JavaOne℠

Ajax Performance Tuning and Best Practice

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Agenda

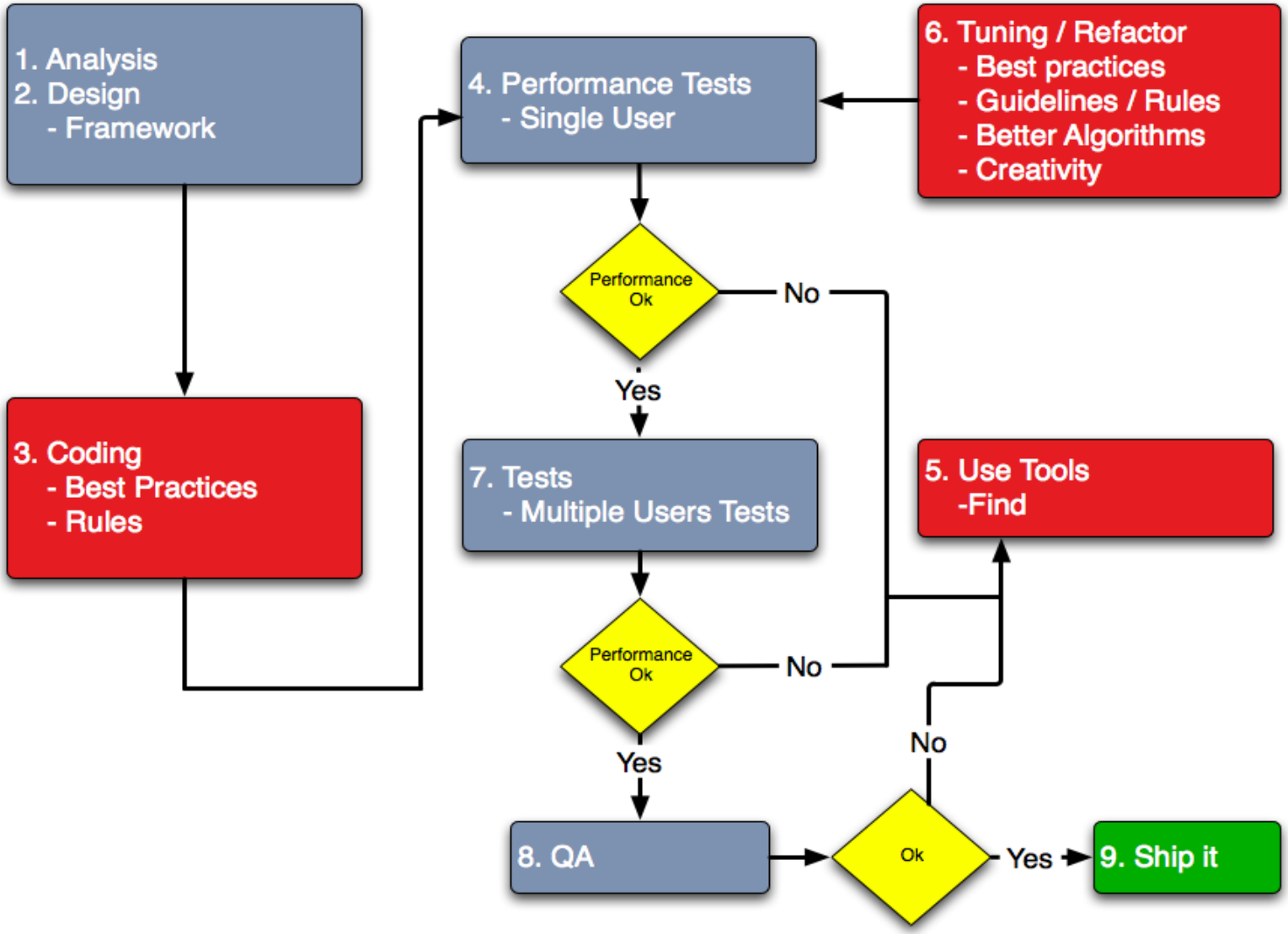
- Optimization Strategies and Process
- General Coding Best Practices
- Measuring Performance
- Performance Optimization Recommendations
- Frameworks and Case Study
- Summary and Resources

Optimization Strategies and Process

Performance Challenges

- Not much control over the deployment environment
  - Load balancers, choice of application servers, server configuration
- Browser incompatibilities
- Large development teams
- Complex projects dependencies
- Application spans client and server
- Hard to diagnose and debug

Development/Optimization Process



General Coding Best Practices

JavaScript Best Practices

- Provide a clean separation of content, CSS, and JavaScript
- De-reference unused objects
- Think Asynchronous
- Working with Objects

Separation of content, CSS, and JavaScript

- A rich web application user interface is made up of
  - content (HTML/XHTML)
  - styles (CSS)
  - JavaScript
- Place CSS and JavaScript code in separate files
  - Optimize the bandwidth usage by having CSS and JavaScript file loaded only once
- Variables to decide using external or inline
  - multiple page views per user per session
  - many of pages re-use the same scripts and stylesheets

Inline or External

Inline JavaScript and CSS in front page, but dynamically download the external files after the page has finished loading

```
<style>#Styles</style>

<script type="text/javascript">
// JavaScript logic
<script>
<body>The quick brown fox...</body>
```

For multiple views per user, and reusable scripts/css:

```
<link rel="stylesheet" type="text/css"
  href="cart.css">

<body>The quick brown fox...</body>

<script type="text/javascript" src="cart.js">
```

De-reference unused objects

```
//delete objects
var foo='Delete Me'; //do something with foo
delete foo;

// detach listeners (IE / W3C difference)
someElement.removeEventListener(type, fn,
false); // W3C
someElement.detachEvent(type,fn); // IE

// remove DOM elements
someElement.parentNode.removeChild(someElement);

// page onunload
window.onunload= function() { /*do something*/}
```

Think Asynchronous

- Prevents browsers from halting execution of a code block that might take a long time
- Semi-Asynchronous – Like an Ajax request
  - Use a callback
- use setTimeout() in conjunction with a callback

```
function longProcess({ name : value}, callback) {
    // do what needs to be done
    callback.apply({});
}

setTimeout(function() {
    longProcess({ name : 'greg'}, function() {
    alert('all done');
      }
}, 0);
```

Working with Objects (I)

```
var i;
for (i = 0; i < divs.length; i += 1) {
    divs[i].style.color = "black";
    divs[i].style.border = thickness + 'px solid blue';
    divs[i].style.backgroundColor = "white";
}
```

Bad

```
var border = thickness + 'px solid blue';
var nrDivs = divs.length;
var ds, i;
for (i = 0; i < nrDivs; i += 1) {
    ds = divs[i].style;
    ds.color = "black";
    ds.border = border;
    ds.backgroundColor = "white";
}
```

Good

Working with Objects (II)
String Concatenation

```
window.tablebuilder = function() {
    var _header, _rows = [];
    this.setHeader = function(_headers) {
        _header = "<tr><th>" +
_headers.join("</th><th>") + "</tr>";
    };
    this.addRow = function(_cells) {
        _rows.push("<tr><td>" +
_cells.join("</td><td>") + "</td></tr>");
    };
    this.toString = function() {
        return  "<table>" + _header +
          "<tbody>" + _rows.join("") + "</tbody>" +
          "</table>";
    };
};
```

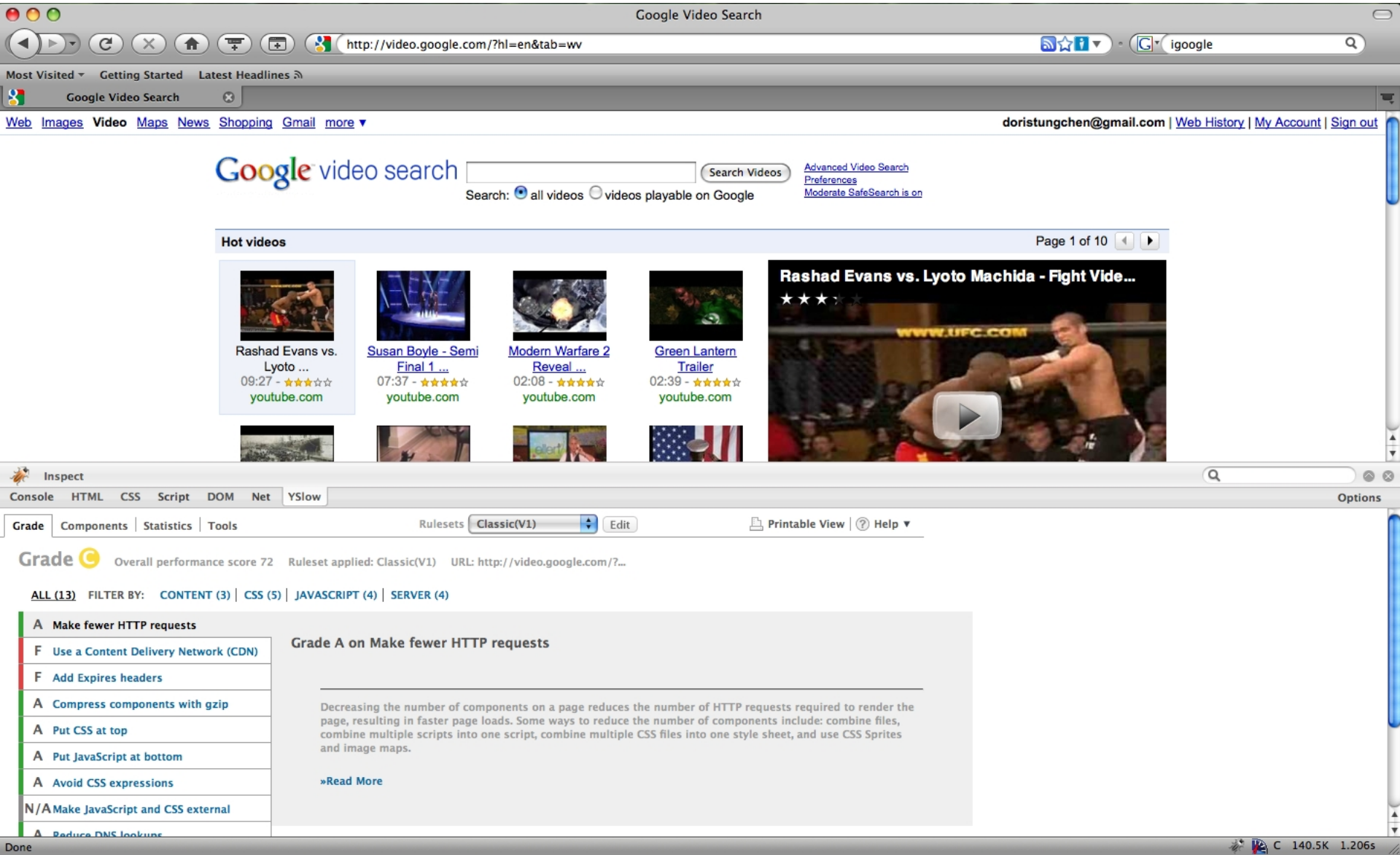
Demo

Measuring Performance

Manual Timing Method

```
function myFunctionToTest() {
var start = new Date().getTime();
... // body of the function
var totalTime = new Date().getTime() - start;
}
```

Tool: Firebug and YSlow



YSlow

- Performance lint tool
  - Analyzes and measures web page performance
    - All components on the page, including components dynamically created by JavaScript
  - Offers suggestion for improvement
- Scores web pages for each rule
- Firefox add-on integrated with Firebug
- Open source license
- http://developer.yahoo.com/yslow

Demo

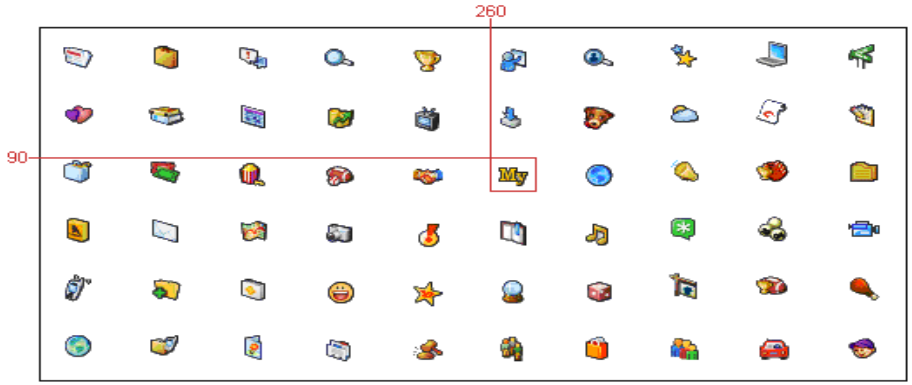
Performance Optimization Recommendations

Recommendations

- Make fewer HTTP requests
- Put stylesheets at the top
- Move scripts to the bottom
- Minify JS
- Defer Loading Resources
- Add an Expires header
- Configure Etags
- Gzip Resources

Make fewer HTTP requests (content)

- Simply page design
- CSS sprites (best for components)
  - http://alistapart.com/articles/sprites



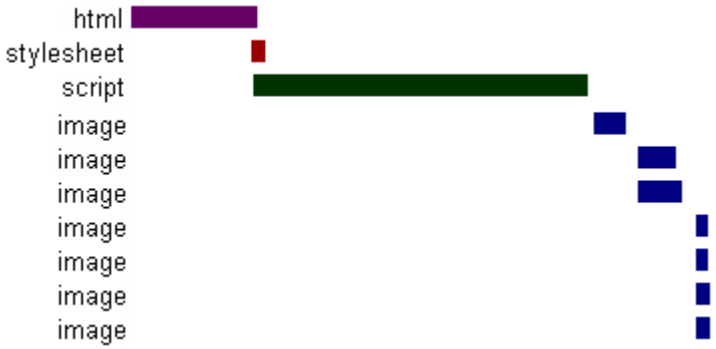
- Combined scripts, combined stylesheets
- combining six scripts into one eliminates five HTTP requests
- Make JS and CSS external

Put stylesheets at the top (css)

- Want the browser to display whatever content it has as soon as possible
  - Avoids flash of unstyled content or blank white screen
- CSS at the bottom:
  - prohibits progressive rendering in many browsers, including Internet Explorer
  - browsers block rendering to avoid having to redraw elements of the page if their styles change
- Solution: put stylesheets in document head
  - allows the page to render progressively

Move scripts to the bottom (javascript)

- Scripts block parallel downloads across all hostnames



- Scripts block rendering of everything below them in the page
- Script *defer* attribute is not a solution
  - IE only, not supported in other browsers

Minify JavaScript (javascript, css)

- Minification is the practice of :
  - removing comments
  - removing white space characters (space, newline, and tab)
  - condensing variable names (optional)
- Popular tools for minifying JavaScript code
  - JSMin http://crockford.com/javascript/jsmin
  - YUI Compressor: can also minify CSS
  - Dean Edwards Packer
- Minifying both external and inlined scripts and styles
  - minifying will still reduce the size by 5% or more even after you gzip

Defer Loading Resources

- If you have a large library or set of libraries, you don't need to load everything when a page is loaded
- Resources can be html, scripts, or css
  - Use Ajax Request
  - Add script/css links using DOM

Example: Defer Loading Resources

```
<script>
var deferredLibs = [ '/resources/jquery.js' ,
'/resources/base.js'];
addLibraries(libs : deferredLibs,
              function(args) {
                 // initialize components
               });
</script>
```

Example: Defer Loading Resources (cont.)

```
function addLibraries( libs, callback) {
 for(var i=0; i < libs.length; i+=1) {
    var head =
document.getElementsByTagName("head")[0];
    var s = document.createElement("script");
    // add callback tracking logic
    s.src = libs[i];
    head.appendChild(s);
 }
}
```

Add an Expires header (server)

- Expires response header tells the client how long a component can be cached
  - Browsers use a cache to reduce the number and size of HTTP requests
  - Avoids unnecessary subsequent HTTP requests
  - Expires headers most often used with images, but should be used for scripts, stylesheets, and Flash
  - For static components:set a far future Expires header
  - For dynamic components: use an appropriate Cache-Control header to help the browser with conditional requests

How to Implement

- May configure on the server conf file
- Implement in a servlet or a serlvet filter

```
long maxAge = 1209600L;
SimpleDateFormat sdf =
 new SimpleDateFormat("EEE, d MMM yyyy HH:mm:ss  z");
long created = System.currentTimeMillis();
Date expiredate = new Date(created + (maxAge* 1000) );
sdf.setTimeZone (TimeZone.getTimeZone("GMT"));
String expires = sdf.format(expiredate);
-----------------------------------------------------
resp.setHeader("Expires", expires);
resp.setHeader("Cache-Control", "public,max-age=" +
maxAge);
```

Configure Etags (server)

- Etags: validate entities, unique identifier returned in response

```
ETag: "10c24bc-4ab-457e1c1f"
```

- Used in conditional GET requests

```
GET /i/yahoo.gif HTTP/1.1
Host: us.yimg.com
If-Modified-Since: Tue, 12 Dec 2008 03:03:59 GMT
If-None-Match: "10c24bc-4ab-457e1c1f"
HTTP/1.1 304 Not Modified
```

- If ETag doesn't match, can't send 304

Etag Implementation

```
String etag = cr.getContentHash();
// get the If-None-Match header
String ifNoneMatch = req.getHeader("If-None-Match");
if (etag != null &&
    ifNoneMatch != null &&
    ifNoneMatch.equals(etag)) {

  resp.setStatus(HttpServletResponse.SC_NOT_MODIFIED);

}
if (etag != null) {
  resp.setHeader("ETag", etag);
}
```

Gzip components (server)

- you can affect users' download times
  - Gzip supported in more browsers
  - Gzip generally reduces the response size by 70%
    - Not just for html, gzip all scripts, stylesheets, XML, JSON but **not** images, PDF

      Content-Encoding: gzip
- Gzip configuration
  - HTTP request

    Accept-Encoding: gzip, **deflate**
  - HTTP response

    Content-Encoding: gzip

How to Implement gzip?

```
boolean canGzip = false;
Enumeration<String> hnum = req.getHeaders("Accept -Encoding");
while (hnum.hasMoreElements()) {
    String acceptType = hnum.nextElement();
    if (acceptType != null && acceptType.indexOf("gzip") != -1) {
        canGzip = true;
        break;
    }
}
if (canGzip ) {
    resp.setHeader("Vary", "Accept-Encoding");
    resp.setHeader("Content-Encoding", "gzip");
    OutputStream out = resp.getOutputStream();
    OutputStream bis = // get gzip outputstream of content
    IOUtil.writeBinaryResource(bis, out);
}
```

Frameworks and Case Study

Protorabbit

- A CSS based templating and Ajax optimization framework
  - Browsers and JavaScript neutral
- Out of the box uses the BluePrint CSS framework
  - You can easily substitute for extend the underlying framework
- Defined in JSON format
  - HTML based template that has properties that can be substituted with strings or the contents of a file
  - specify the underlying HTML template, cache time for the template, scripts, CSS links, properties
  - may extend any number of other templates with the child properties inheriting from their ancestors

Protorabbit (cont.)

- Protorabbit Engine will sets
  - correct headers, combines CSS and JavaScript assets (if specified)
  - gzips those resources as the page is rendered
  - surrounding final pages are also cached and gzipped for as long as you specify in your template
  - can defer loading of scripts, styles or page fragments
  - Includes HttpClient that can fetch content from external sources
  - Different templates may override the cache times of their parents or just inherit them
- http://wiki.github.com/gmurray/protorabbit

How to get Started?

- Include protorabit jar, and org.json.jar files in WEB-INF/lib directory
- Include the servlet reference, servlet mapping, template references, other parameters in web.xml
- Include the CSS template files (Blueprint CSS or Yahoo Grid template frameworks)
- Include the a JSON template (templates.json)

```
<context-param>
    <description> Template Definitions</description>
    <param-name>prt-templates</param-name>
    <param-value>/WEB-INF/templates.json,/resources/blueprint/blueprint-templates.json
</param-value>
</context-param>
```

Demo

Summary and Resources

Summary

- Performance optimization is an iterative process :
  - Starts with a good architecture and page design
  - Understand the page processing
  - Client coding best practices matters
- Optimization should be measured
- Use optimization recommendations, frameworks and solutions

Resources

- Best practices and Guidelines
  - https://blueprints.dev.java.net/bpcatalog/conventions/javascript-recommendations.html
  - http://developer.yahoo.com/performance/rules.html
- Tool
  - http://developer.yahoo.com/yslow
- Protorabbit
  - http://wiki.github.com/gmurray/protorabbit
- Other Sites
  - http://stevesouders.com/
  - http://javascript.crockford.com/

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Thank You

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