

# INTRODUCTION TO CANVAS

CONTENT OWNER:

**Sutrix Media**

All future revisions to this document shall be approved by the content owner prior to release.

The information contained herein is PROPRIETARY to The Sutrixmedia Joint Stock Company and shall not be reproduced or disclosed in whole or in part or used for any purpose except when the user possesses direct, written authorization from

The Sutrixmedia Joint Stock Company

# Preface

❖ Signature

**Prepared By: Cuong.Tran**

Date: 07-Apr-2015

**Reviewed By: Len.Nguyen**

Date: 15-Apr-2015

**Approved By: Len.Nguyen**

Date: 15-Apr-2015



# Outline

- ❖ Overview
- ❖ Shapes, fill style and gradient
- ❖ Text and image
- ❖ Transformation, animation and interaction
- ❖ Canvas tips
- ❖ Some canvas frameworks
- ❖ References



# Overview

## ❖ What is HTML Canvas?

- ✓ Is the HTML `<canvas>` element
- ✓ Used to draw graphics via scripting: JS
- ✓ Is only a container for graphics. You must use a script to actually draw the graphics.
- ✓ Has several methods for drawing paths, boxes, circles, text, and adding images.



# Overview(cont)

## ❖ Browsers and devices support

<http://caniuse.com/#search=canvas>

Current aligned	Usage relative	Show all						
IE	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Chrome for Android
		31						
		36						
		37					4.1	
8		38					4.3	
9	31	39	7				4.4	
10	35	40	7.1		7.1		4.4.4	
11	36	41	8	27	8.1	8	40	41
TP	37	42		28				
	38	43		29				
	39	44						

(Captured at 08/04/2015)

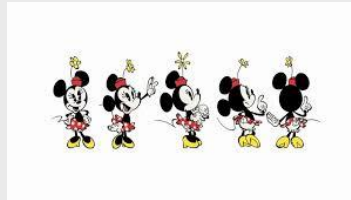


# Overview(cont)

## ❖ What's great?



**Interactivity**



**Animation**



**Flexibility**



**Support**



**Popularity**



**Web standard**



**Develop once, run everywhere...**

# Overview(cont)

## ❖ Q&A:

What exactly can use it for?



# Shapes, fill style and gradient

## ❖ How to use <canvas> tag:

1. HTML embed:

```
<canvas id="myCanvas" width="500" height="500"></canvas>
```

2. Scripting with JavaScript:

```
<script >  
var canvas = document.getElementById("myCanvas");  
var context = canvas.getContext("2d");      //WHY?  
</script>
```

3. Change stroke and fill style color:

```
context.strokeStyle="#FF0000";  
context.fillStyle="#FF0000";
```

Problem???





# Shapes, fill style and gradient(cont)

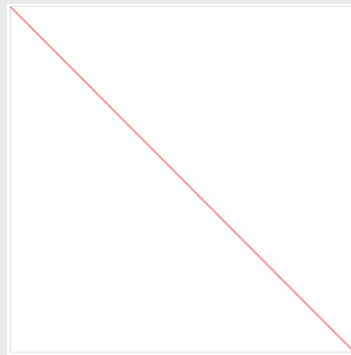
## ❖ Line:

```
context.moveTo(0, 0);  
context.lineTo(500, 500);  
context.stroke();
```

[http://www.w3schools.com/tags/canvas\\_moveto.asp](http://www.w3schools.com/tags/canvas_moveto.asp)

[http://www.w3schools.com/tags/canvas\\_lineto.asp](http://www.w3schools.com/tags/canvas_lineto.asp)

**Code:** <http://codepen.io/cuongtran3001/pen/gbJEpg>

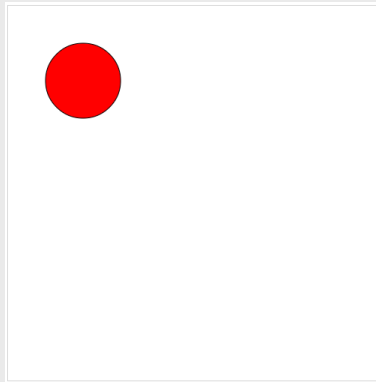


# Shapes, fill style and gradient(cont)

## ❖ Circle:

```
context.strokeStyle="black";  
context.fillStyle = "red";  
context.beginPath();  
context.arc(100, 100, 50, 0,2 * Math.PI);  
context.fill();  
context.stroke();
```

**Code:** <http://codepen.io/cuongtran3001/pen/WbBmQd>



# Shapes, fill style and gradient(cont)

❖ Try it: rectangle, path, bezier...



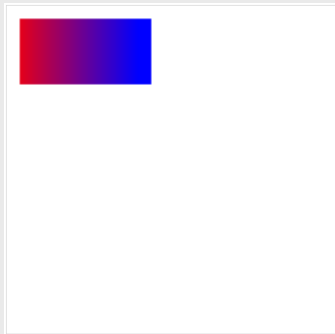
# Shapes, fill style and gradient(cont)

## ❖ Gradient: Linear

```
var gradient = context.createLinearGradient(0,0,200,0);  
gradient.addColorStop(0,"red");  
gradient.addColorStop(1,"blue");
```

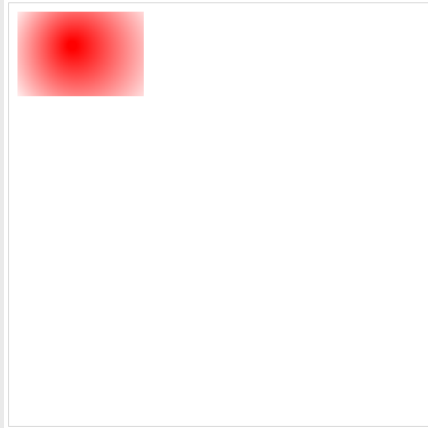
```
context.fillStyle = gradient;  
context.fillRect(20, 20, 200, 100);
```

**Code:** <http://codepen.io/cuongtran3001/pen/azrMBe>



# Shapes, fill style and gradient(cont)

## ❖ Gradient: Radial

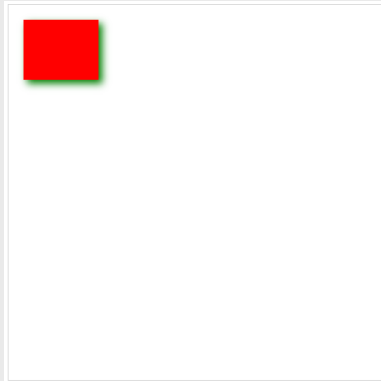


# Shapes, fill style and gradient(cont)

## ❖ Shadow

```
context.shadowColor = "green";  
context.shadowBlur = 15;  
context.shadowOffsetX = 5;  
context.shadowOffsetY = 5;
```

**Code:** <http://codepen.io/cuongtran3001/pen/zxQbwV>

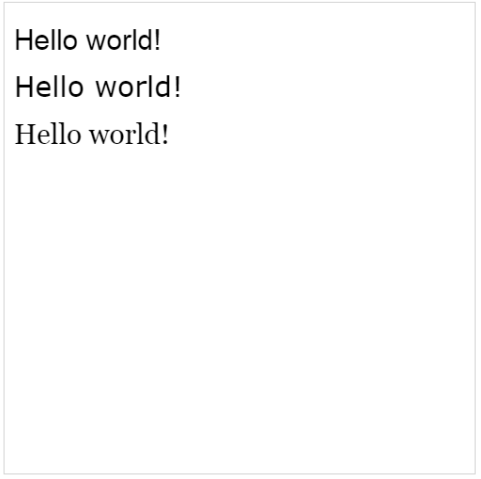


# Text and image

## ❖ Text

```
context.font = "30px Arial";  
context.fillText("Hello world!", 10, 50);
```

**Code:** <http://codepen.io/cuongtran3001/pen/PwvLKJ>



Hello world!  
Hello world!  
Hello world!

# Text and image(cont)

## ❖ Text – more

- Apply gradient
- Add drop shadow
- Measure text
- Input text???



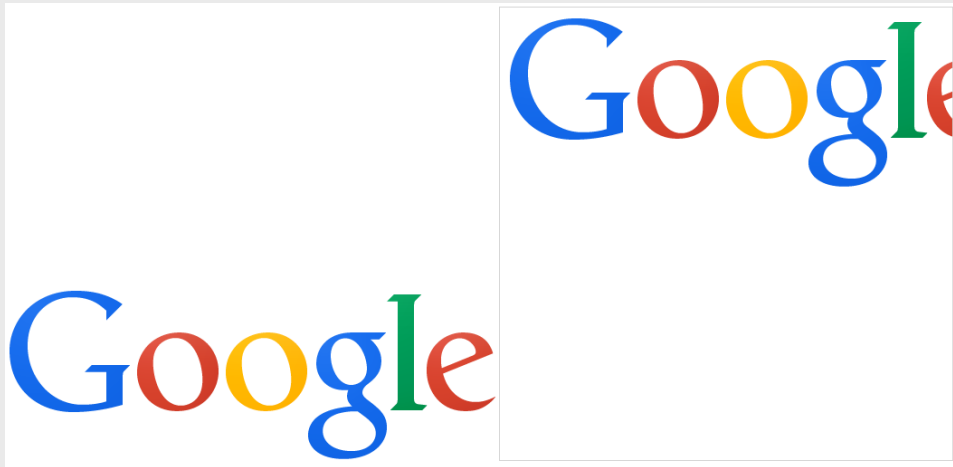


# Text and image(cont)

## ❖ Image – drawImage()

```
window.onload = function() {  
    var image = document.getElementById("imageId");  
    context.drawImage(image, 10, 10);  
}
```

**Code:** <http://codepen.io/cuongtran3001/pen/MYdxVx>



# Text and image(cont)

## ❖ Image – drawImage(): parameter values

Parameter	Description
<i>img</i>	Specifies the image, canvas, or video element to use
<i>sx</i>	Optional. The x coordinate where to start clipping
<i>sy</i>	Optional. The y coordinate where to start clipping
<i>swidth</i>	Optional. The width of the clipped image
<i>sheight</i>	Optional. The height of the clipped image
<i>x</i>	The x coordinate where to place the image on the canvas
<i>y</i>	The y coordinate where to place the image on the canvas
<i>width</i>	Optional. The width of the image to use (stretch or reduce the image)
<i>height</i>	Optional. The height of the image to use (stretch or reduce the image)

**Reference:** [http://www.w3schools.com/tags/canvas\\_drawimage.asp](http://www.w3schools.com/tags/canvas_drawimage.asp)

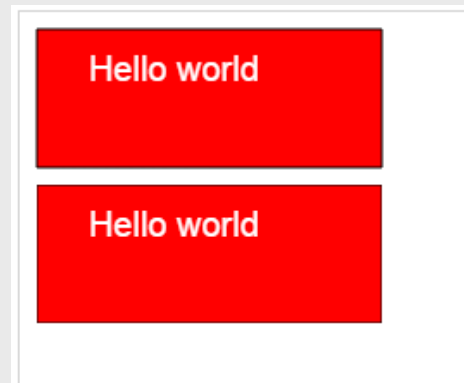


# Text and image(cont)

## ❖ Image – ImageData

```
context.fillStyle = "red";  
context.strokeStyle = "black";  
context.rect(10, 10, 200, 80);  
context.fill();  
context.stroke();  
var imageData = context.getImageData(10, 10, 200, 80);  
context.putImageData(imageData, 10, 100);
```

**Code:** <http://codepen.io/cuongtran3001/pen/GgbJXp>



# Text and image(cont)

## ❖ Image – ImageData

- Capture area including image

**Code:** <http://codepen.io/cuongtran3001/pen/zxVGgy>

- Capture video or webcam???

➤ **Code:** <http://codepen.io/cuongtran3001/pen/RNzWwr>

**Note:** ImageData.data !!!

**Problem:** cross domain error for draw image ???



# Transform, animate and interact

## ❖ Transformation

scale()

rotate()

translate()

transform()

setTransform()



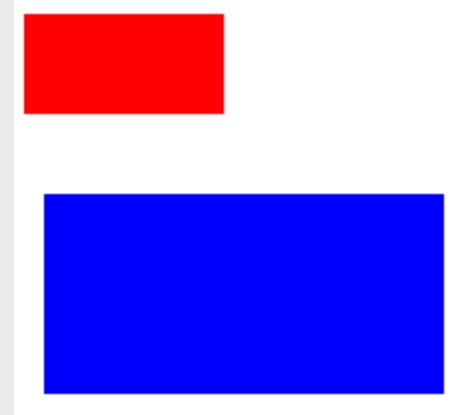
# Transform, animate and interact

## ❖ Transformation - scale

```
context.fillStyle = "red";  
context.fillRect(10, 10, 100, 50);  
context.fill();
```

```
context.scale(2, 2);
```

```
context.fillStyle = "blue";  
context.fillRect(10, 50, 100, 50);  
context.fill();
```



**Code:** <http://codepen.io/cuongtran3001/pen/LEKLZP>

scale(): -1, -1 !!!

Reset???

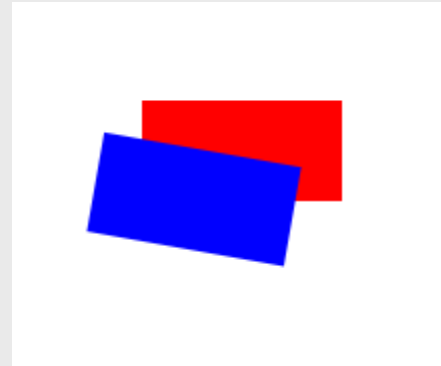
# Transform, animate and interact

## ❖ Transformation - rotate

```
context.fillStyle = "red";  
context.fillRect(100, 100, 100, 50);  
context.fill();
```

```
context.rotate( 10 * Math.PI/180); //10 degree
```

```
context.fillStyle = "blue";  
context.fillRect(100, 100, 100, 50);  
context.fill();
```



**Code:** <http://codepen.io/cuongtran3001/pen/LEKLZP>

Reset???

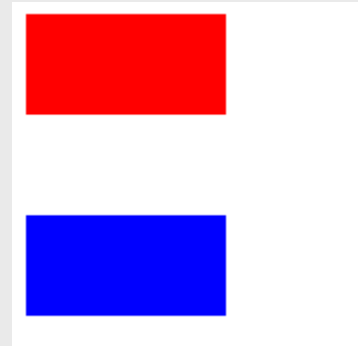
# Transform, animate and interact

## ❖ Transformation - translate

```
context.fillStyle = "red";  
context.fillRect(10, 10, 100, 50);  
context.fill();
```

```
context.translate(0, 100);
```

```
context.fillStyle = "blue";  
context.fillRect(10, 10, 100, 50);  
context.fill();
```



**Code:** <http://codepen.io/cuongtran3001/pen/pvXwRK>

Reset???



# Transform, animate and interact

## ❖ Transformation - transform

```
// translation matrix:
```

```
// scx sky tx
```

```
// skx scy ty
```

```
var tx = 50;
```

```
var ty = 50;
```

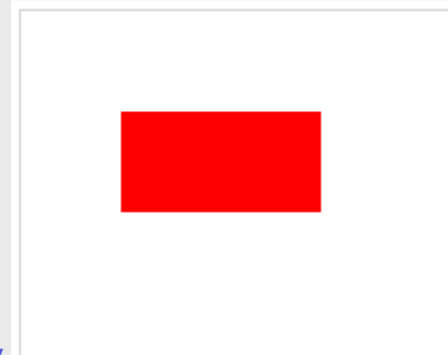
```
// apply custom transform
```

```
context.transform(1, 0, 0, 1, tx, ty);
```

```
context.fillStyle = "red";
```

```
context.fillRect(0, 0, 100, 50);
```

```
context.fill();
```



**Code:** <http://codepen.io/cuongtran3001/pen/JoQjpo>

**Reset:** `transform(1, 0, 0, 1, 0, 0);`

# Transform, animate and interact

## ❖ Animation

Create element, then loop:

- Clear element
- Apply transformation
- Draw element again

**Code:** <http://codepen.io/cuongtran3001/pen/JoQJpo>



# Transform, animate and interact

## ❖ Interaction

Can add mouse event on canvas: click, mousedown, mouseup...

**Code:** <http://codepen.io/cuongtran3001/pen/QwXMQe>

### Difficulty:

Add event for element: shapes, text or image...???

Scroll page???



# Canvas tips

## ❖ Performance

Because of the bitmap operation, just used `clearRect(x, y, width, height)` for clear and redraw the changed pixels



# Canvas tips

## ❖ State Stack

Should use `save()` and `restore()` to apply the transformation to previous state to make next shape is not affected



# Canvas tips

## ❖ Anti-Aliasing

Round to integer values or offset when drawing fills or strokes

`Math.floor()` or `Math.round()`



# Canvas tips

## ❖ Layered canvases

Use multiple layered canvases for complex scenes



# Canvas tips

## ❖ shadowBlur

Avoid shadowBlur

```
context.shadowOffsetX = 5;  
context.shadowOffsetY = 5;  
context.shadowBlur = 4;  
context.shadowColor = 'rgba(255, 0, 0, 0.5)';
```



# Canvas tips

## ❖ clear the canvas

```
canvas.width = canvas.width;
```

<http://simonsarris.com/blog/346-how-you-clear-your-canvas-matters>



# Canvas tips

## ❖ **requestAnimationFrame**

Also known as:

- ✓ mozRequestAnimationFrame
- ✓ webkitRequestAnimationFrame
- ✓ msRequestAnimationFrame
- ✓ oRequestAnimationFrame

It is the recommended way of implementing interactive applications in the browser

```
function update() {  
    requestAnimationFrame(update);  
    //TODO: update canvas  
}  
update();
```



# Canvas tips

## ❖ Temporary canvas

Using temporary canvas to load the off-screen images

```
var tmpCanvas = document.createElement('canvas'),  
    tmpCtx = tmpCanvas.getContext('2d'),  
    img = document.createElement('img');  
  
img.onload = function() {  
    tmpCtx.drawImage(thumbImg, 0, 0, 200, 200);  
};  
  
img.src = 'image.png';
```



# Canvas tips

## ❖ Canvas reference

Access canvas via context

```
var canvas = document.createElement('myCanvas');
```

```
var context = canvas.getContext('2d');
```

canvas vs context.canvas ???



# Canvas frameworks

- ✓ <http://paperjs.org/>
- ✓ <http://fabricjs.com/>
- ✓ [www.createjs.com](http://www.createjs.com)
- ✓ <http://raphaeljs.com/>



# Canvas frameworks

- ✓ Document and examples/showcases
- ✓ Support necessary functionality: draw shapes, mask, interaction, animation, images, video...
- ✓ Hit test and calculate



# References

- ❖ <http://www.html5canvastutorials.com/>
- ❖ <http://cheatsheetworld.com/programming/html5-canvas-cheat-sheet/>
- ❖ <https://www.chromeexperiments.com/>
- ❖ <http://tutorials.jenkov.com/html5-canvas/index.html>
- ❖ <http://www.html5rocks.com/en/tutorials/canvas/performance/>



**Thank You**