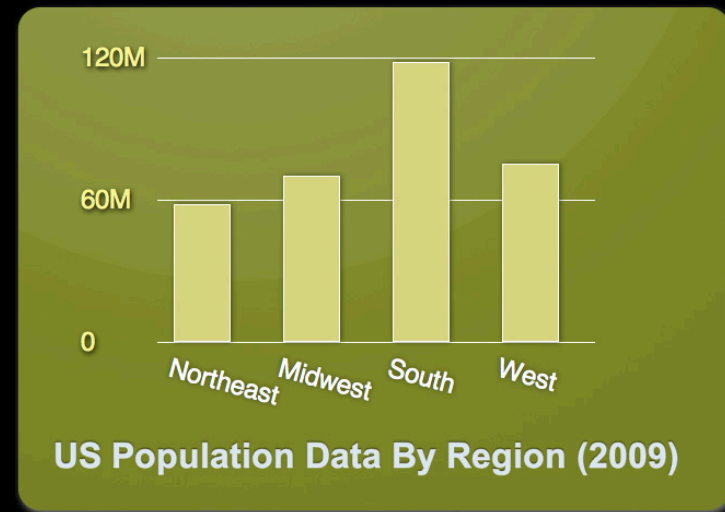
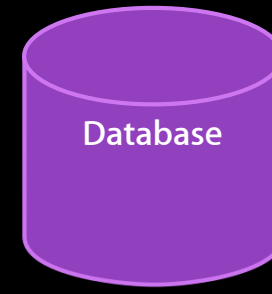
Why Standard Web Technologies?

Display on desktop, tablet, and iPhone



What You'll Learn

- Integrating remote data into simple charts
- Richer visualizations
- Showing data in context



Integrating Remote Data into Simple Charts

Data for Info Graphics

- Sources
 - Your own data
 - Public—<http://www.data.gov/>
- Formats
 - XML
 - JSON
 - CSV and others

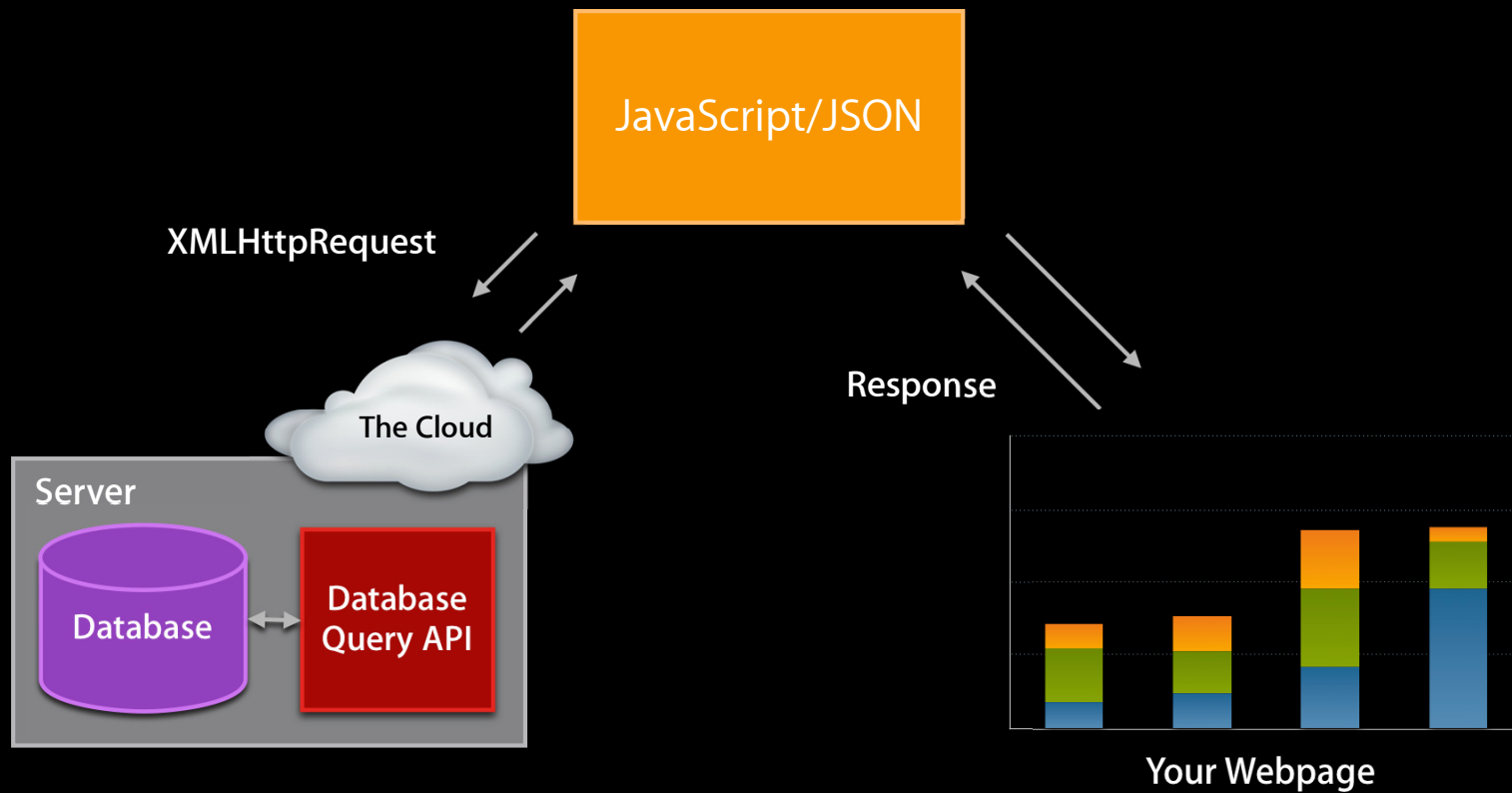
[{"OSVN;"12281343-9

Which Format?

- Depends on the source
- Some data only available in one format
 - Offline tools convert (e.g., CSV to JSON)
 - ~~Write client side JavaScript to handle available format~~
- Many server-side tools to make XML data access simple
- XMLHttpRequest loads XML and JSON equally well
- JSON is new and very fast with WebKit JSON Parser

Info Graphics Data Access

Information flow



Data Access Using JSON

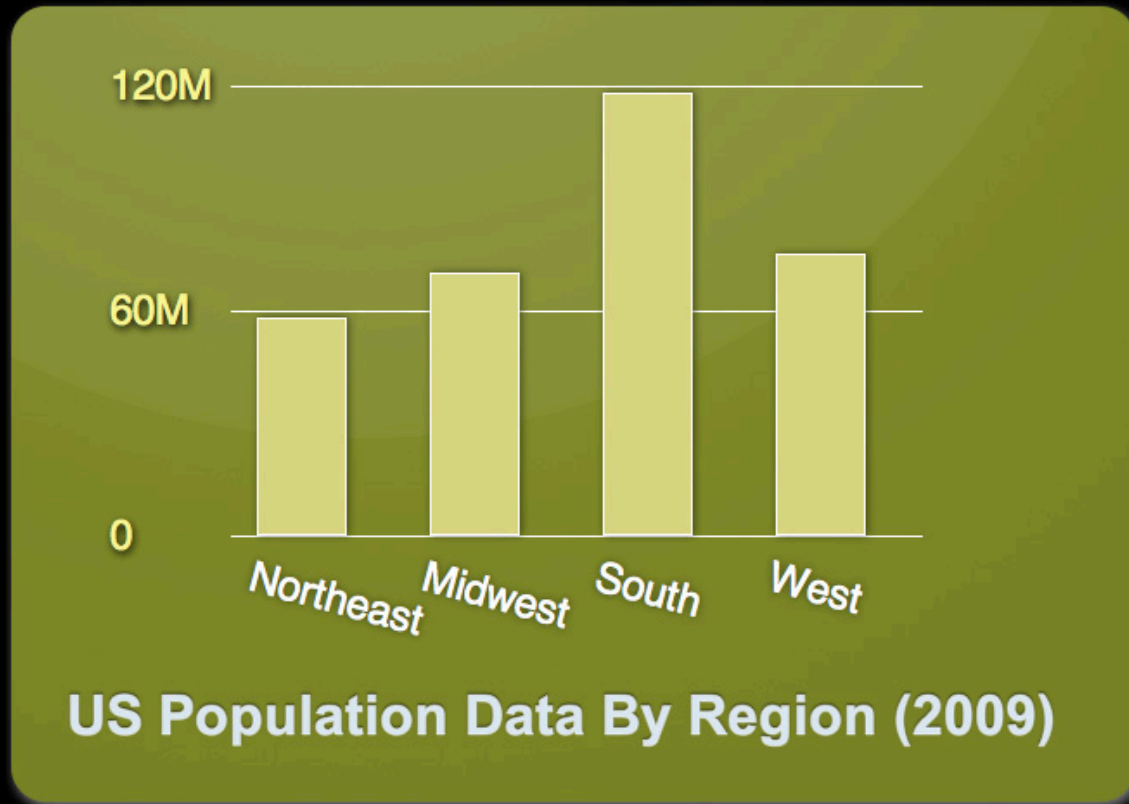
- Request data

```
var request = new XMLHttpRequest();
request.onreadystatechange = processResponse;
request.open('GET', "CensusData.js", true);
request.send();
```

- Process response

```
function processResponse()
{
    if (this.readyState == 4 /* DONE */) {
        censusData = JSON.parse(this.responseText);
        loadChart();
    }
}
```

Bar Chart



Dynamic Chart Creation

```
for (var i = 0; i < n; ++i) {  
    var datum = getCensusDataItem(xProp, names[i])[yProp];  
    var barRoot = document.createElement("div");  
    barRoot.className = "barRoot";  
  
    var bar = document.createElement("div");  
    bar.className = "bar";  
    bar.style.height = (datum / scale * barMaxHeight) + "px";  
    barRoot.appendChild(bar);  
  
    var barTitle = document.createElement("div");  
    barTitle.className = "barTitle";  
    barTitle.innerHTML = names[i];  
    barRoot.appendChild(barTitle);  
  
    root.appendChild(barRoot);  
}
```

Demo

Interactive bar chart

Transitions and Interaction with CSS

Requires no additional JavaScript

- Simple—hover reveal effect

```
.barPopup {  
  position:fixed; overflow:hidden;  
  top:150px; left:350px;  
  z-index:10; border:2px black solid;  
  -webkit-box-shadow:5px 10px 10px rgba(0, 0, 0, 0.5);  
  opacity:0;  
  -webkit-transform:scale(0, 0) rotate(30deg) translate(0, 0);  
  -webkit-transition:opacity 1s linear, -webkit-transform 0.5s ease-out;  
}  
.bar:hover + .barPopup {  
  opacity:1;  
  -webkit-transform:scale(1, 1) rotate(0deg) translate(200px, -100px);  
}
```

Demo

Interactive bar chart on iPhone/iPad

iPhone/iPad and Touch Events

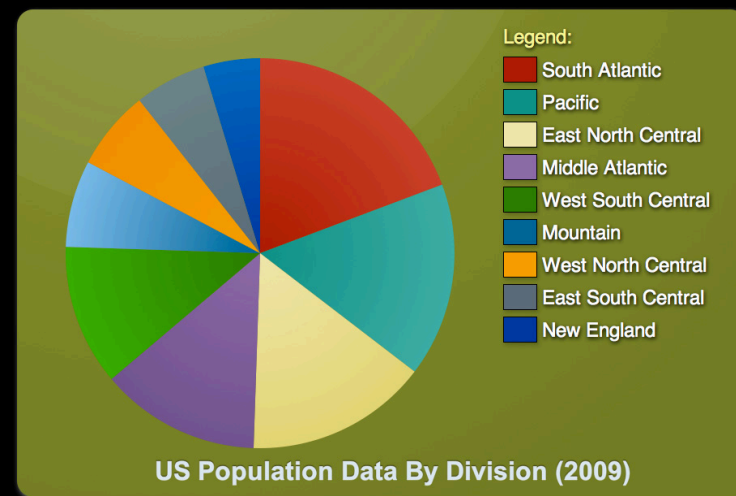
- :hover effect is not used on iPhone/iPad
- Use Touch Events instead
- Add event handlers

```
bar.addEventListener("touchstart", function()  
    { this.className = "bar bar-show" }, false);  
bar.addEventListener("touchend", function()  
    { this.className = "bar" }, false);
```

```
.bar:hover + .barPopup, .bar-show + .barPopup {  
    opacity:1;  
    -webkit-transform:translateX(20px);  
}
```

What You'll Learn

- Integrating remote data into simple charts
- Rich data visualizations
- Showing data in context

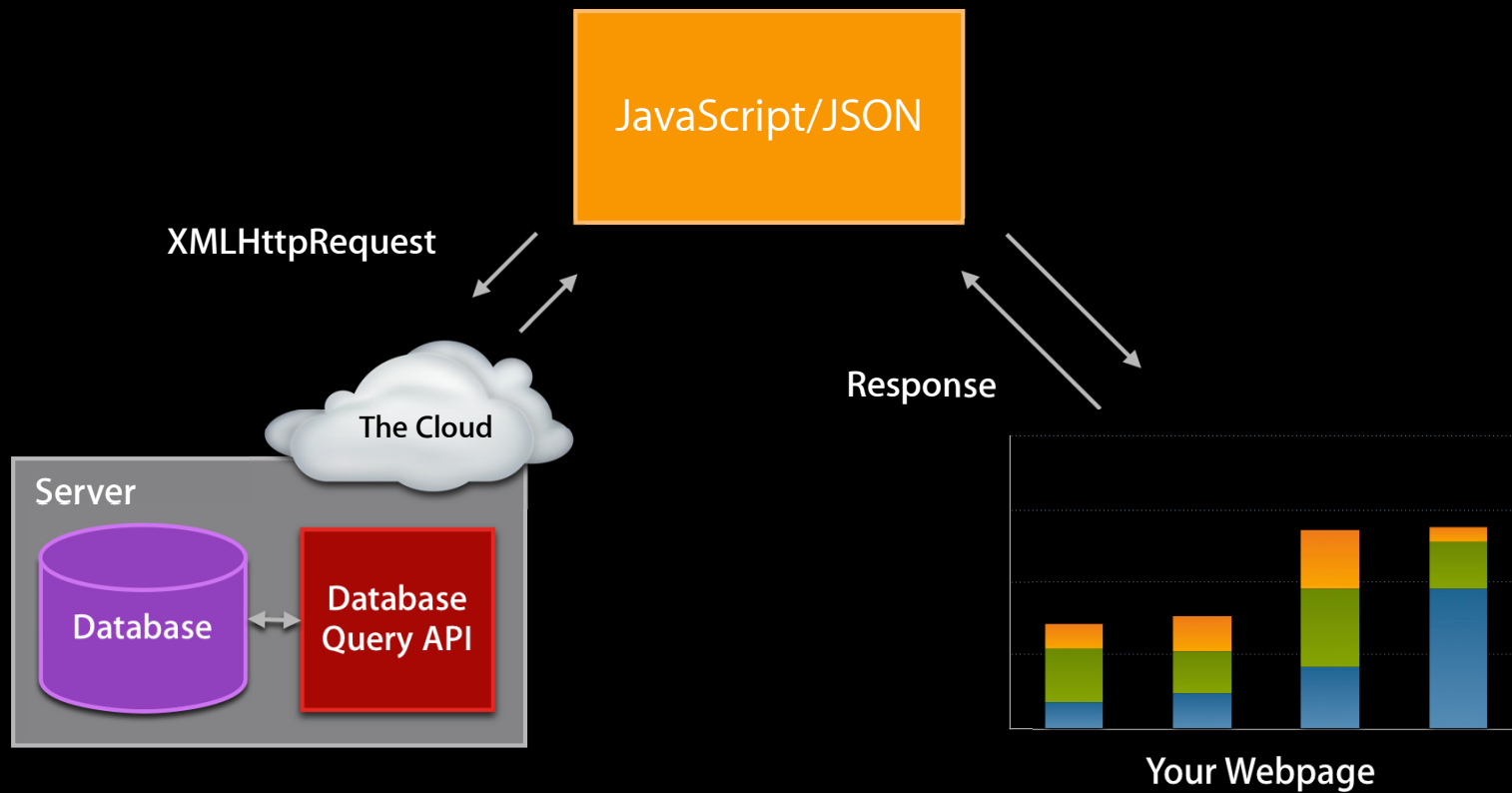


Richer Visualizations

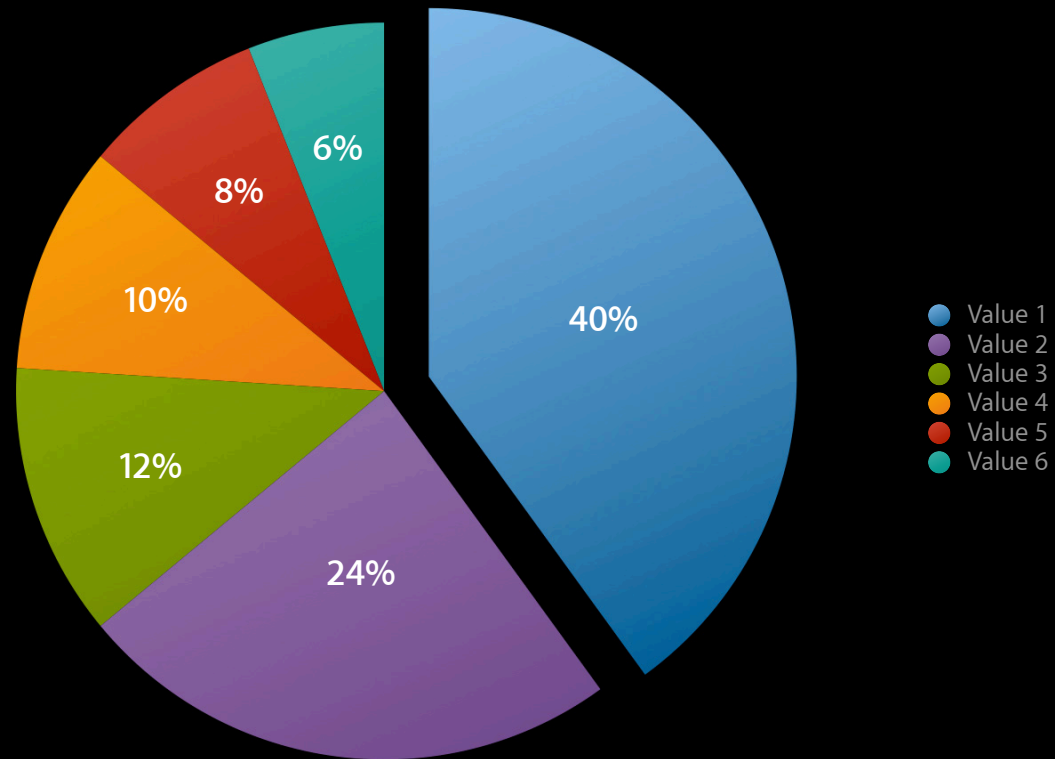
Sam Weinig

Info Graphics Data Access

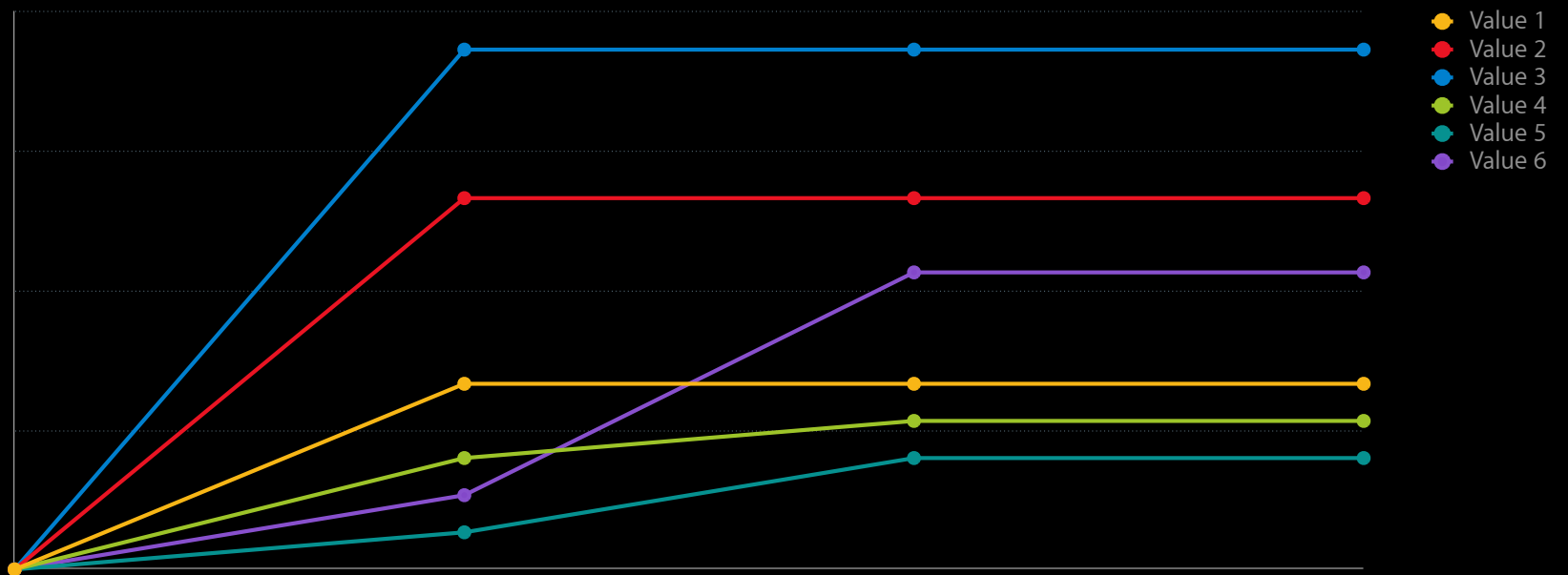
Information flow



Pie Chart



Line Chart



Scatter Chart



<canvas>

HTML5





Airline: **Trans American**

Departure City: 12:40 PM
IAD - Washington DC

Arrival City: 3:20 PM
NRT - Tokyo

Flight 21 Arriving Term 1

← 25 minutes late

457 MPH 37000 FEET

INDU	10540.93	+135.23
COMPX	2005.67	+31.79
AAPL	42.80	+1.05
EBAY	37.69	+1.59
GOOG	180.45	+0.88
AMZN	34.32	+0.89

1d 3m 6m 1y 2y 3y

Oct Nov Dec Jan Feb Mar

45
35
28
19

Quotes delayed by 20 mins

Canvas

- Similar to the CGContext API (Quartz)
- Part of HTML5
- Available in all major browsers

HTML5

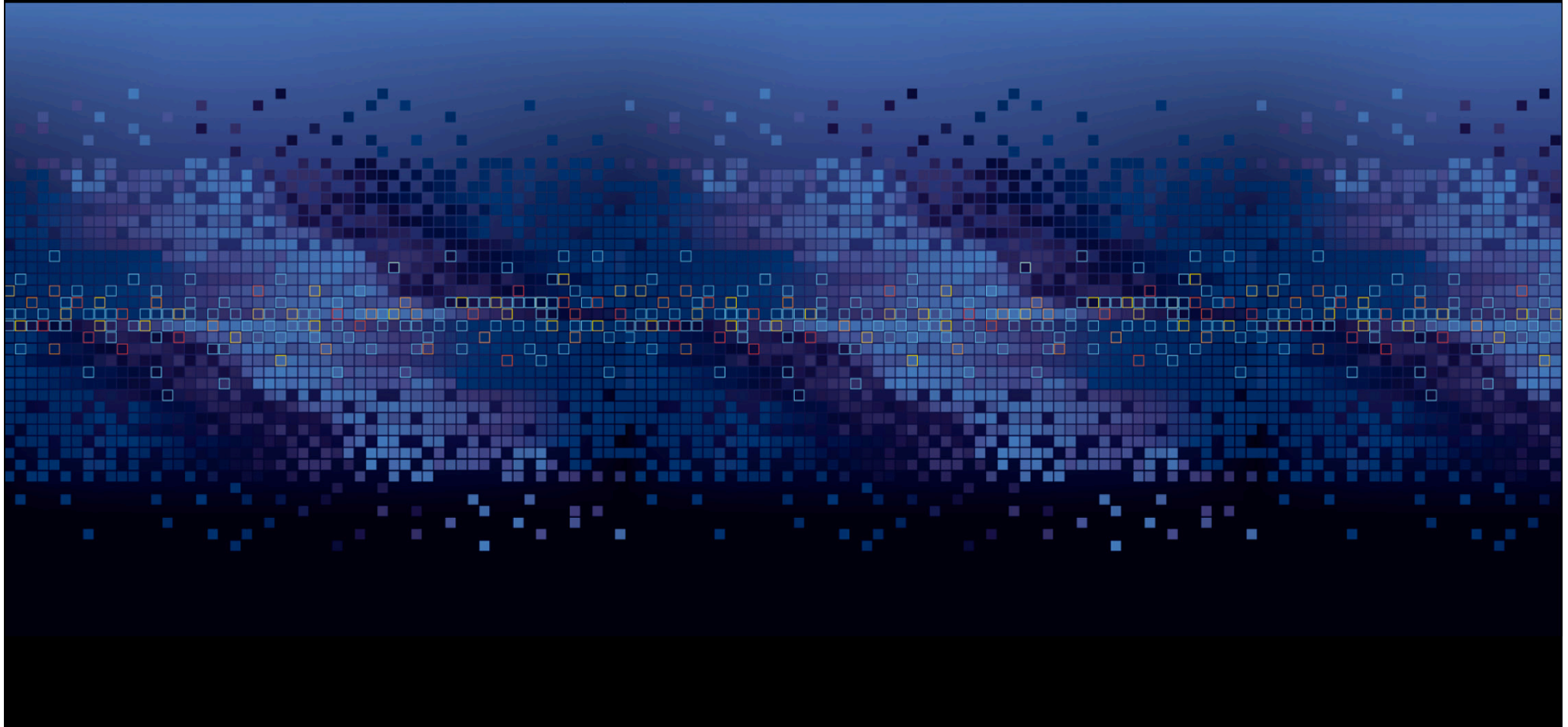


Demo

Interactive pie chart

Canvas

Immediate Mode



Canvas

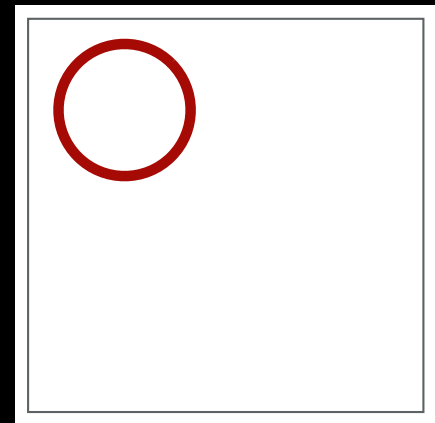
Basics—drawing shapes

```
<canvas id="myCanvas" width="300" height="300"></canvas>
<script>
  var ctx = document.getElementById("myCanvas").getContext("2d");

  // Create a circle path
  ctx.beginPath();
  ctx.arc(75, 75, 50, 0, Math.PI * 2, true);
  ctx.closePath();

  // Set a stroke style
  ctx.lineWidth(10);
  ctx.strokeStyle(255, 0, 0, 0.5);

  // Stroke the path
  ctx.stroke();
</script>
```



Canvas

Basics—drawing text

```
ctx.font = 'italic 30px serif'; // CSS fonts syntax  
ctx.fillText('West North Central', x, y);
```

West North Central

Canvas

Drawing a pie slice

```
function drawPieSlice(canvas, radius, startAngle, delta, color) {  
  var ctx = canvas.getContext("2d");  
  
  // Create a path  
  ctx.beginPath();  
  ctx.moveTo(canvas.width / 2, canvas.height / 2);  
  ctx.arc(canvas.width / 2, canvas.height / 2,  
          ctx.radius, startAngle,  
          startAngle + delta, false);  
  ctx.lineTo(canvas.width / 2, canvas.height / 2);  
  ctx.closePath();  
  
  ctx.fillStyle = color;  
  
  // Fill the path.  
  ctx.fill();  
}
```

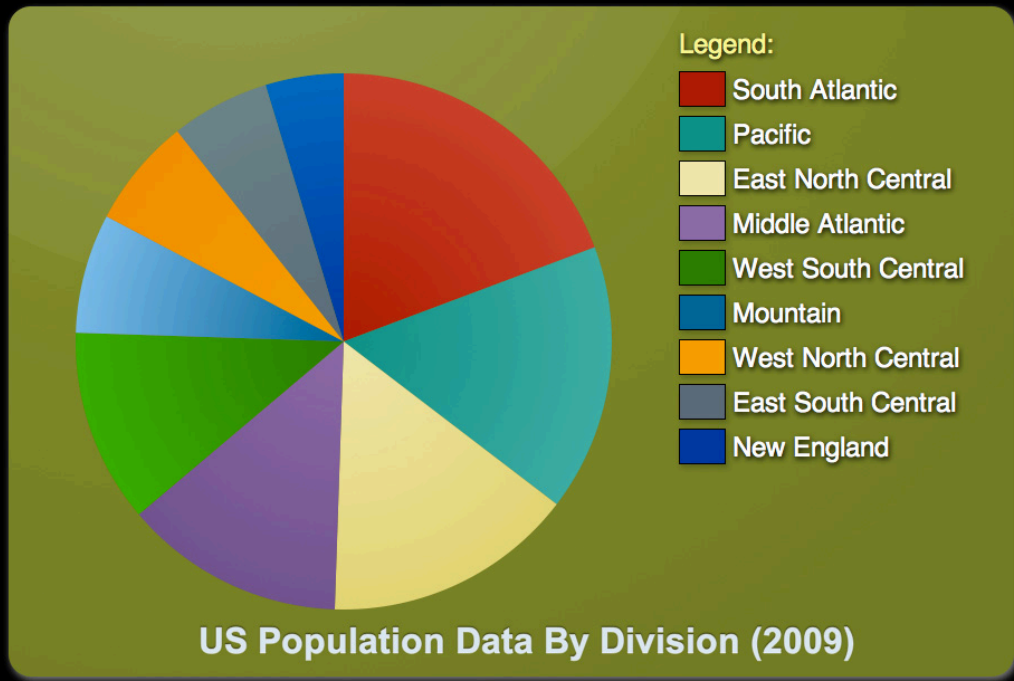


Canvas

Drawing the whole pie

```
function buildPieChar() {  
    var canvas = document.getElementById(canvasId);  
  
    var data = loadDivisionData(); // Load the census data.  
    var startAngle = 0;  
    for (var division in data) {  
        var deltaAngle = data[division].percentOfPopulation  
            * Math.PI * 2;  
  
        ctx.save();  
        drawPieSlice(canvas, 100 /* radius */,  
                    startAngle, deltaAngle, color);  
        ctx.restore();  
  
        startAngle += deltaAngle;  
    }  
}
```

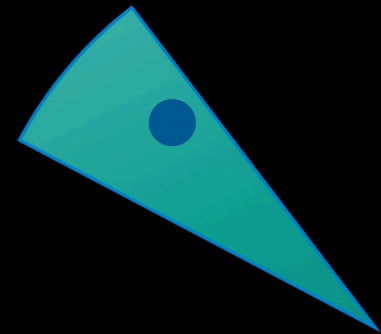




Canvas

Basic interaction

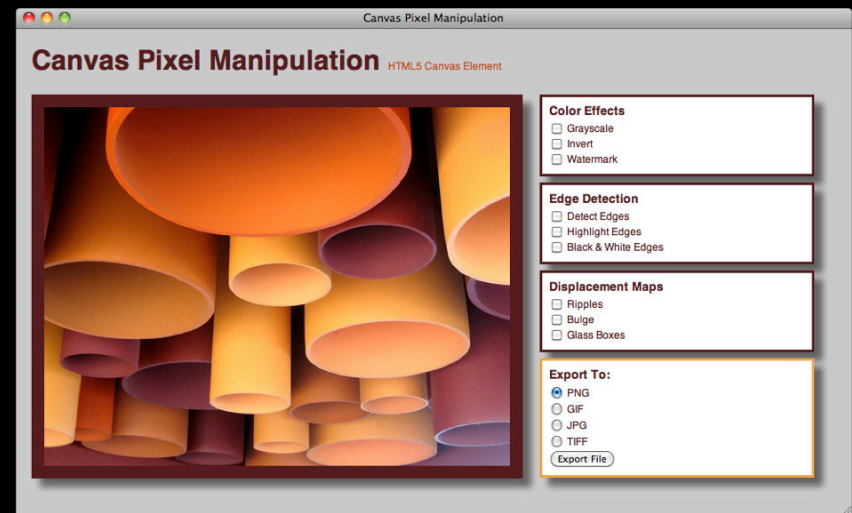
```
function hitTestSlice(canvas, radius, startAngle, delta, evt) {  
  var ctx = canvas.getContext("2d");  
  ctx.beginPath();  
  ctx.moveTo(canvas.width / 2, canvas.height / 2);  
  ctx.arc(canvas.width / 2, canvas.height / 2,  
          ctx.radius, startAngle,  
          startAngle + delta, false);  
  ctx.lineTo(canvas.width / 2, canvas.height / 2);  
  ctx.closePath();  
  
  return ctx.isPointInPath(evt.offsetX, evt.offsetY);  
}
```



Canvas

So much more

- Pixel manipulation with `getImageData/setImageData`
- Saving images with `toDataURL`



<http://developer.apple.com/safaridemos>

Canvas

Additional resources

Flot

<http://code.google.com/p/flot/>

Flotr

<http://solutoire.com/flotr/>

HTML5 Specification

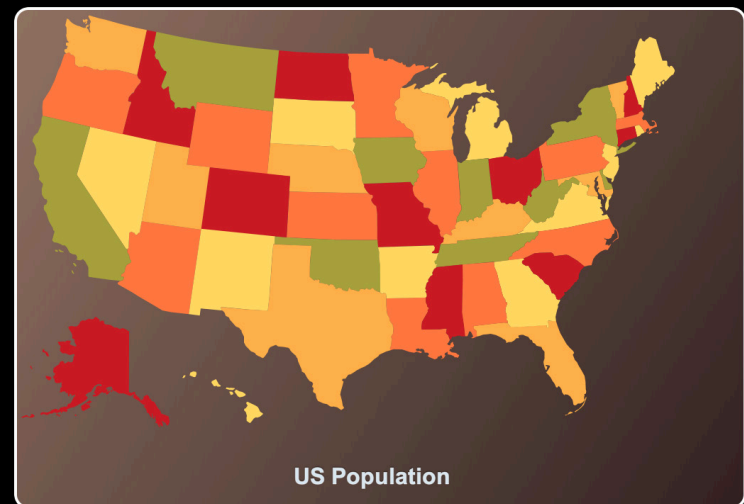
<http://www.w3.org/TR/html5/>

HTML5 Canvas Specification

<http://www.w3.org/TR/2dcontext/>

What You'll Learn

- Integrating remote data into simple charts
- Richer visualizations
- Showing data in context




Showing Data in Context

WHO IS COMING TO AMERICA?

Immigration may have taken a back seat during the financial crisis, but the issue still needs resolving. While illegal immigrants sneaking over the border is still a primary concern, it's good to know who came to our country legally, and from where. This is a look at the 20 countries from which the most people came to America in 2008, how many immigrants already had family here, and how many received asylum when they arrived on our shores.


 **Total: 188,015**
Immediate relatives of U.S. citizens
111,448
Refugees & asylees: **614**

 **Total: 75,410**
Immediate relatives of U.S. citizens
25,540
Refugees & asylees: **21,082**


 **Total: 59,728**
Immediate relatives of U.S. citizens
18,271
Refugees & asylees: **3,475**


 **Total: 52,391**
Immediate relatives of U.S. citizens
29,428
Refugees & asylees: **939**


 **Total: 48,057**
Immediate relatives of U.S. citizens
3,113
Refugees & asylees: **42,160**

 **Total: 31,801**
Immediate relatives of U.S. citizens
21,352
Refugees & asylees: **DATA WITHHELD**


 **Total: 29,807**
Immediate relatives of U.S. citizens
12,096
Refugees & asylees: **1,462**

 **Total: 29,349**
Immediate relatives of U.S. citizens
14,835
Refugees & asylees: **7,909**

 **Total: 26,155**
Immediate relatives of U.S. citizens
8,878
Refugees & asylees: **8**

 **Total: 25,522**
Immediate relatives of U.S. citizens
8,854
Refugees & asylees: **5,498**

 **Total: 22,366**
Immediate relatives of U.S. citizens
8,536
Refugees & asylees: **188**


 **Total: 20,023**
Immediate relatives of U.S. citizens
8,227
Refugees & asylees: **1,317**


 **Total: 18,937**
Immediate relatives of U.S. citizens
6,302
Refugees & asylees: **560**

 **Total: 18,077**
Immediate relatives of U.S. citizens
11,754
Refugees & asylees: **22**

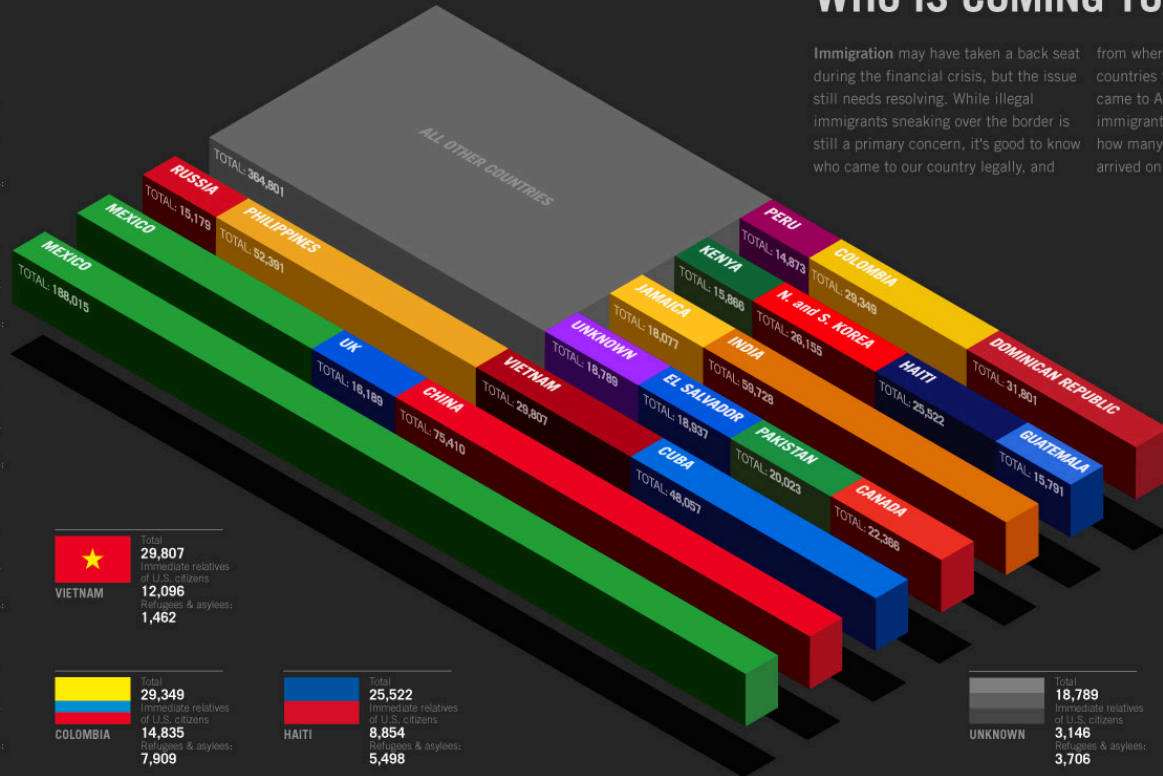
 **Total: 14,873**
Immediate relatives of U.S. citizens
9,733
Refugees & asylees: **799**

 **Total: 16,189**
Immediate relatives of U.S. citizens
7,294
Refugees & asylees: **64**

 **Total: 15,866**
Immediate relatives of U.S. citizens
2,411
Refugees & asylees: **11,353**

 **Total: 15,791**
Immediate relatives of U.S. citizens
8,255
Refugees & asylees: **886**

 **Total: 15,179**
Immediate relatives of U.S. citizens
4,078
Refugees & asylees: **6,583**



SOURCE: Department of Homeland Security

Image courtesy of GOOD and Timko & Klick



Image courtesy of lokeshdhakar.com

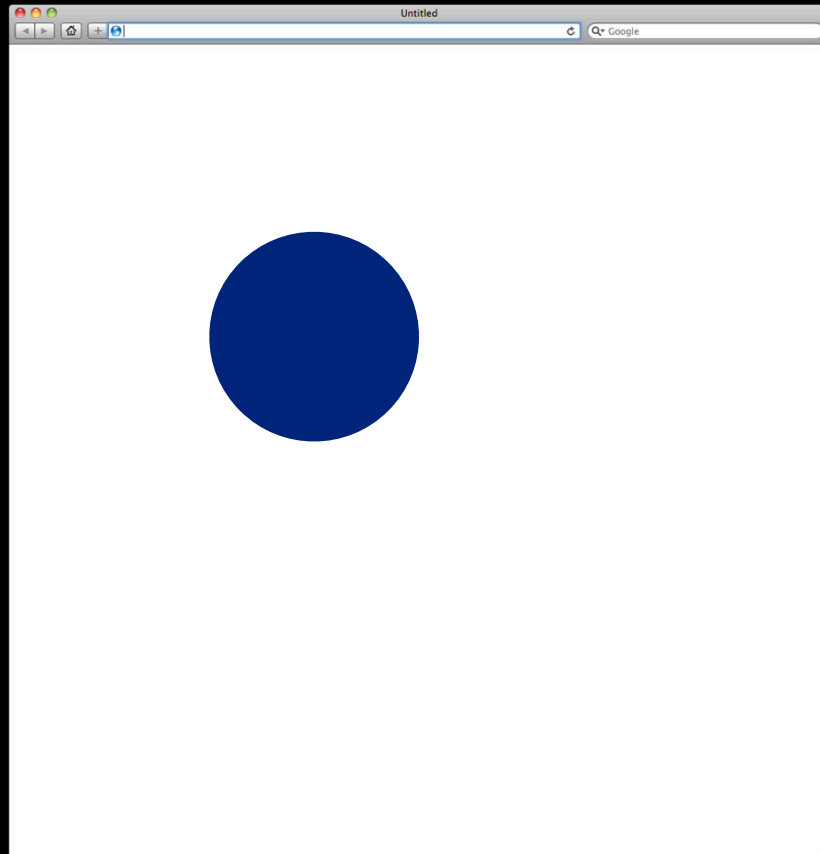
Scalable Vector Graphics



Scalable Vector Graphics

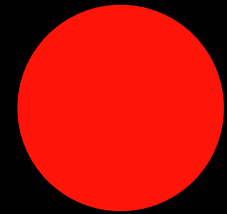
Retained mode

```
<circle r="20"/>
```



Scalable Vector Graphics

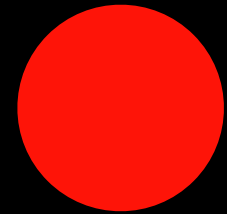
Drawing basic shapes



```
<svg xmlns="http://www.w3.org/2000/svg">  
  <circle cx="100" cy="50" r="40" fill="red"/>  
</svg>
```

Scalable Vector Graphics

Animating objects



```
<svg xmlns="http://www.w3.org/2000/svg">  
  <circle cx="100" cy="50" r="40" fill="red">  
    <animateMotion from="0,0" to="0, 300"  
      dur="1s" fill="freeze"/>  
  </circle>  
</svg>
```


Scalable Vector Graphics

Using SVG in webpages

- Image reference

```
  
div { -webkit-mask: url('artwork.svg'); }
```

- Document reference

```
<iframe src="artwork.svg"></iframe>  
<object data="artwork.svg" type="image/svg+xml"></object>
```

- Inline in XHTML

```
<div>  
  <svg xmlns="http://www.w3.org/2000/svg">  
    <rect width="300" height="100"></rect>  
  </svg>  
</div>
```

Scalable Vector Graphics

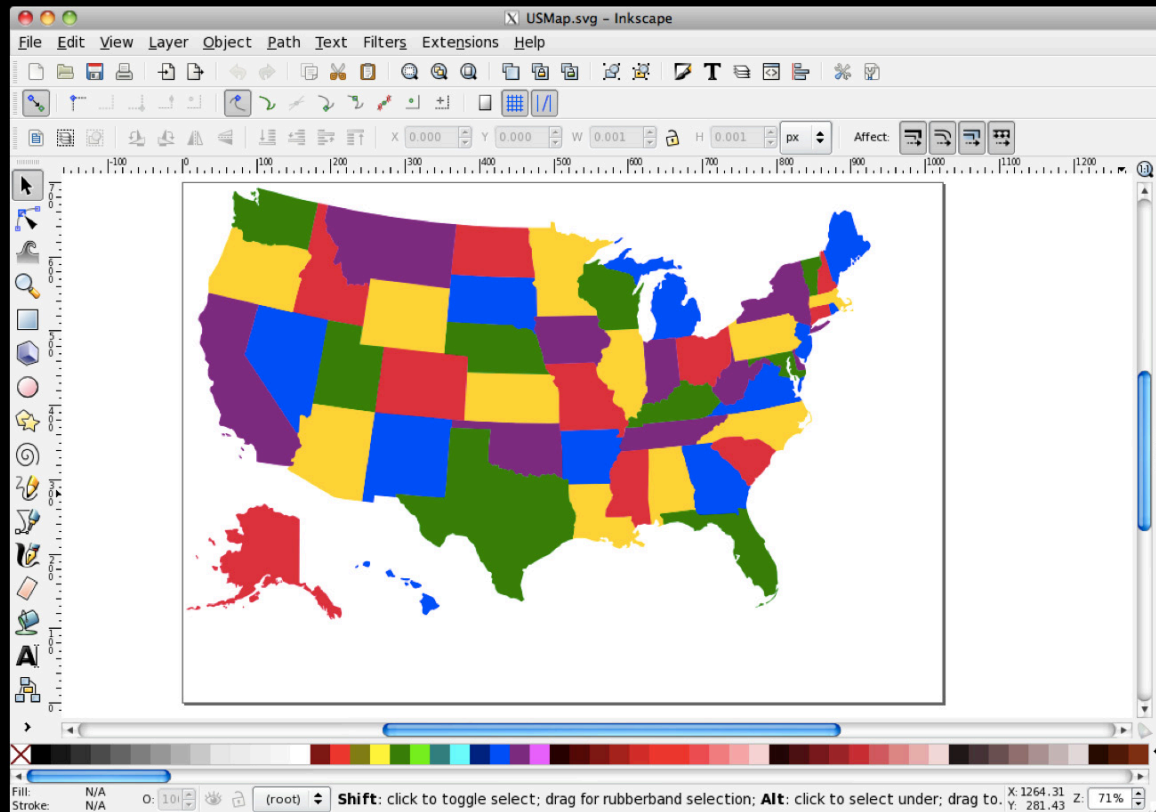
Path

```
<svg xmlns="http://www.w3.org/2000/svg">  
  <path  
    id="NY"  
    d="M 830.37944,188.7456 L 829.24781,187.77564  
      L 824.39799,185.67406 L 822.76738,179.54493  
      ...  
      L 837.9775,191.6555 L 830.37944,188.7456 z"  
  />  
</svg>
```



Scalable Vector Graphics

Content creation



Demo

Exporting SVG

Scalable Vector Graphics

Interaction

- JavaScript
 - The DOM you know
 - The event model you know (addEventListener/removeEventListener)

Scalable Vector Graphics

So much more...

- SVG fonts
- Text on a path
- Sprites using `<use>`



SVG

Additional resources

Inkscape

<http://www.inkscape.org/>

Raphaël

<http://raphaeljs.com/>

SVG Specification

<http://www.w3.org/TR/2003/REC-SVG11-20030114/>

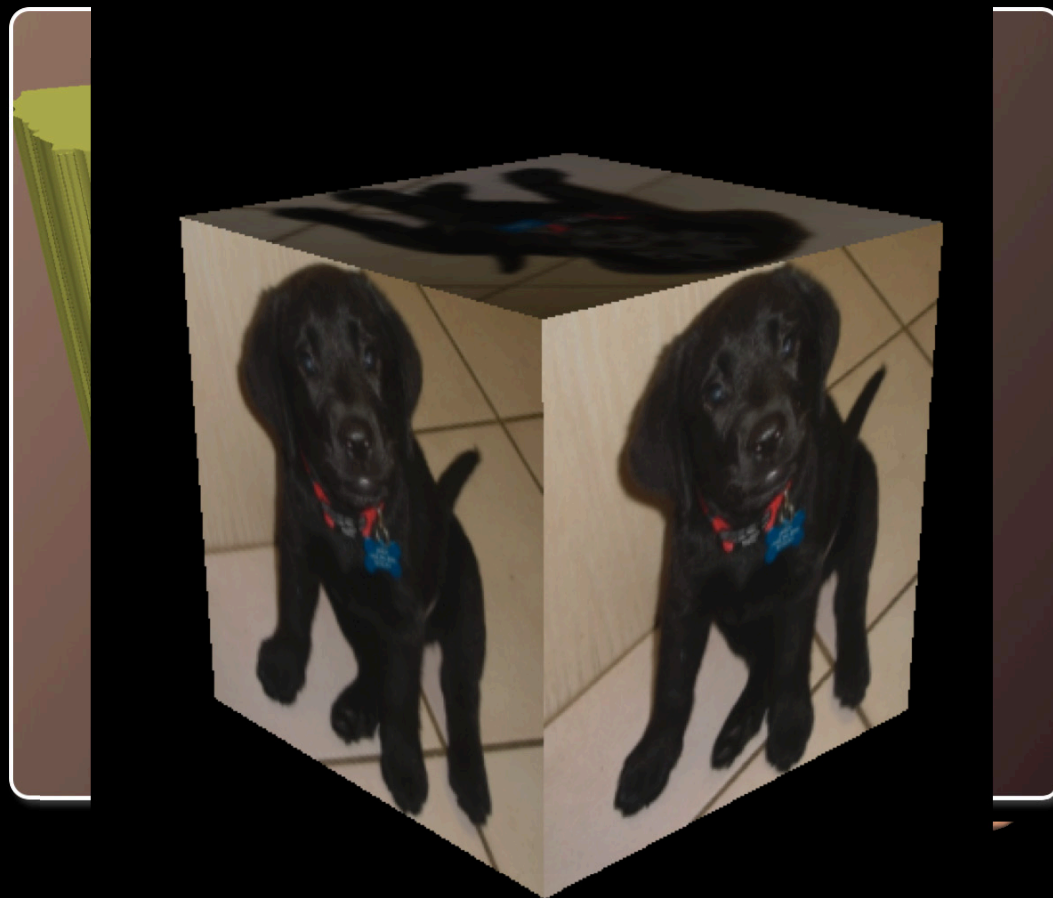
Canvas vs. SVG

	Canvas	SVG
Mode	Immediate	Retained
Paths	✓	✓
Pixel Manipulation	✓	
Image I/O	✓	
Accessibility		✓
Animation		✓
Authoring tools		✓

Demo

One more thing

WebGL





- Working Group in Khronos
- Collaboration between Apple, Google, Mozilla and others
- Apple is Spec Editor
- Spec went to public review December 2009
- For more information about WebGL
 - <http://webgl.org/wiki/>
- Available in WebKit nightly builds
 - <http://webkit.org/blog/603/webgl-now-available-in-webkit-nightlies/>

Summary

- Info graphics are engaging and informative
- Web info graphics lets you add animation and interaction
- Standard web technologies let you run everywhere
 - Without plug-ins
 - Accessibility
- Many standard web technologies available in WebKit
 - HTML + CSS
 - Canvas
 - SVG

More Information

Vicki Murley

Safari Technology Evangelist

vicki@apple.com

Safari Dev Center

<http://developer.apple.com/safari/>

HTML5 Demos

<http://apple.com/html5/>

Apple Developer Forums

<http://devforums.apple.com>

Related Sessions

CSS Effects, Part 1: UI Elements and Navigation

Marina
Tuesday 3:15PM

CSS Effects, Part 2: Galleries and 3D Effects

Marina
Tuesday 4:30PM

Using HTML5 Offline Storage

Marina
Thursday 2:00PM

Getting the Most Out of Safari Integrated Developer Tools

Marina
Wednesday 11:30AM

Adding Touch and Gesture Detection to Web Pages on iPhone OS

Nob Hill
Wednesday 2:00PM

Labs

Safari on iPhone OS

Internet & Web Lab B
Thursday 9:00AM

Safari on iPhone OS

Internet & Web Lab B
Thursday 2:00PM

Safari Open Lab

Internet & Web Lab A
Friday 9:00AM

Q&A



