

Google Web Toolkit

Overview and Feature Preview



Silicon Valley Web JUG

June 16, 2009

Fred Sauer
Developer Advocate
fredsa@google.com



Agenda

- What to do about questions?
- How do you pronounce GWT?
- Introduction
- Selecting a language
- Feature tour
- Who's using GWT?
- Compiler, Generator, Linker
- What's new in 2.0, roadmap
- Q&A



Introducing GWT



Google-Web-Toolkit

*"GWT's mission is to **radically improve** the web experience for **users** by **enabling developers** to use existing **Java tools** to build **no-compromise AJAX** for **any modern browser**."*



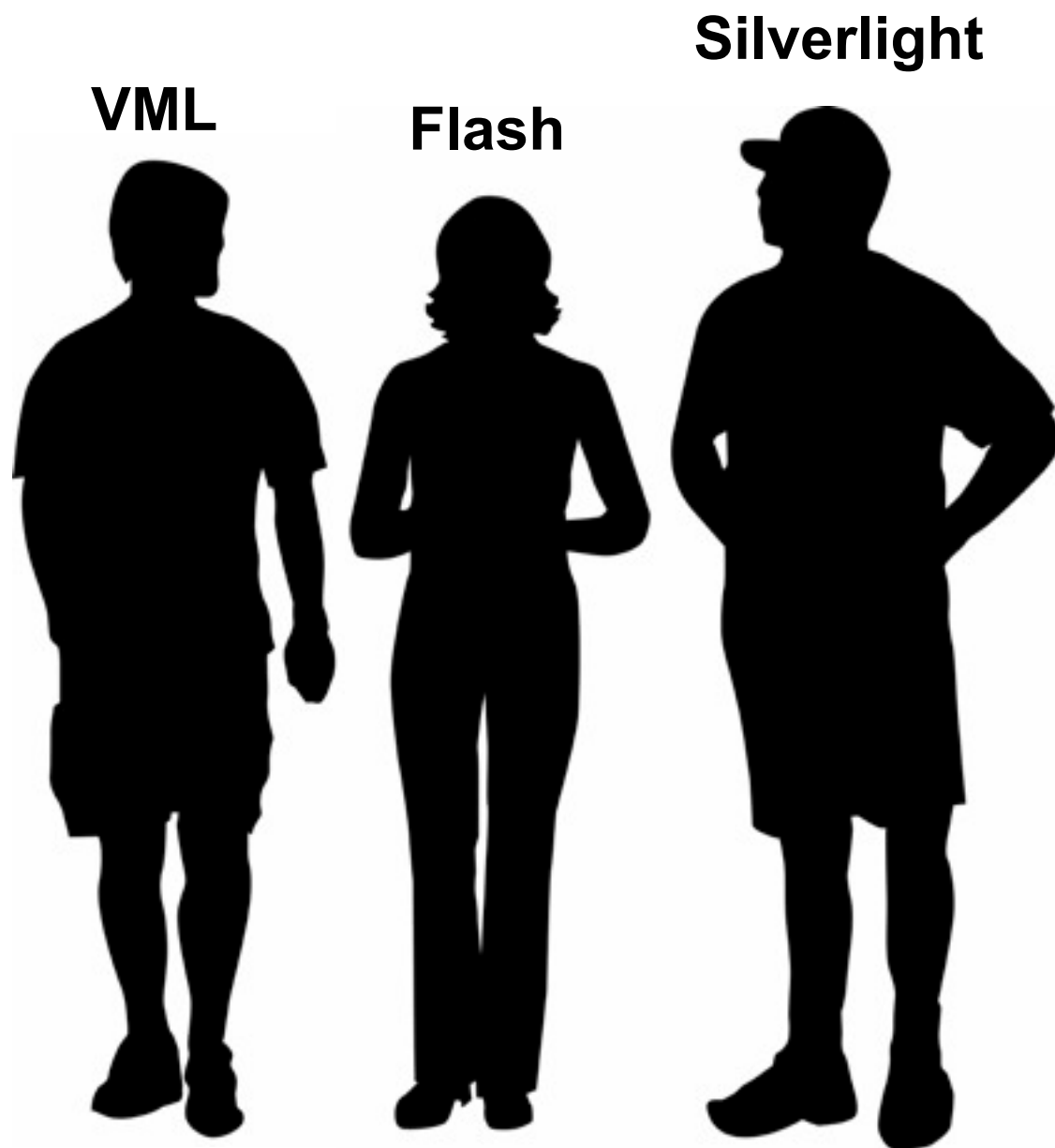
Google-Web-Toolkit

Productivity and Performance

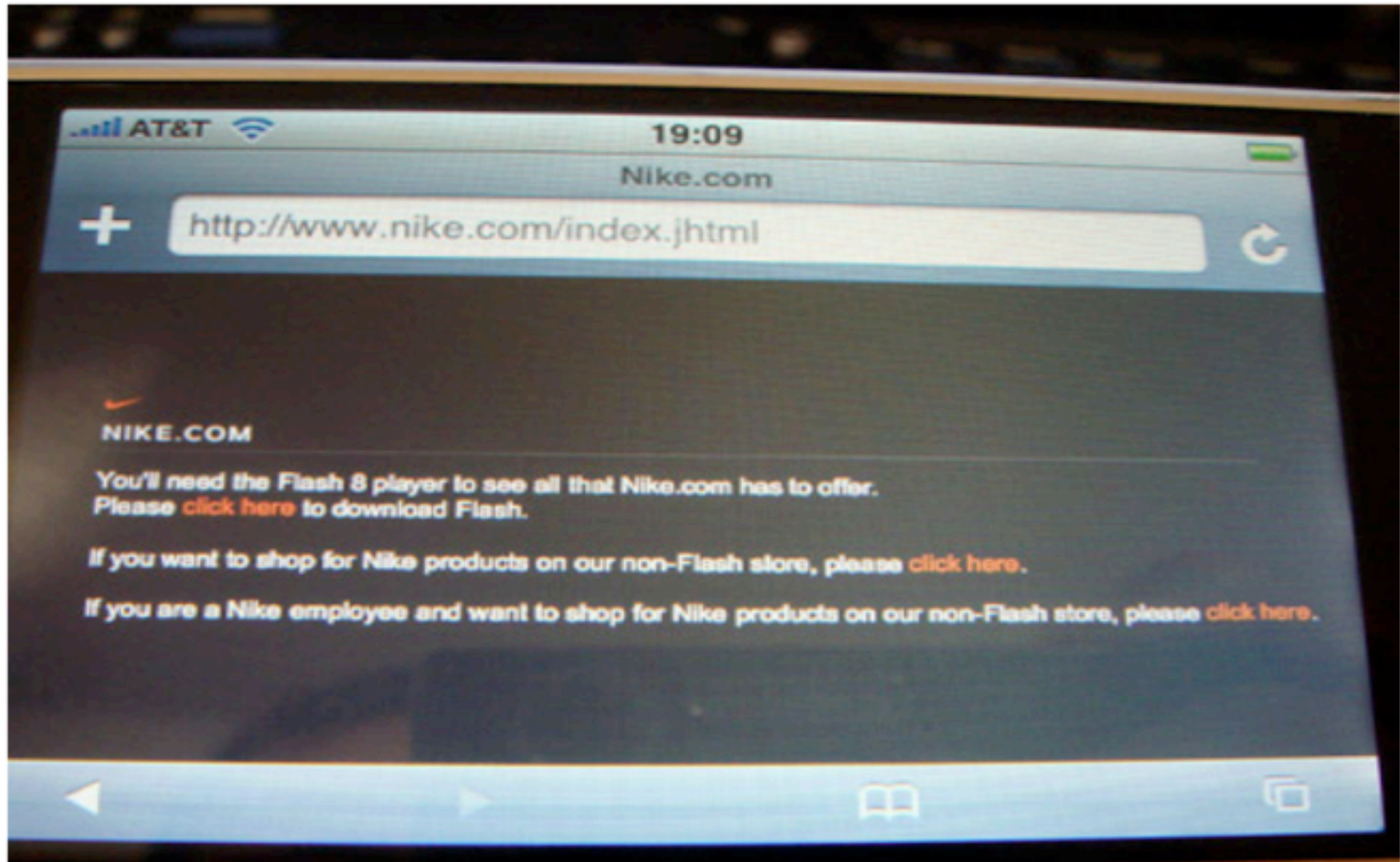
- *Productivity for you*
- *Performance for your users*



No plugins required

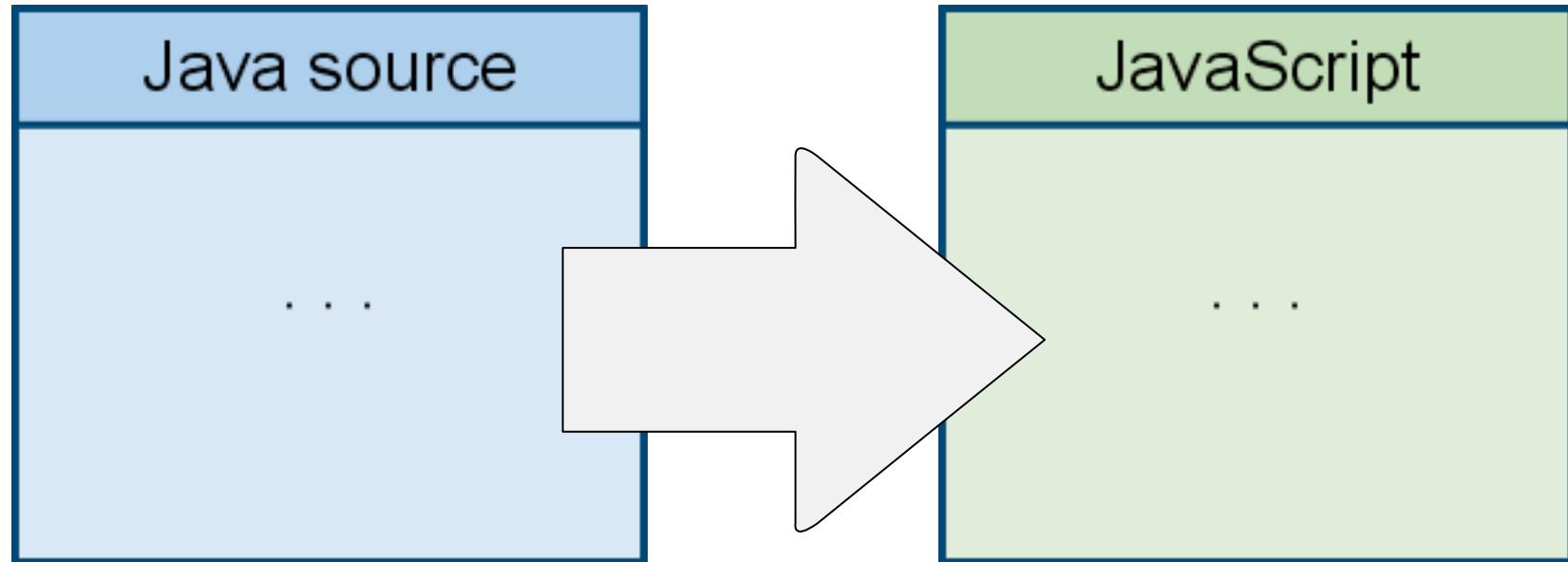


What we don't want



Google™

An idea

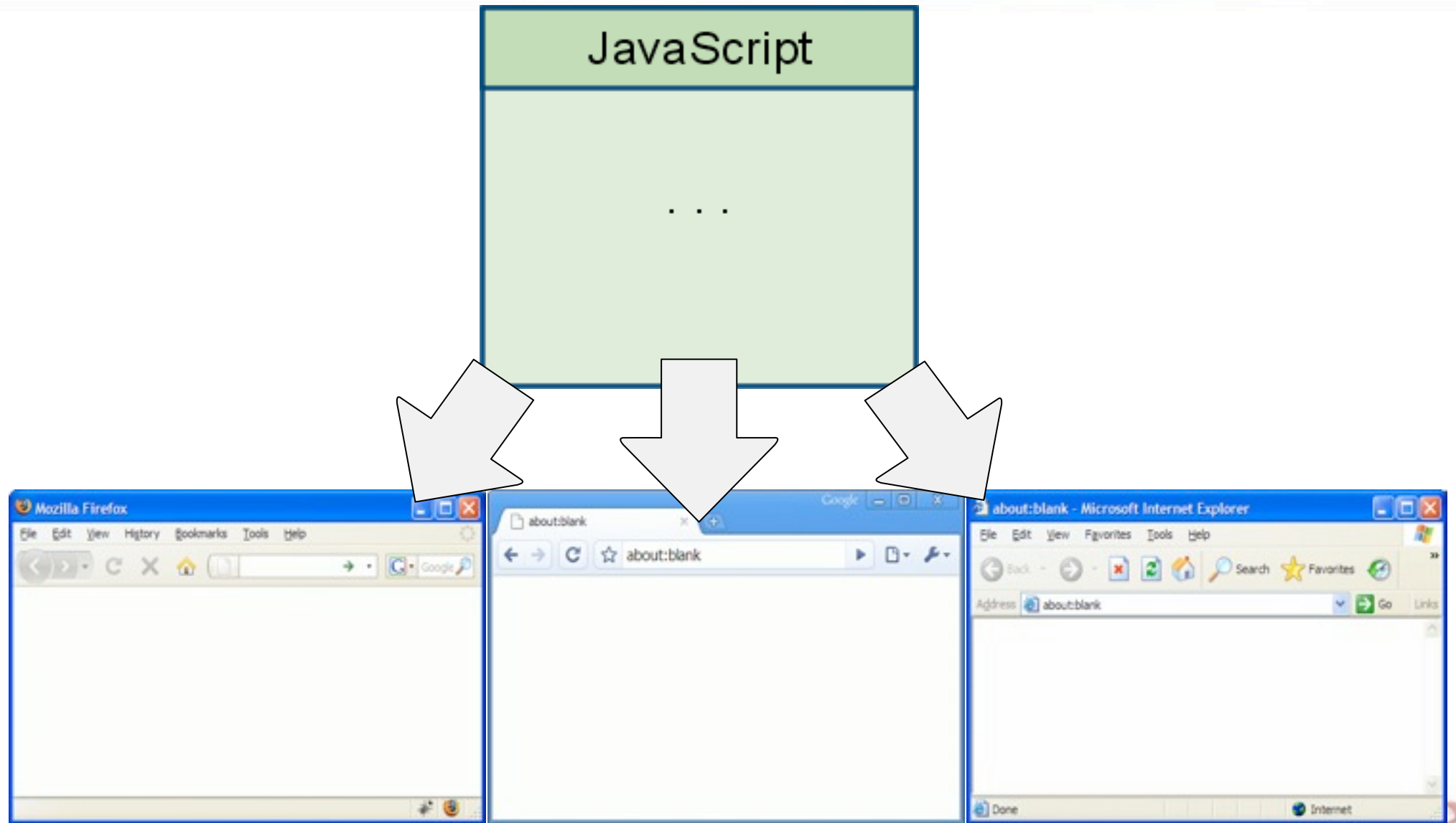


Productivity for you

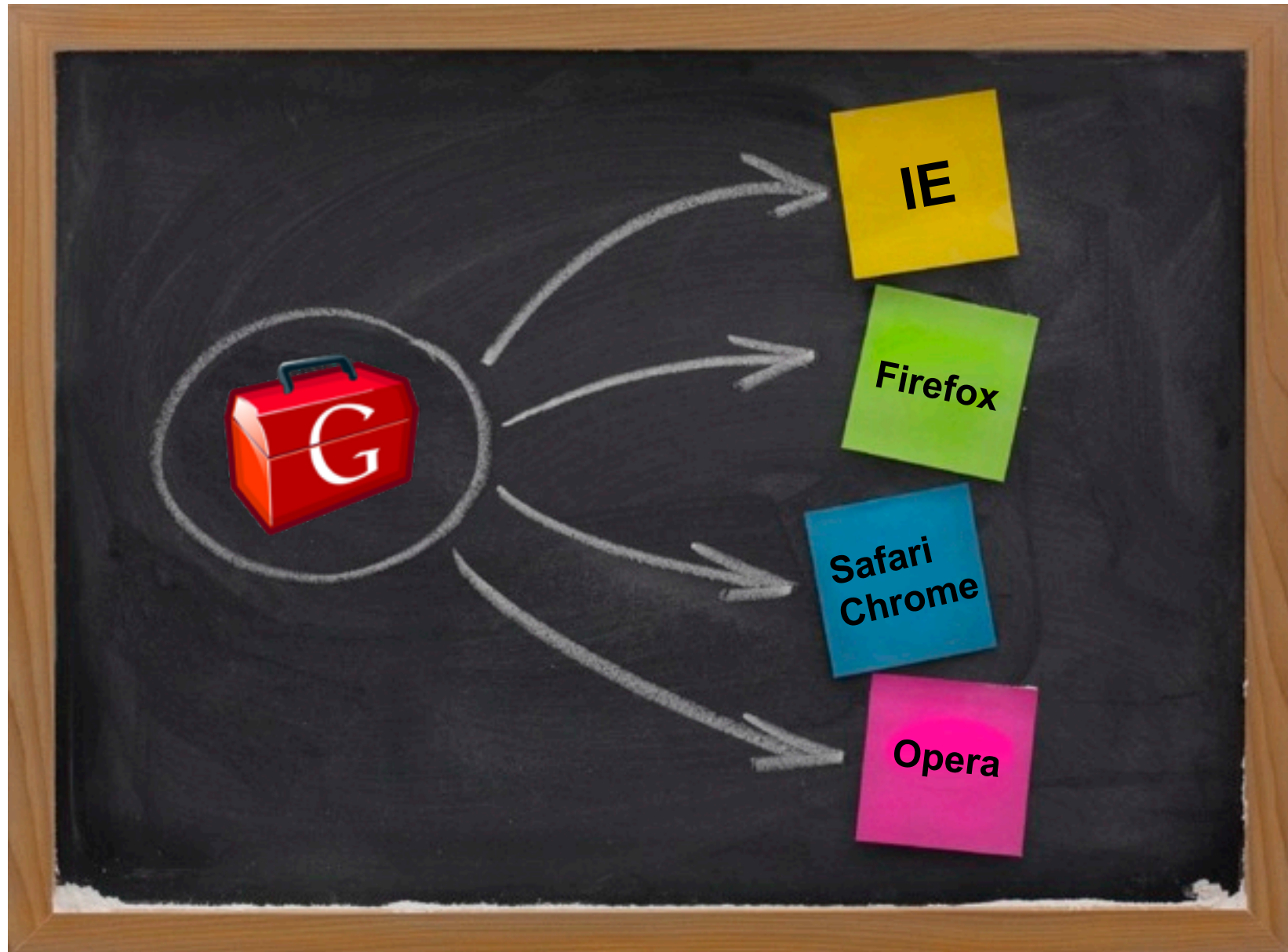
Performance for your users



HTML, JavaScript, CSS



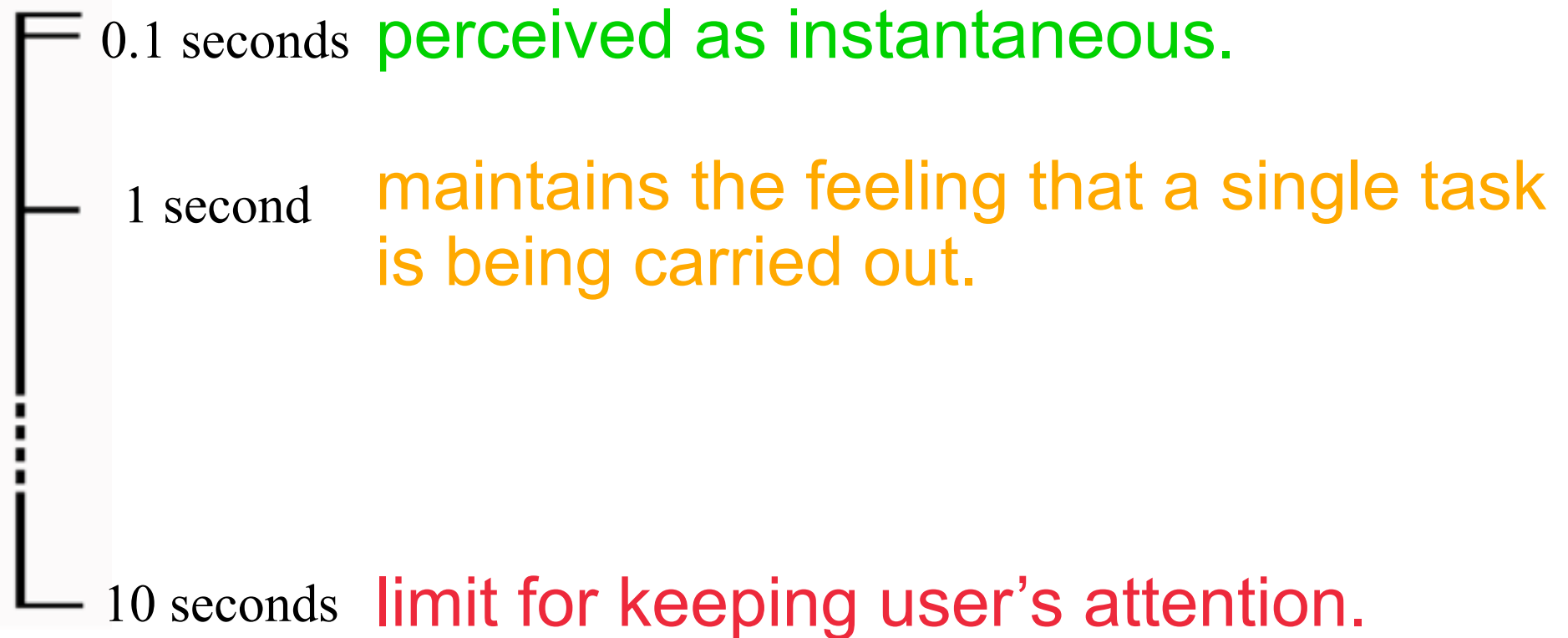
GWT Browser-Proofs Your JavaScript Code...



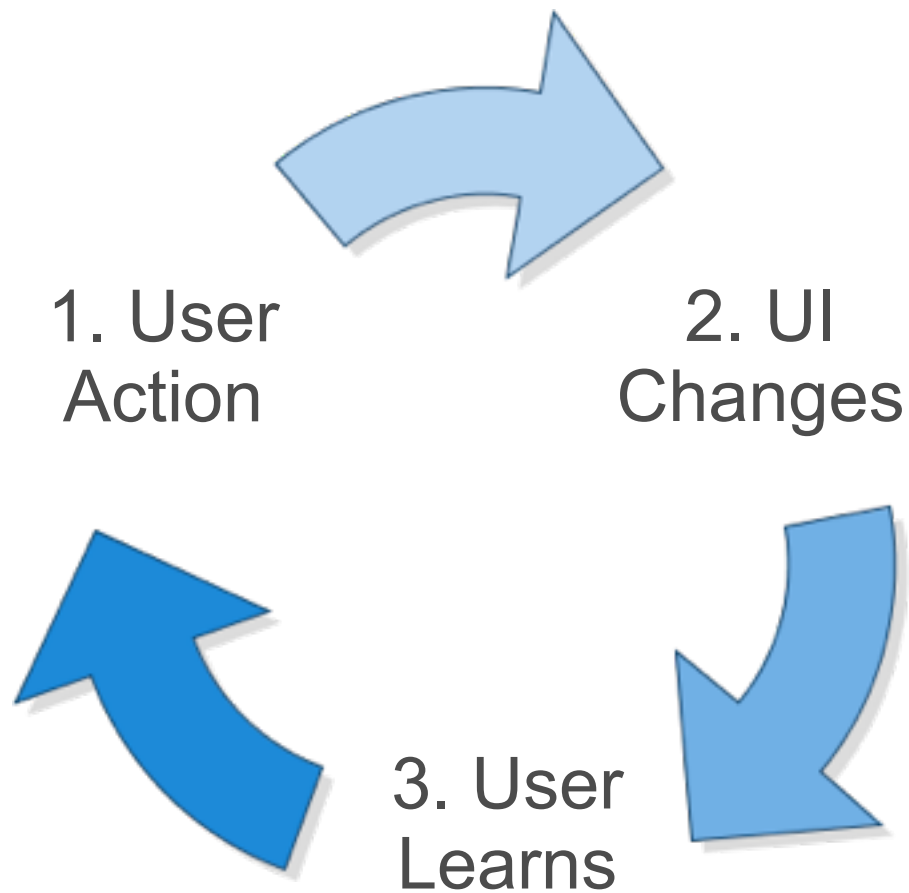
A More Powerful Web, *Made Easier*



Speed matters



Another reason speed matters



- Each cycle provides feedback
- Each cycle is a learning opportunity
- A faster UI => shorter learning curve

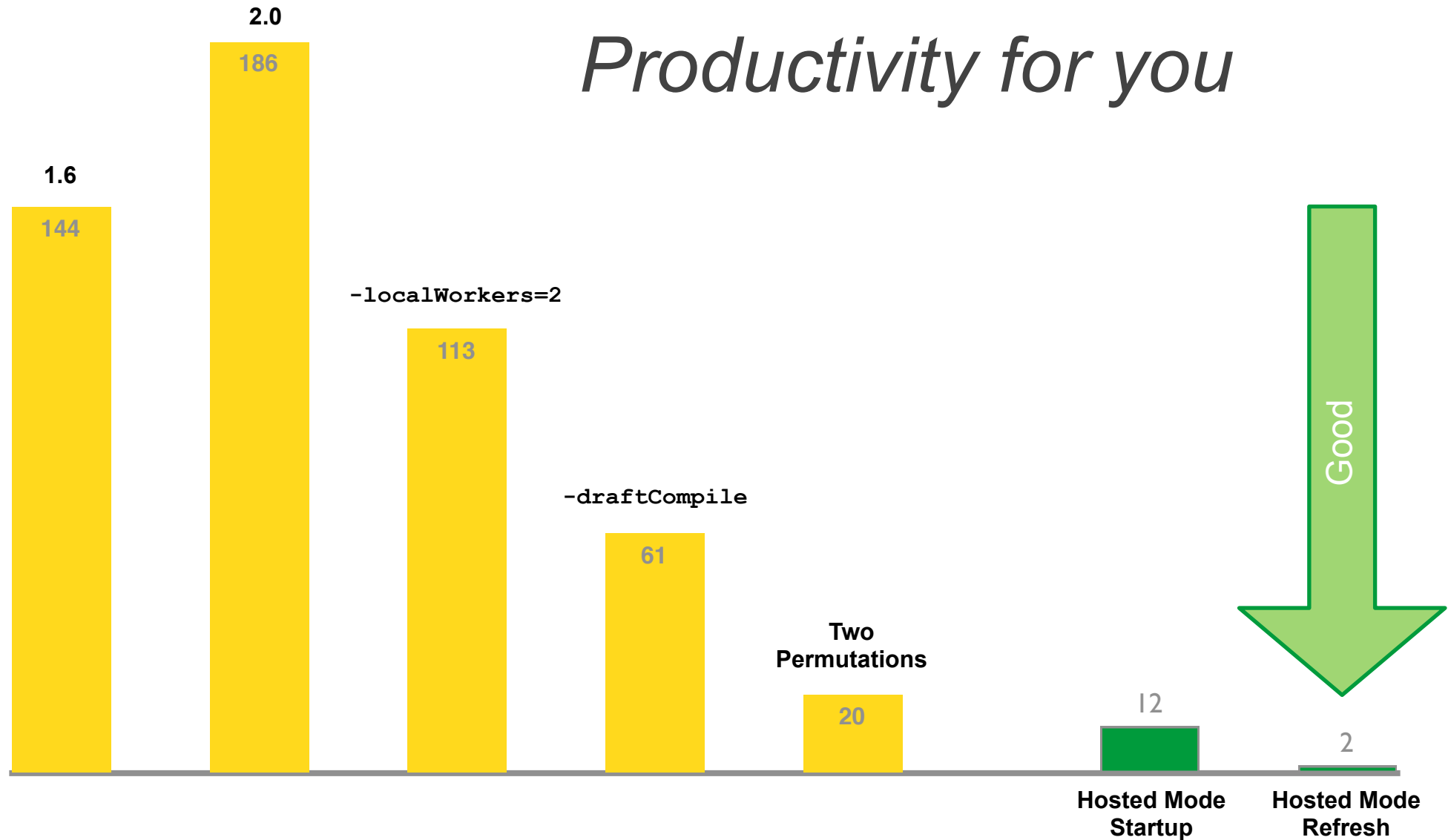
Performance for your users

Google Web Toolkit



Speeding up Compilation

Productivity for you

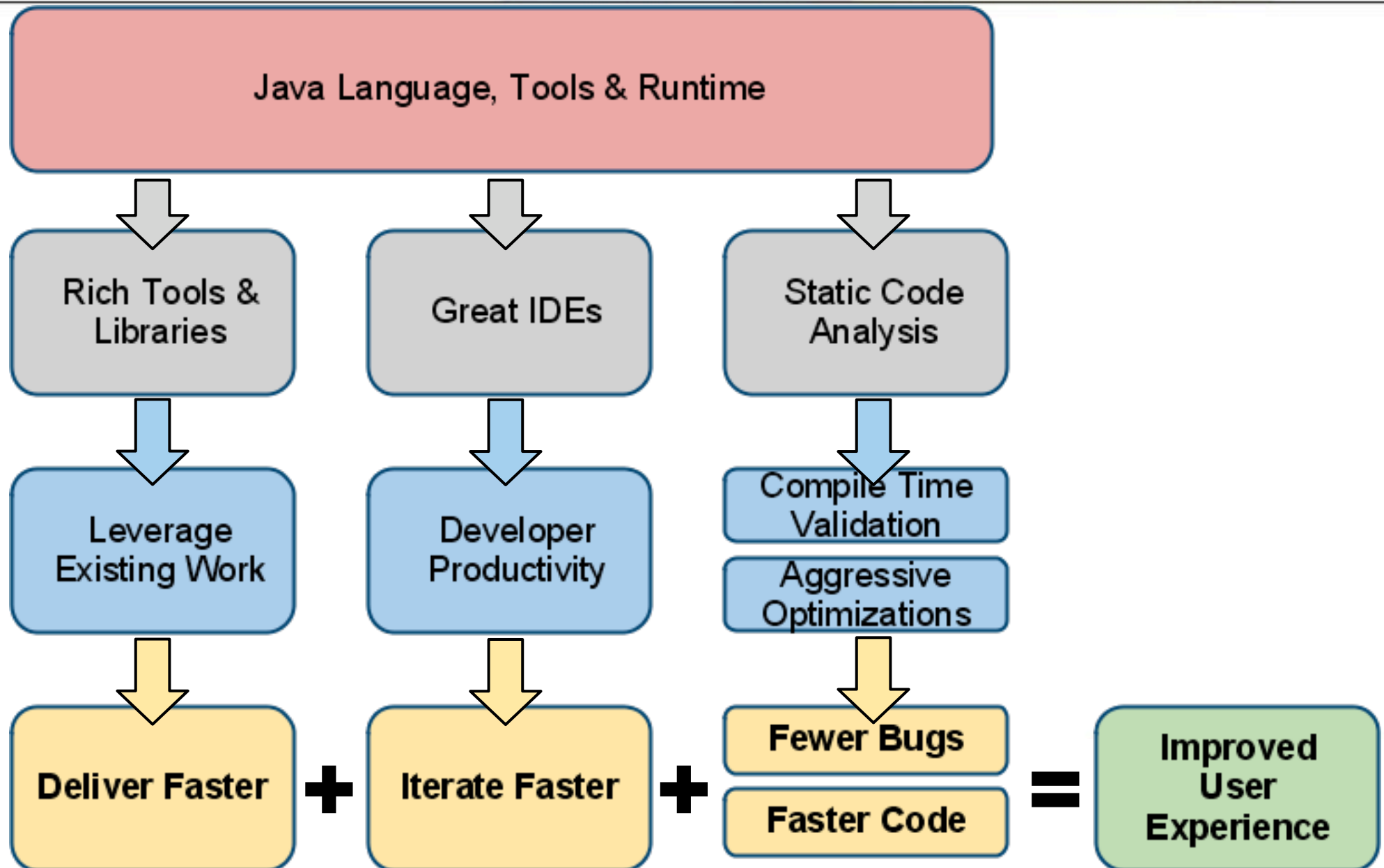


Times gathered using Showcase on a 2-core MacBook Pro

Selecting a language



Rich ecosystem of tools and libraries



Code completion and javadoc

```
26  /**
27   * This is the entry point method.
28   */
29  public void onModuleLoad() {
30      Button button = new Button();
31      button.set
32
33      RootPanel.
34  }
35  }
36
```

- `setAccessKey(char key) : void - FocusWidget`
- `setEnabled(boolean enabled) : void - FocusWidget`
- `setFocus(boolean focused) : void - FocusWidget`
- `setHeight(String height) : void - UIObject`
- `setHTML(String html) : void - ButtonBase`
- `setPixelSize(int width, int height) : void - UIObject`
- `setSize(String width, String height) : void - UIObject`
- `setStyleName(String style) : void - UIObject`
- `setStylePrimaryName(String style) : void - UIObject`
- `setTabIndex(int index) : void - FocusWidget`
- `setText(String text) : void - ButtonBase`
- `setTitle(String title) : void - UIObject`
- `setVisible(boolean visible) : void - UIObject`
- `setWidth(String width) : void - UIObject`
- `setVisible(Element elem, boolean visible) : void - UIObject`

Press 'Ctrl+Space' to show Template Proposals

Clears all of the object's style names and sets it to the given style. You should normally use [setStylePrimaryName\(String\)](#) unless you wish to explicitly remove all existing styles.

See Also:
[setStylePrimaryName\(String\)](#)

Parameters:
style the new style name

Press 'Tab' from proposal table or click for focus



Can you find the bug?

```
1 // JavaScript function to determine the maximum
2 // value among the provided array elements
3 //
4 // Can you find the bug?
5
6 function getMax(values) {
7
8     var maximum = values[0];
9
10    for ( var i = 1; i < values.length; i++) {
11        if (values[i] > maximum) {
12            maximum = values[i];
13        }
14    }
15
16    return maximum;
17 }
```

Hint: JavaScript is a dynamic language



Catch errors at compile time

```
5  /**
6   * Java method to determine the maximum
7   * value among the provided array elements
8   *
9   * Our IDE already found the bug
10  */
11  public int getMax(int[] values) {
12
13      int maximum = values[0];
14
15      for (int i = 1; i < values.length; i++) {
16          if (values[i] > maximum) {
17              maxinum = values[i];
18          }
19      }
20
21      return maximum;
22  }
```

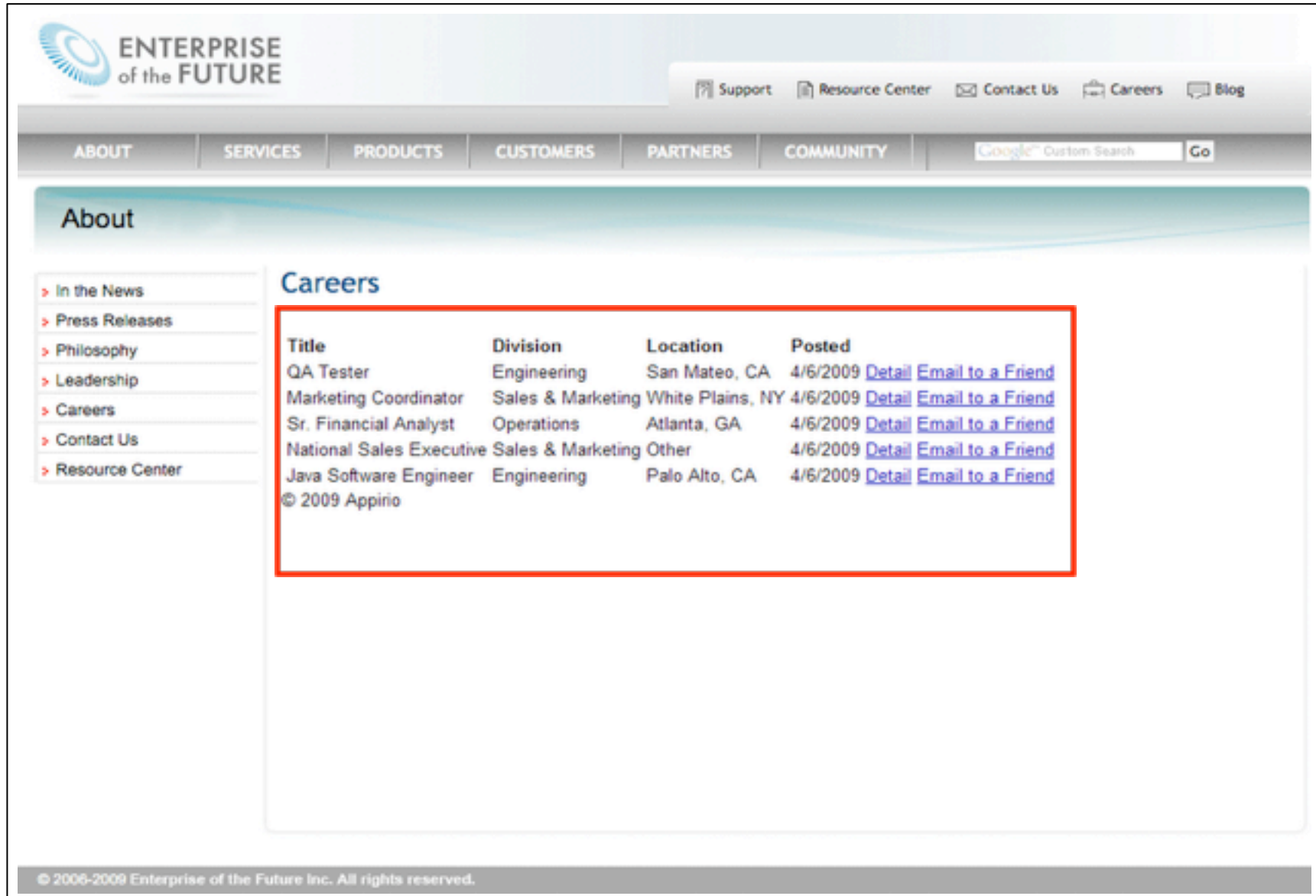
Java is a static language



Feature tour



Site integration options



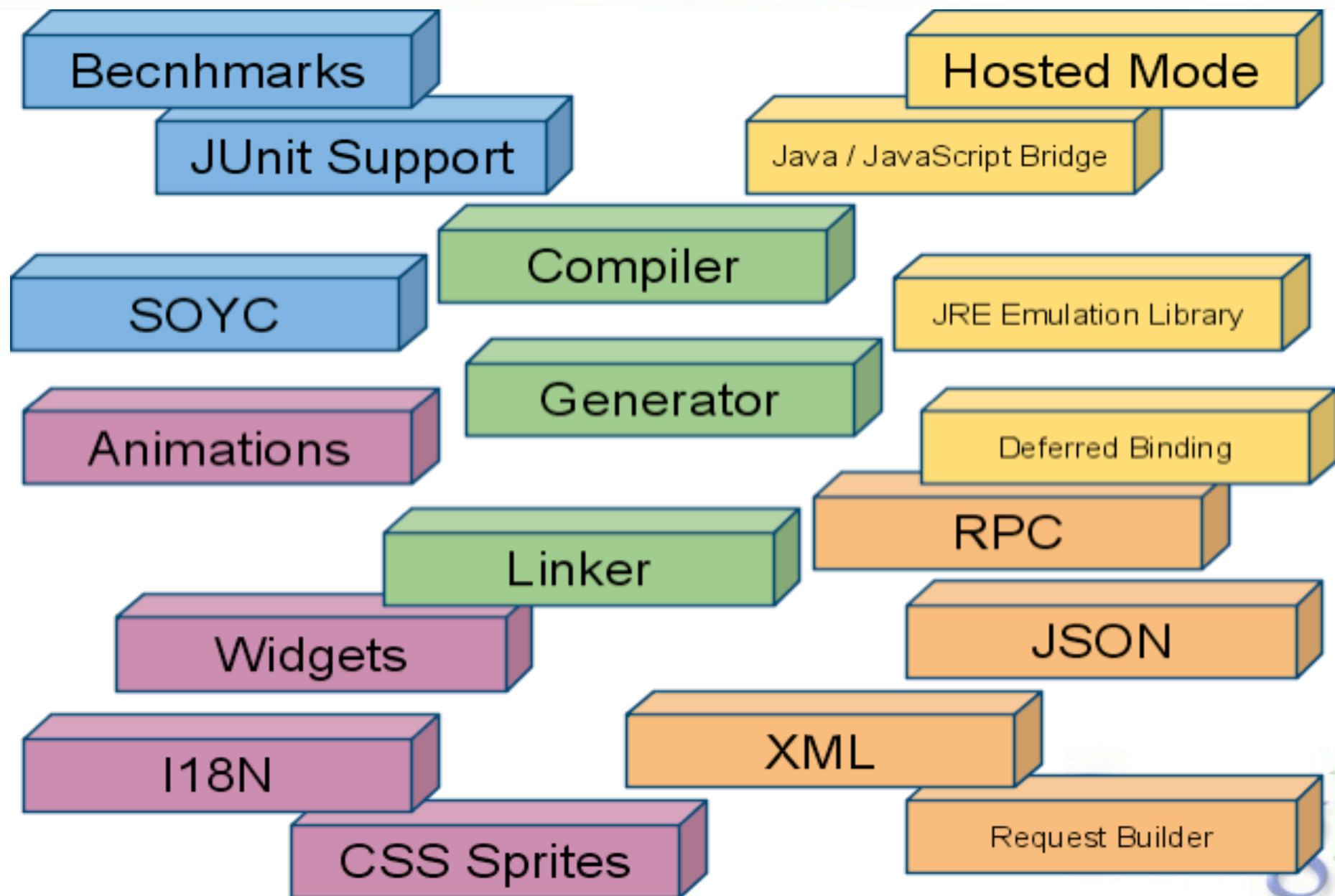
The screenshot shows the 'Enterprise of the Future' website. The header includes the company logo and navigation links: Support, Resource Center, Contact Us, Careers, and Blog. Below the header is a main navigation bar with links to ABOUT, SERVICES, PRODUCTS, CUSTOMERS, PARTNERS, and COMMUNITY, along with a Google Custom Search bar. The 'About' section is active, displaying a sidebar with links to In the News, Press Releases, Philosophy, Leadership, Careers, Contact Us, and Resource Center. The main content area features a 'Careers' section with a table of job openings. The table has four columns: Title, Division, Location, and Posted. Each row includes a 'Detail' link and an 'Email to a Friend' link. The footer contains the copyright notice: © 2006-2009 Enterprise of the Future Inc. All rights reserved.

Title	Division	Location	Posted
QA Tester	Engineering	San Mateo, CA	4/6/2009
Marketing Coordinator	Sales & Marketing	White Plains, NY	4/6/2009
Sr. Financial Analyst	Operations	Atlanta, GA	4/6/2009
National Sales Executive	Sales & Marketing	Other	4/6/2009
Java Software Engineer	Engineering	Palo Alto, CA	4/6/2009

© 2009 Apprio



More than just a compiler



Abstractions

- Widgets
- Events
- DOM (compatibility & convenience)
- History
- Unit Testing
- RPC
- JSON, XML
- JSOs - JavaScript Overlay types
- Gears, GViz, Maps, ...

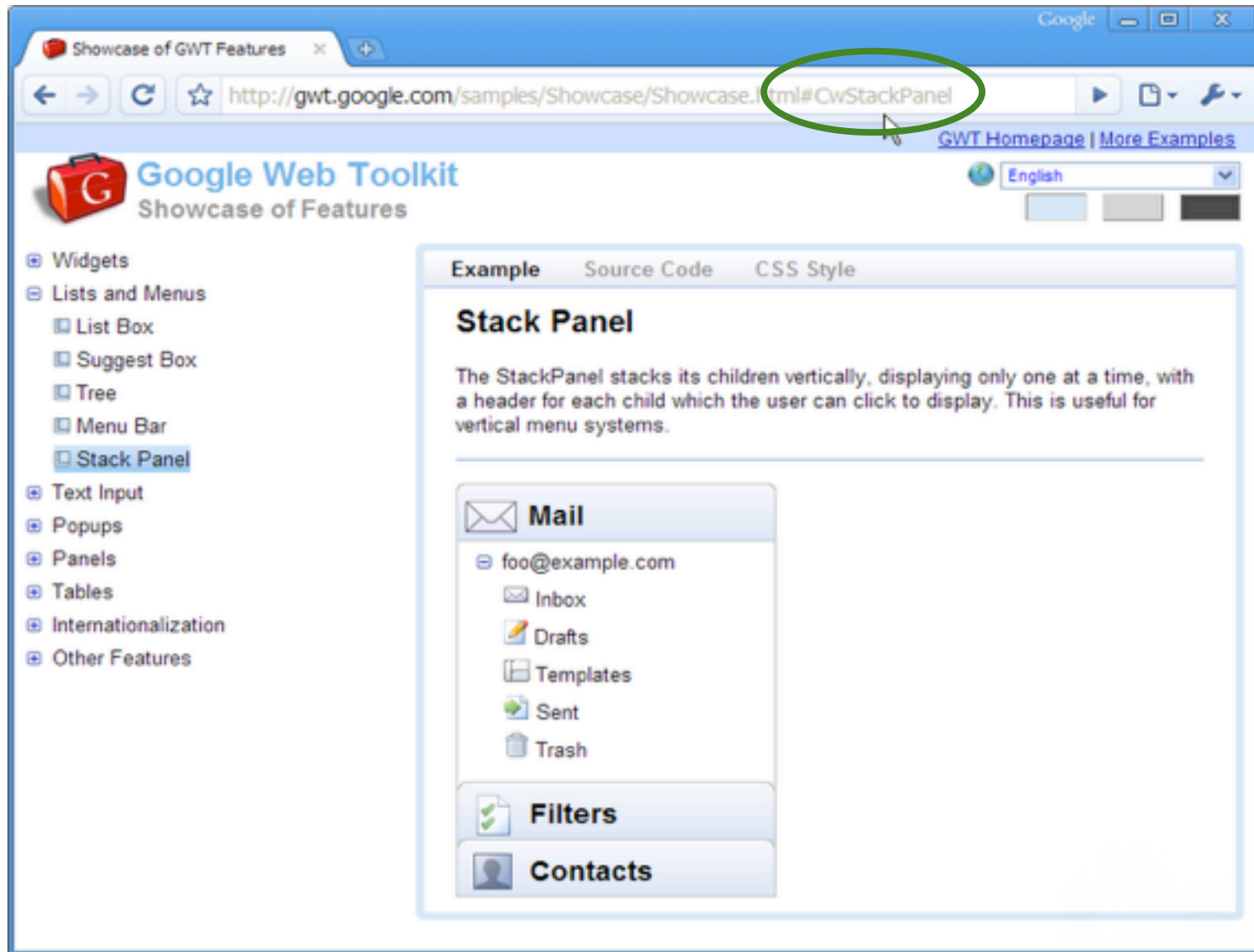


Event handling

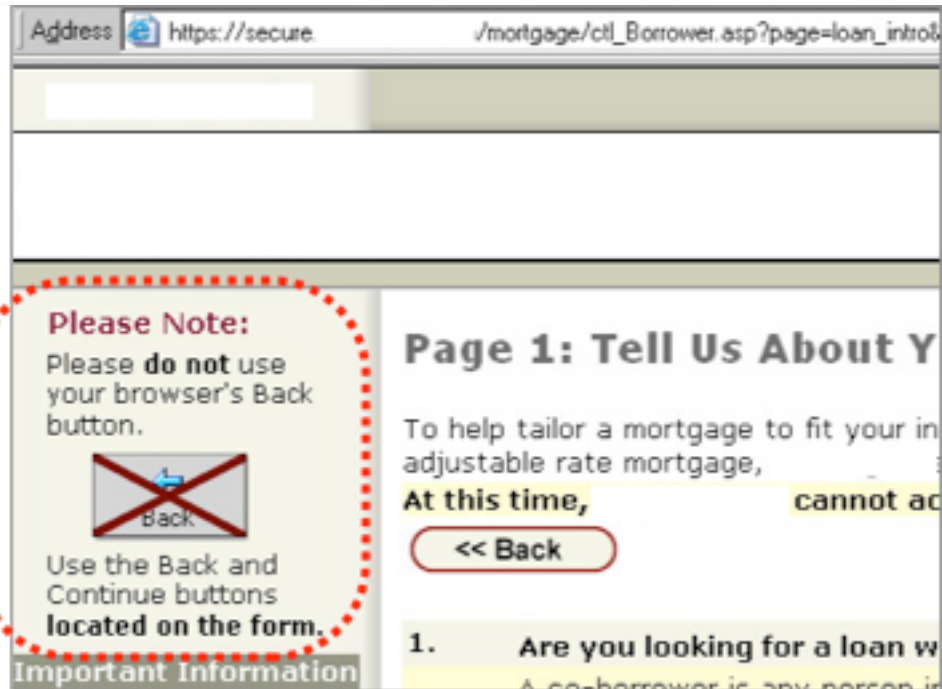
```
Button button = new Button("Click me");  
  
button.addClickListener(new ClickHandler() {  
    public void onClick(ClickEvent event) {  
        Window.alert("Hello, world.");  
    }  
});
```



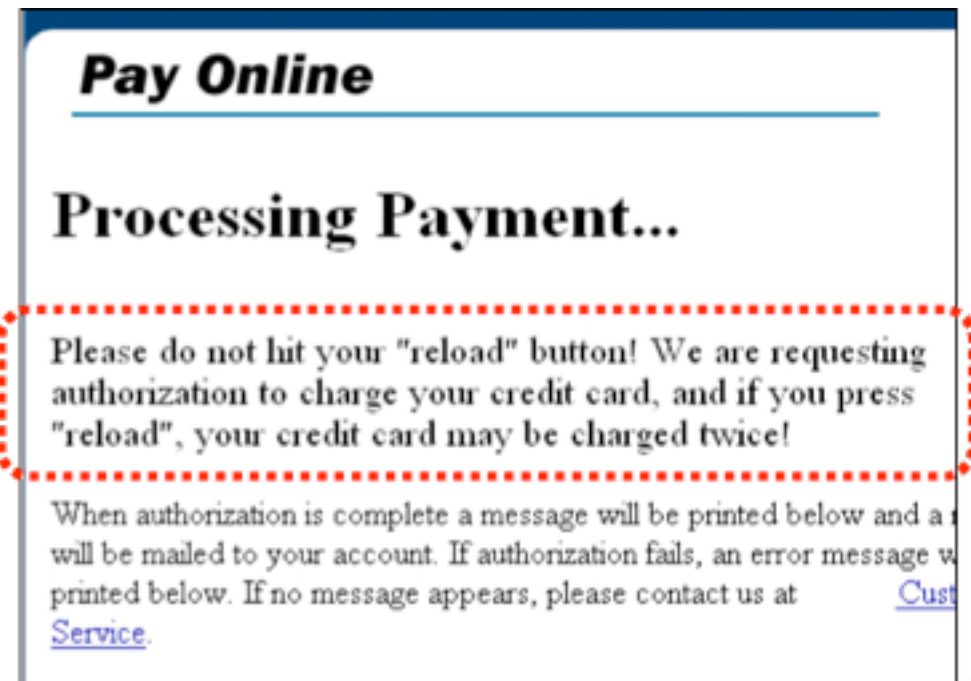
Bookmark application state



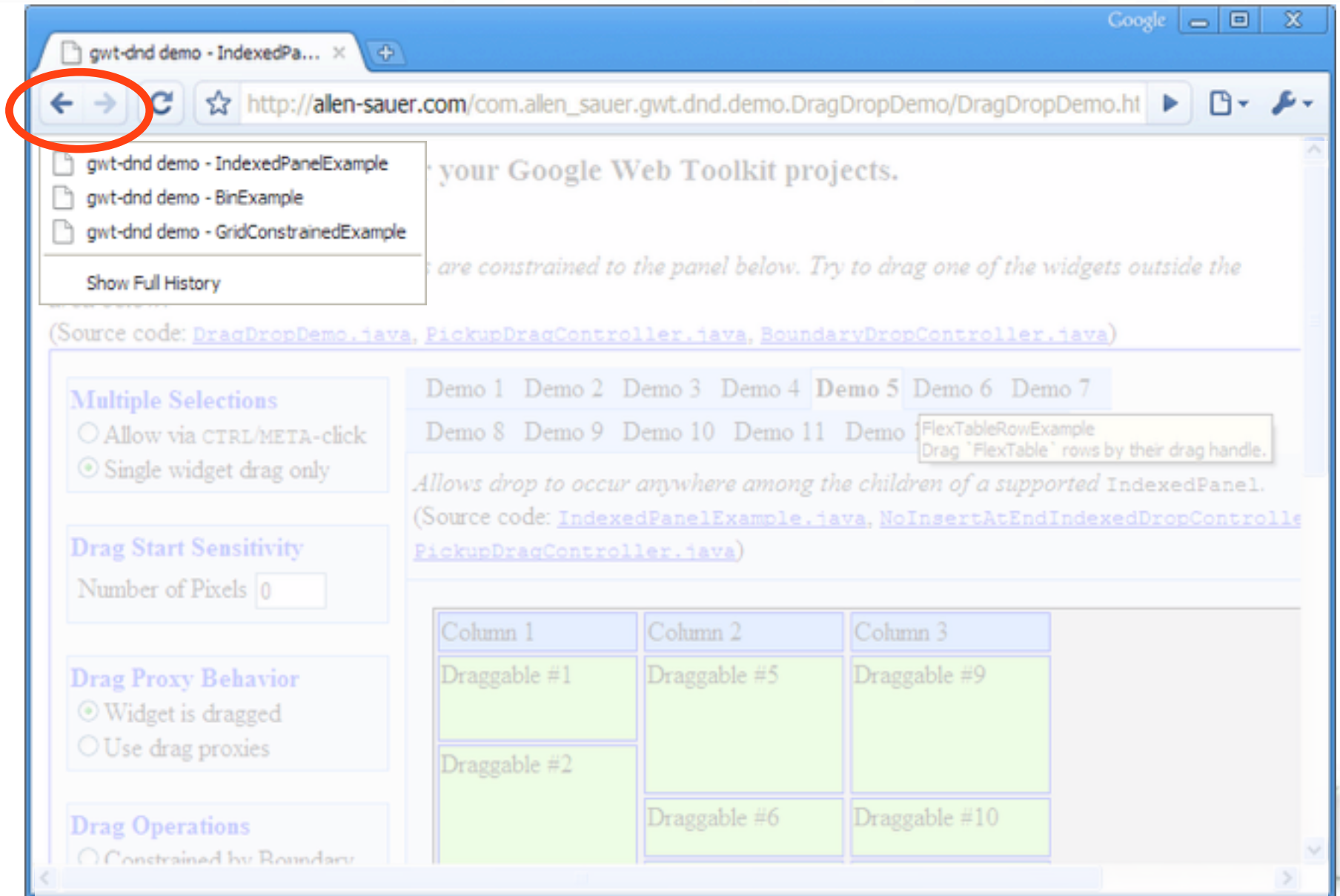
We used to expect this



and...



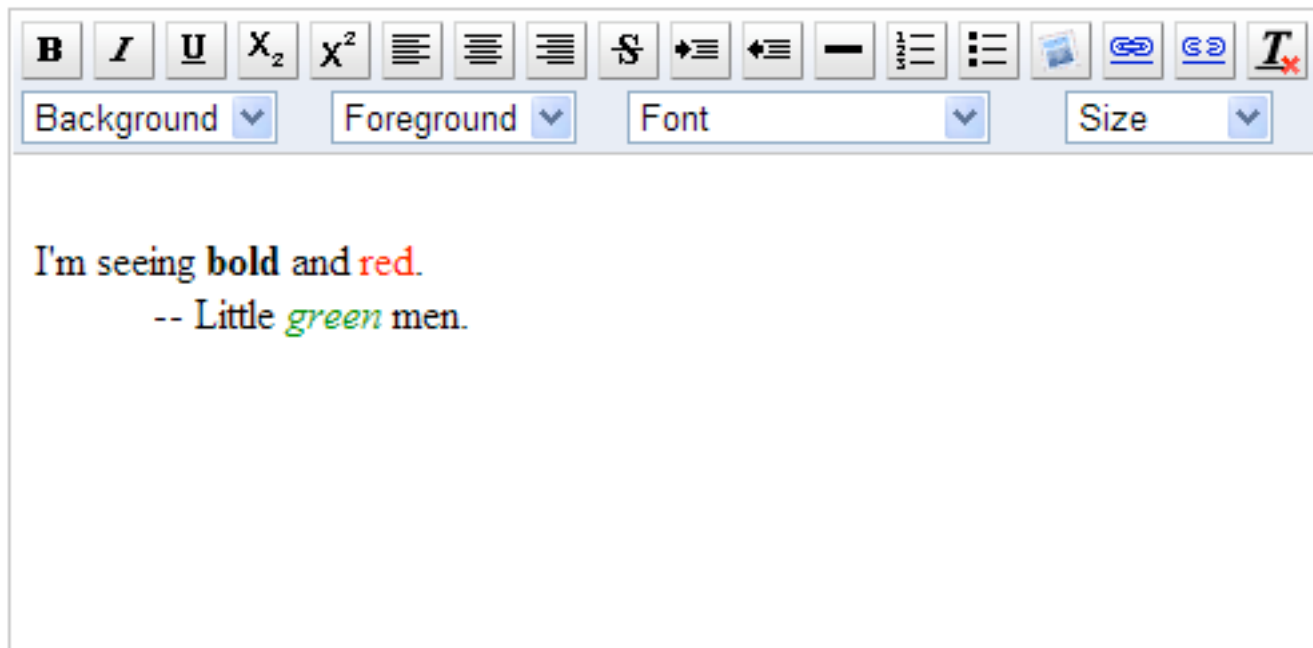
But now we expect this



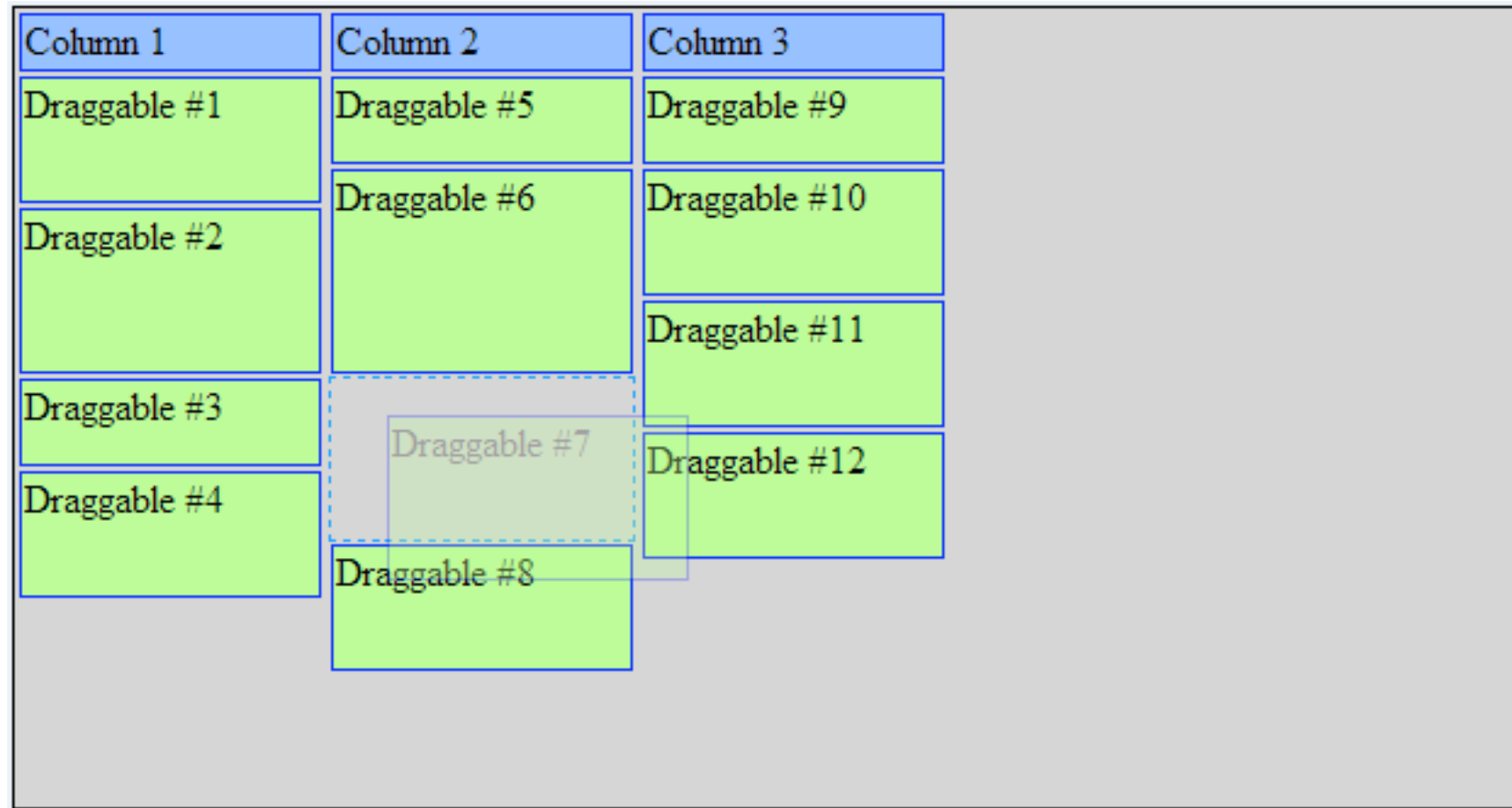
RTL languages



Rich text editor



Drag and drop in the browser



Widget libraries

- GWT (<http://code.google.com/webtoolkit/>)
 - Incubator (<http://code.google.com/p/google-web-toolkit-incubator/>)
-
- Smart GWT (<http://code.google.com/p/smartgwt/>)
 - GWT-Ext (<http://code.google.com/p/gwt-ext/>)
 - IT Mill Toolkit (<http://www.itmill.com/>)
 - GWT mosaic (<http://code.google.com/p/gwt-mosaic/>)
 - Ext GWT (<http://extjs.com/products/gxt/>)
 - Advanced GWT Components
(<http://advanced-gwt.sourceforge.net/>)



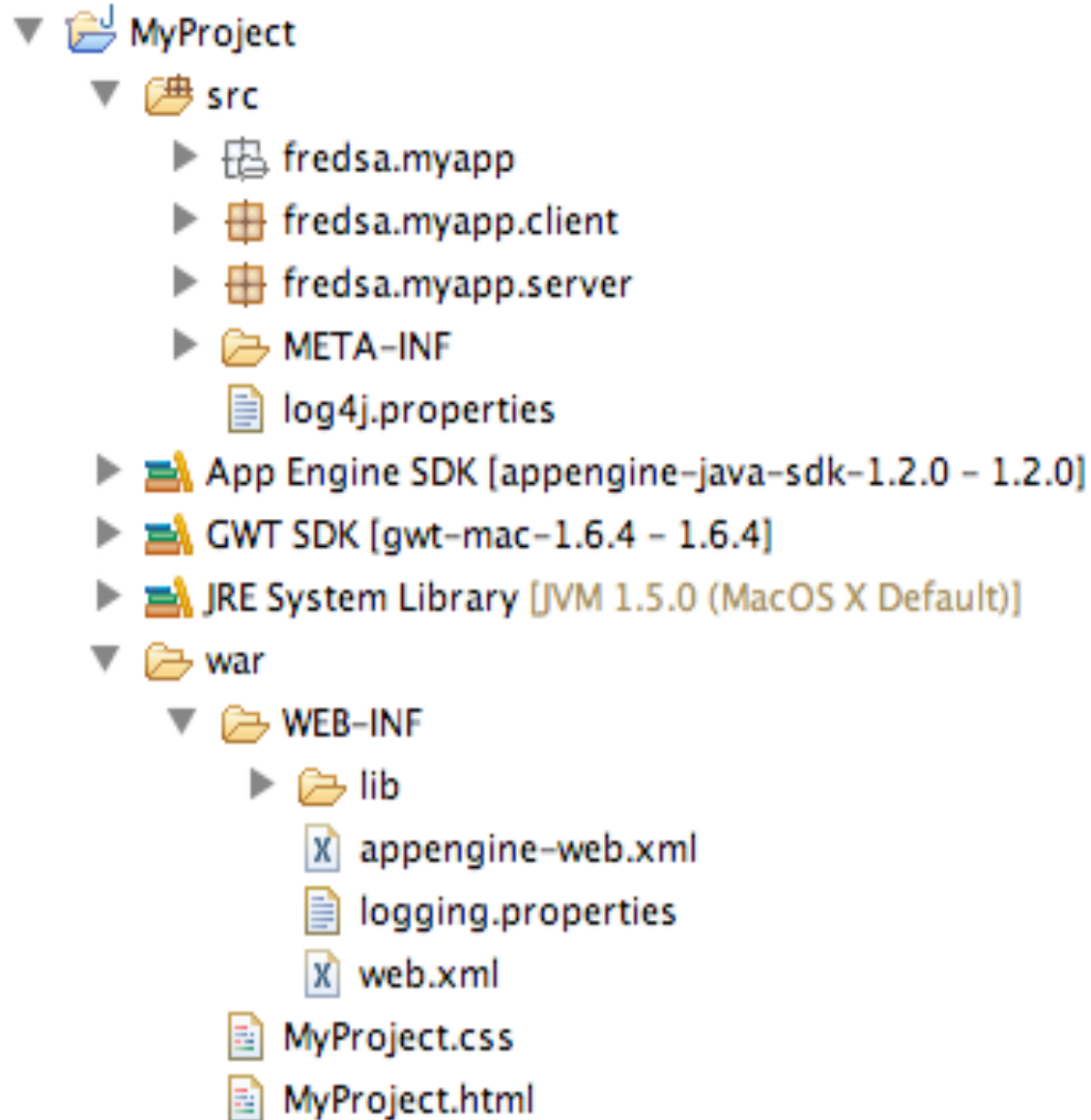
Simple, powerful RPC

- Many formats: JSON, XML, custom
- Why not just speak one language?

```
interface SpellService extends RemoteService {  
/**  
 * Checks spelling and suggests  
 * alternatives.  
 * @param the word to check  
 * @return the list of alternatives  
 */  
String[] suggest(String word)  
}
```



WAR directory structure



App Engine and Google Web Toolkit (GWT)

Easier to Scale and Optimize Your App

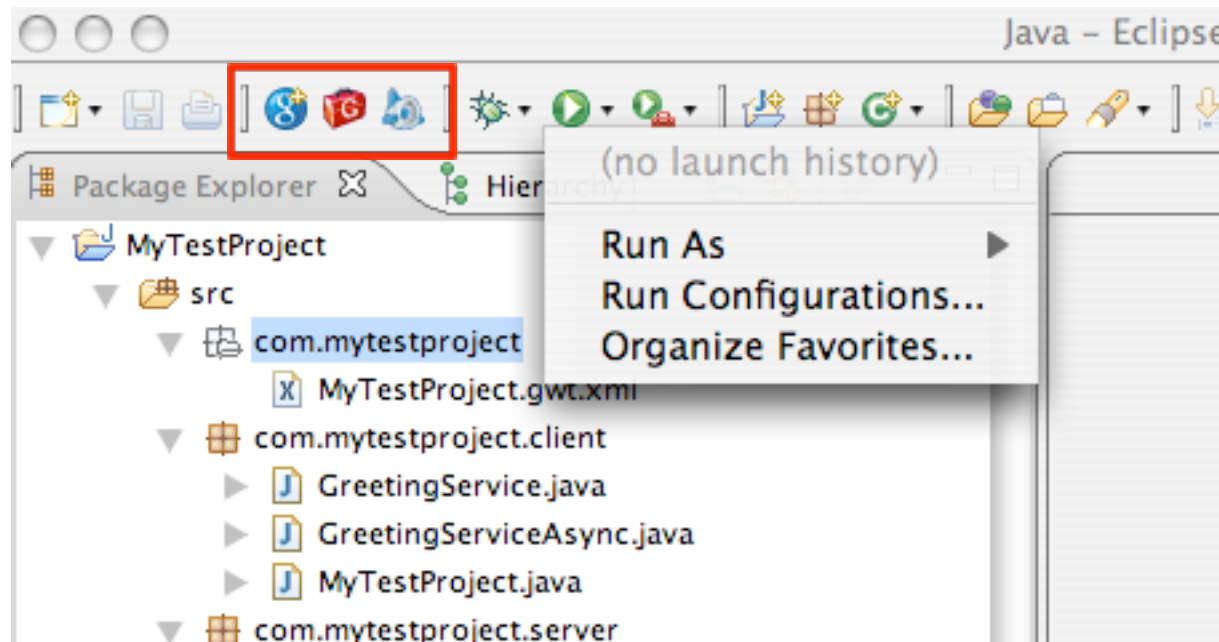




App Engine for Java

<http://code.google.com/appengine>

Google Plugin for Eclipse



<http://code.google.com/eclipse/>

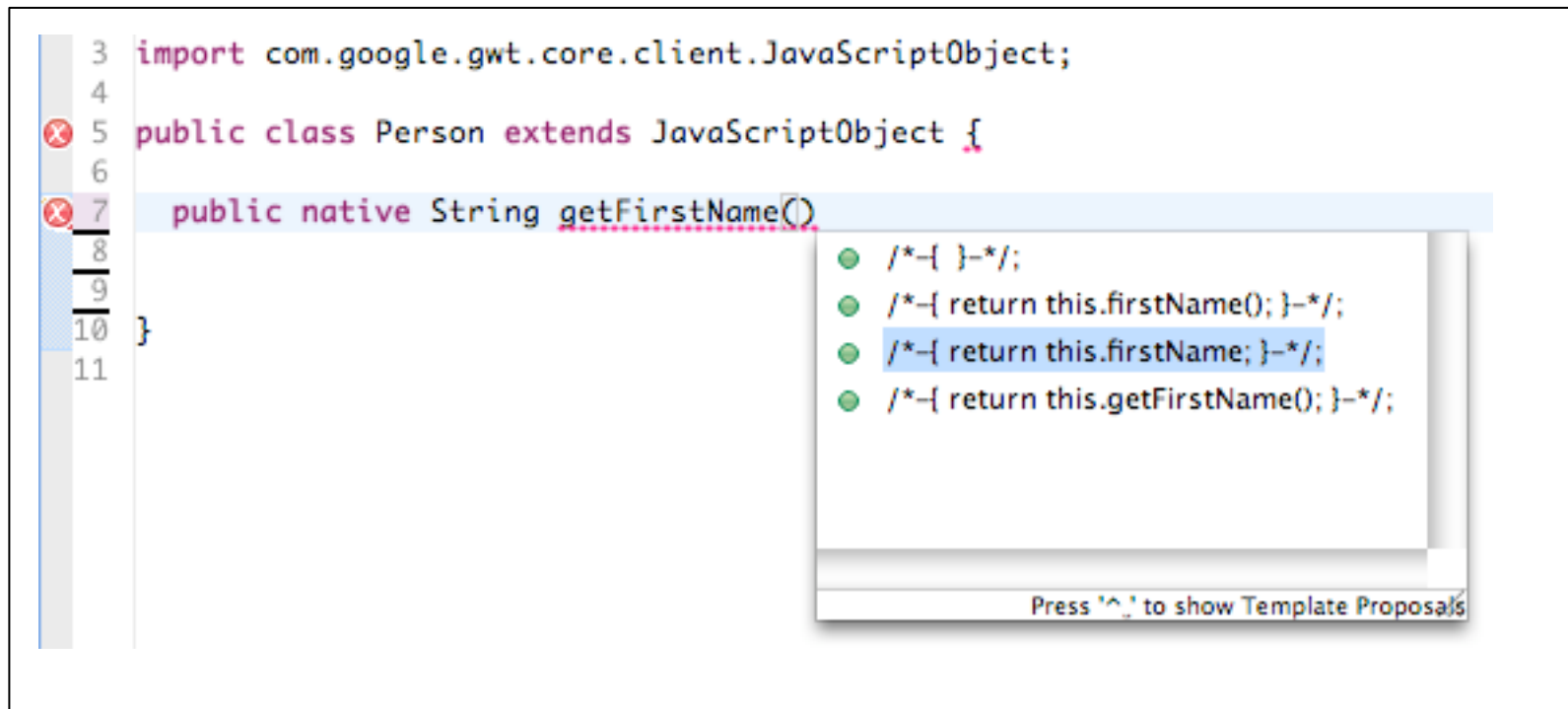


Disappearing Code - JavaScript Overlays



Disappearing code - JavaScript overlays

Let the Google Plugin for Eclipse work for you



Disappearing code - JavaScript overlays

```
// Magic disappearing class
public class Person extends JavaScriptObject {

    protected Person() {}

    final public String getDisplayName()
    { return getFirstName() + " " + getLastName(); }

    final public native String getFirstName()
    /*-{ return this.firstName; }-*/;

    final public native String getLastName()
    /*-{ return this.lastName; }-*/;

}
```



Disappearing code - JavaScript overlays

```
// You write  
Window.alert("Hi, my name is " +  
    person.getDisplayName());
```

```
// GWT translates  
$wnd.alert('Hi, my name is ' +  
    (person.firstName + ' ' + person.lastName));
```



Code Splitting

`GWT.runAsync()`



Manual code splitting is difficult



Big script, big problems

- It's easy to ignore compiled script size until it's too big
- Initial download can be sloooooow
- Super-linear parse time on some browsers
- UI hangs during script parsing
- Script parsing adds latency to initial UI setup
- Seems like GWT ought to do something about this...



Developer Guided Code Splitting

Split point

```
GWT.runAsync(new RunAsyncCallback() {
```

only async
on first call

```
    public void onFailure(Throwable caught) {  
        Window.alert("Code download failed");  
    }
```

Handle the
unexpected

```
    public void onSuccess() {  
        Window.alert("Hello, AJAX");  
        accessAdditionalFunctionality();  
    }
```

```
} );
```

1.cache.js

2.cache.js



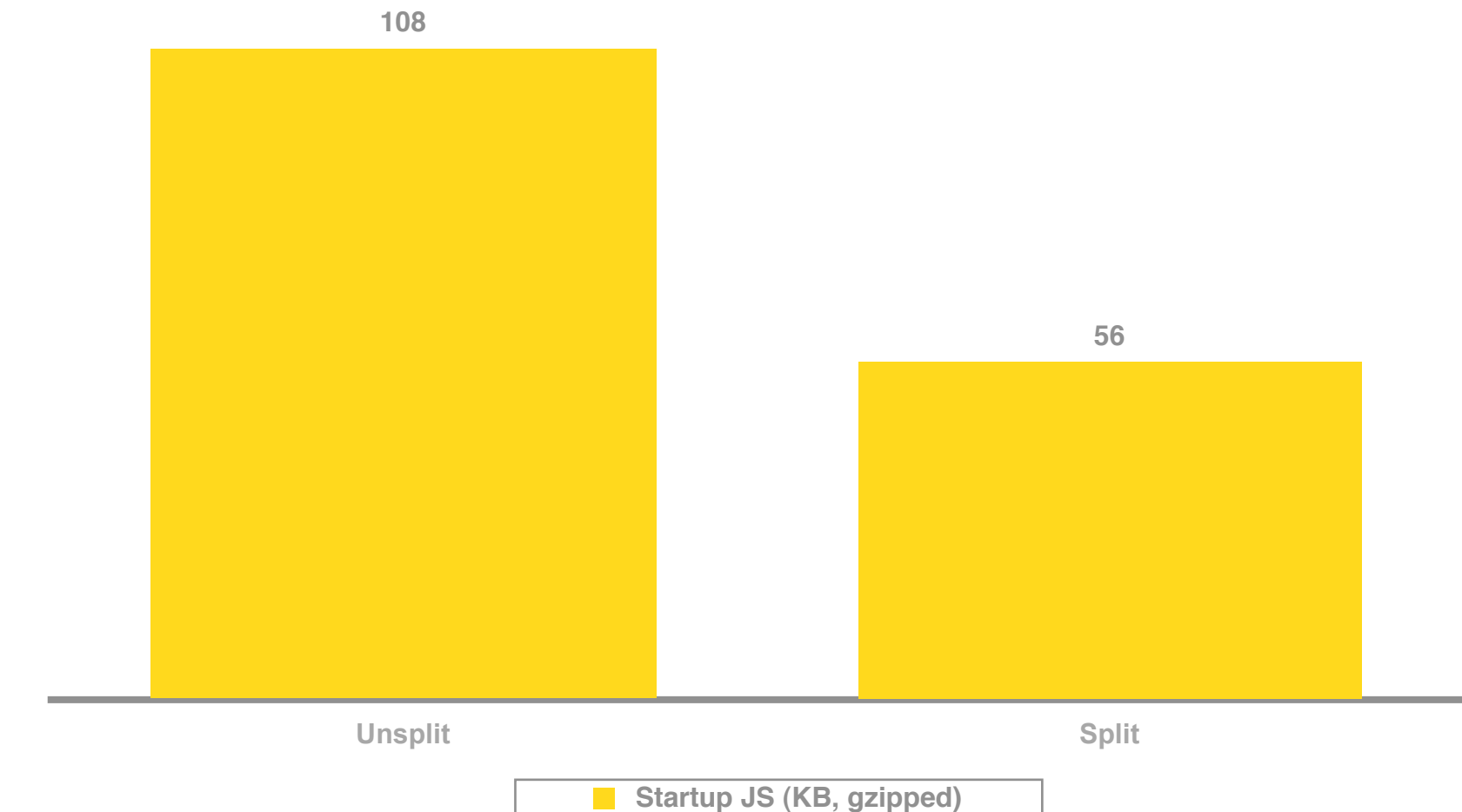
Getting to know `GWT.runAsync()`

- Intentionally developer-guided
- Intentionally asynchronous
- Intentionally forces you to think about failure paths
- Split point doesn't necessarily delay
- Split point doesn't necessarily split
 - Compiler decides how to cluster code
 - Guaranteed to be correct, ordering-wise...
 - ...but might not split as you had hoped due to cross-refs
- Be sure to look at SOYC (Story of Your Compile)

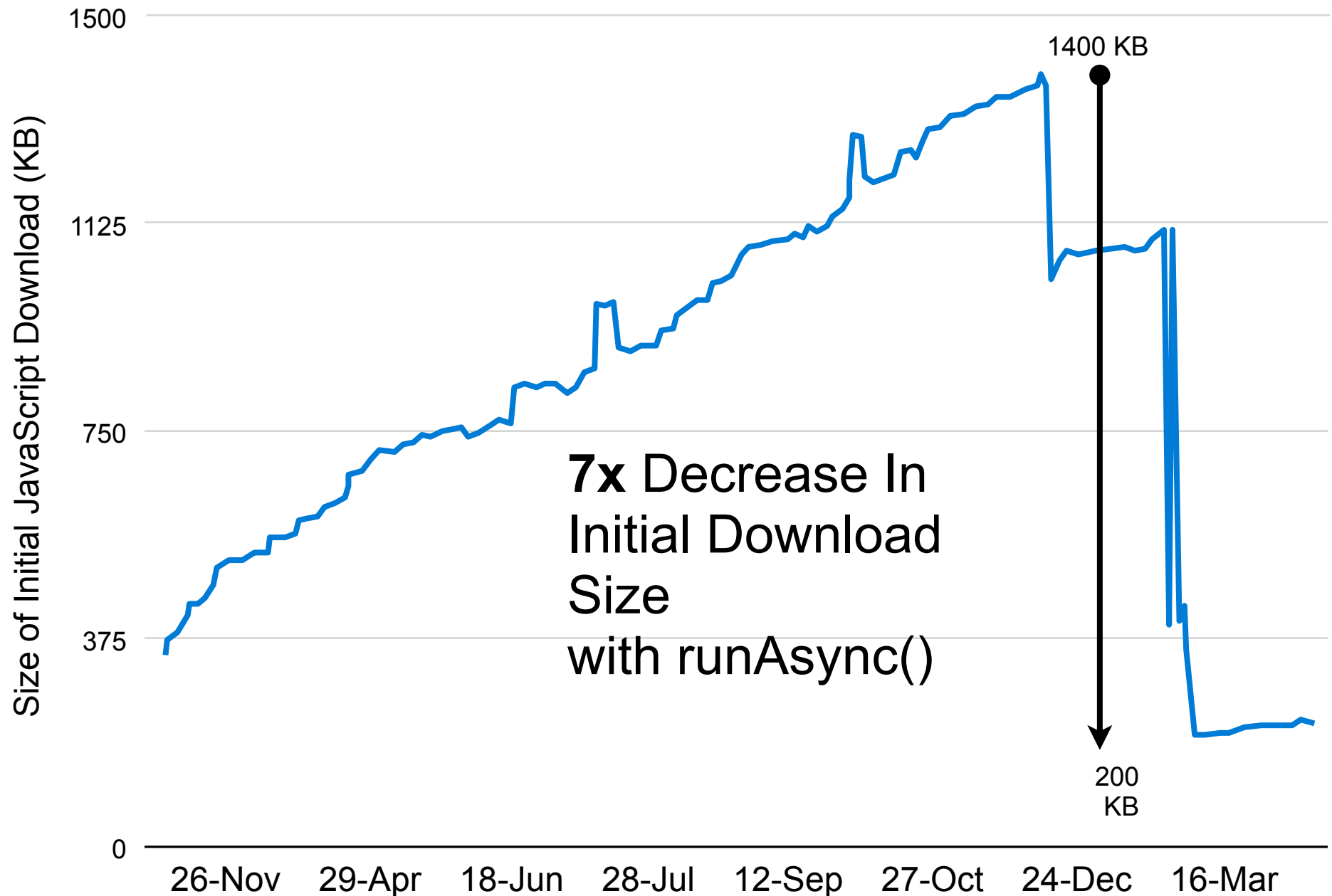


Splitting the Showcase demo

- Split point per link in the tree



`runAsync()` Helps Apps Startup More Quickly



Story of your compile



-C



Compiler, Generator, Linker



Evaporating code

“The fastest code is that
which does not run.”

– Joel Webber, GWT co-creator

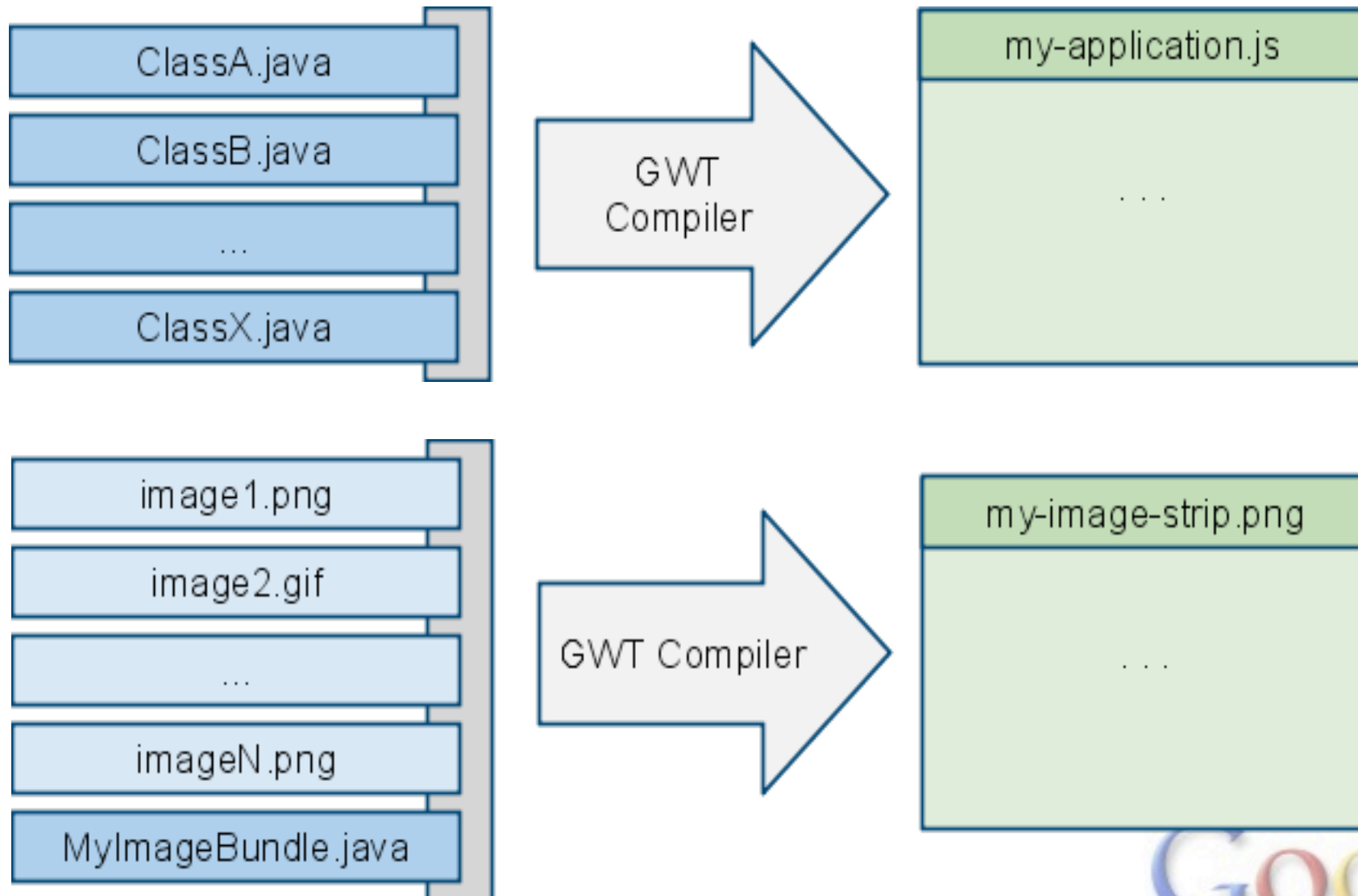


GWT compiler optimizations

Examples of compiler optimizations

- Dead code removal
- Type tightening
- Polymorphism removal
- Inlining
- JavaScript code gen compression

GWT Compiler



What does the output look like?

You write...

```
Label foo;  
foo.getElement().getStyle().setProperty("border",  
    "1px solid green");
```

GWT compiler (-style PRETTY)

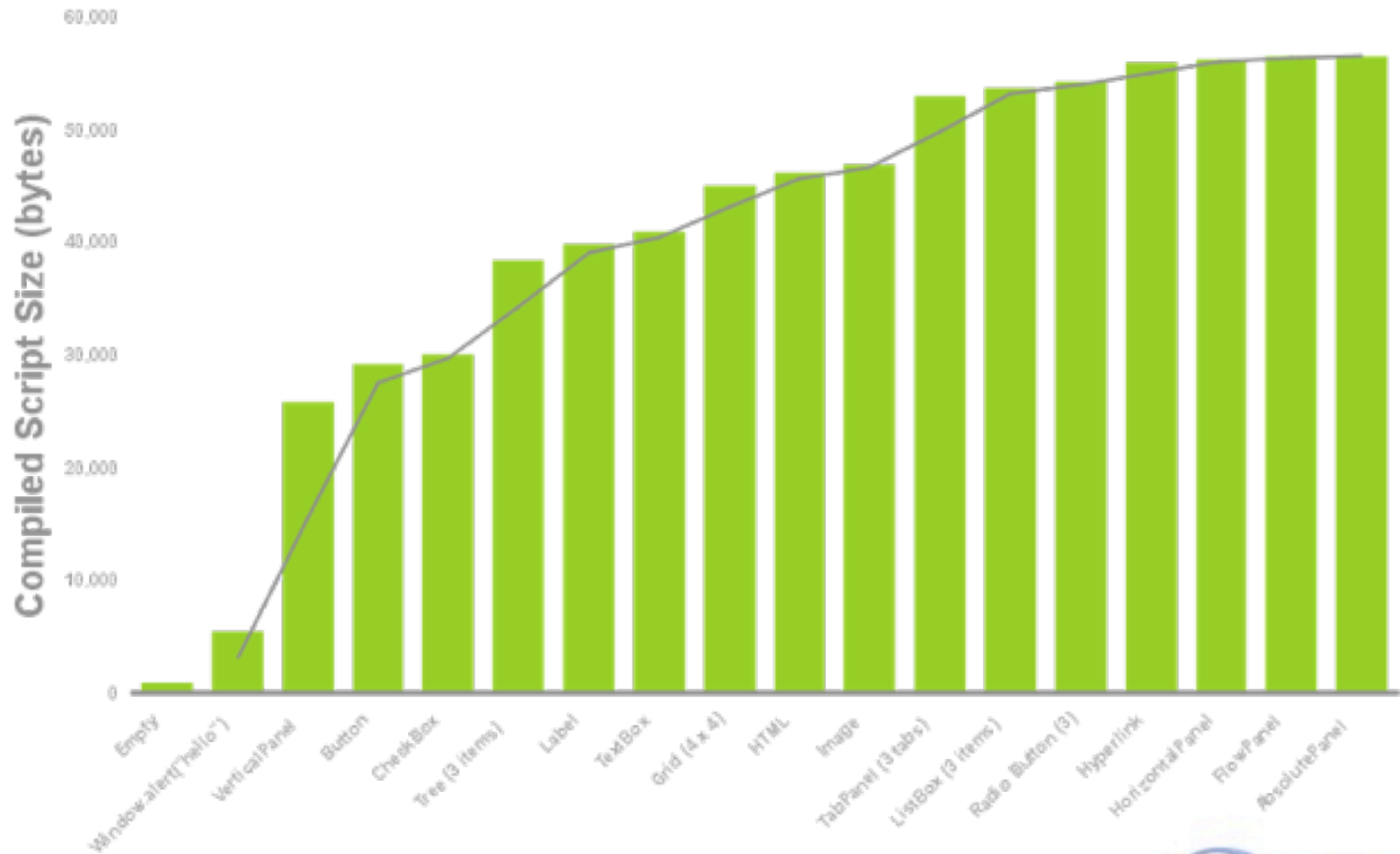
```
foo.element.style['border'] = '1px solid green';
```

GWT compiler (-style OBFUSCATED)

```
var r='1px solid green', q='border';  
b.i.style[q]=r;
```



Only pay for what you use



Additional Widgets

Google Web Toolkit



Deferred Binding



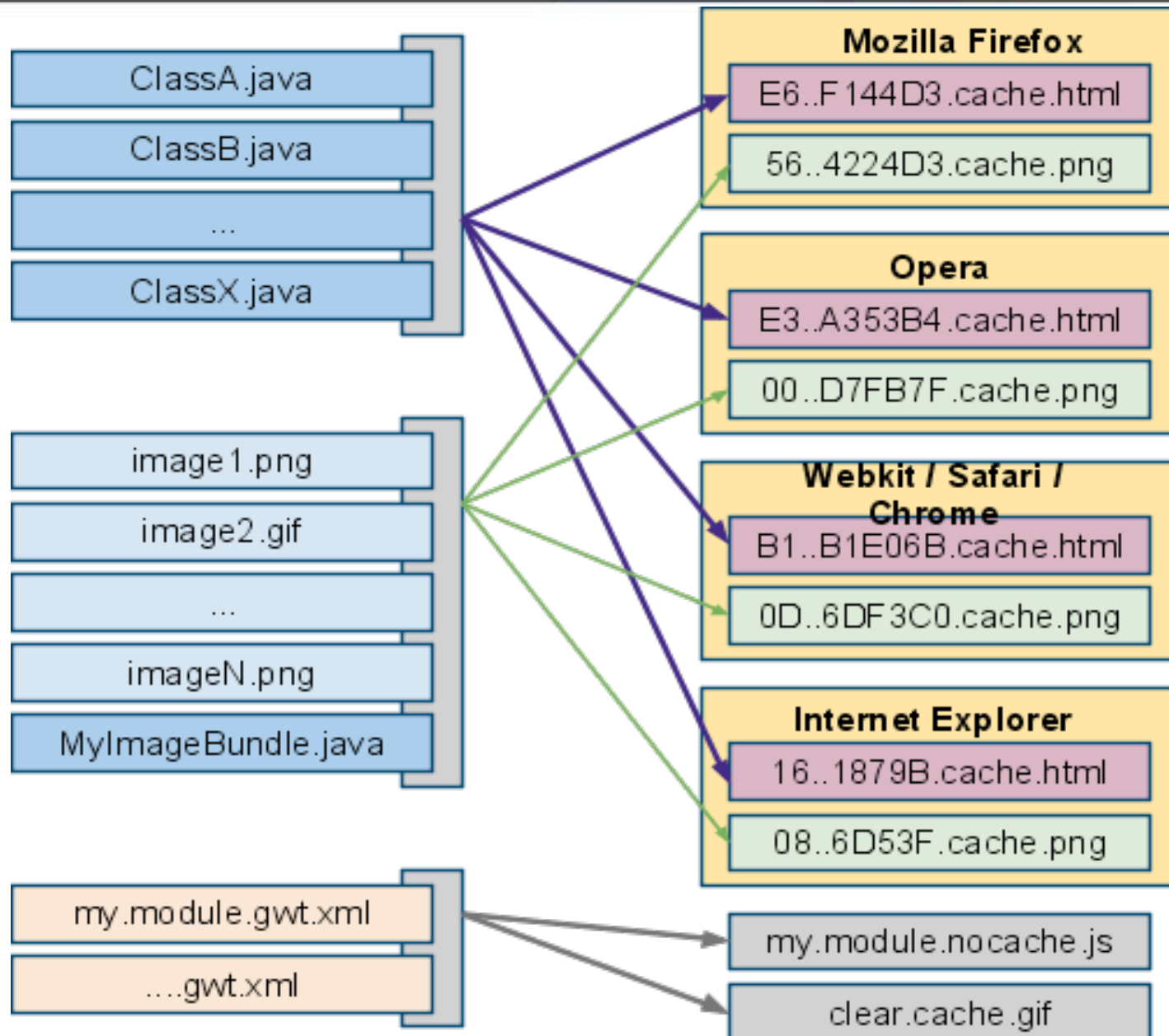
Browser-specific optimizations (Deferred Binding)

	Firefox	Webkit (Safari)	Opera	IE
Typical portable <code>setInnerText()</code>	2876 ms	1276 ms	2053 ms	4078 ms
<code>textContent=...</code>	-	908 ms	1386 ms	-
<code>innerText=...</code>	2477 ms	918 ms	1520 ms	2469 ms
DOM manipulation	7148 ms	1997 ms	4836 ms	14800 ms

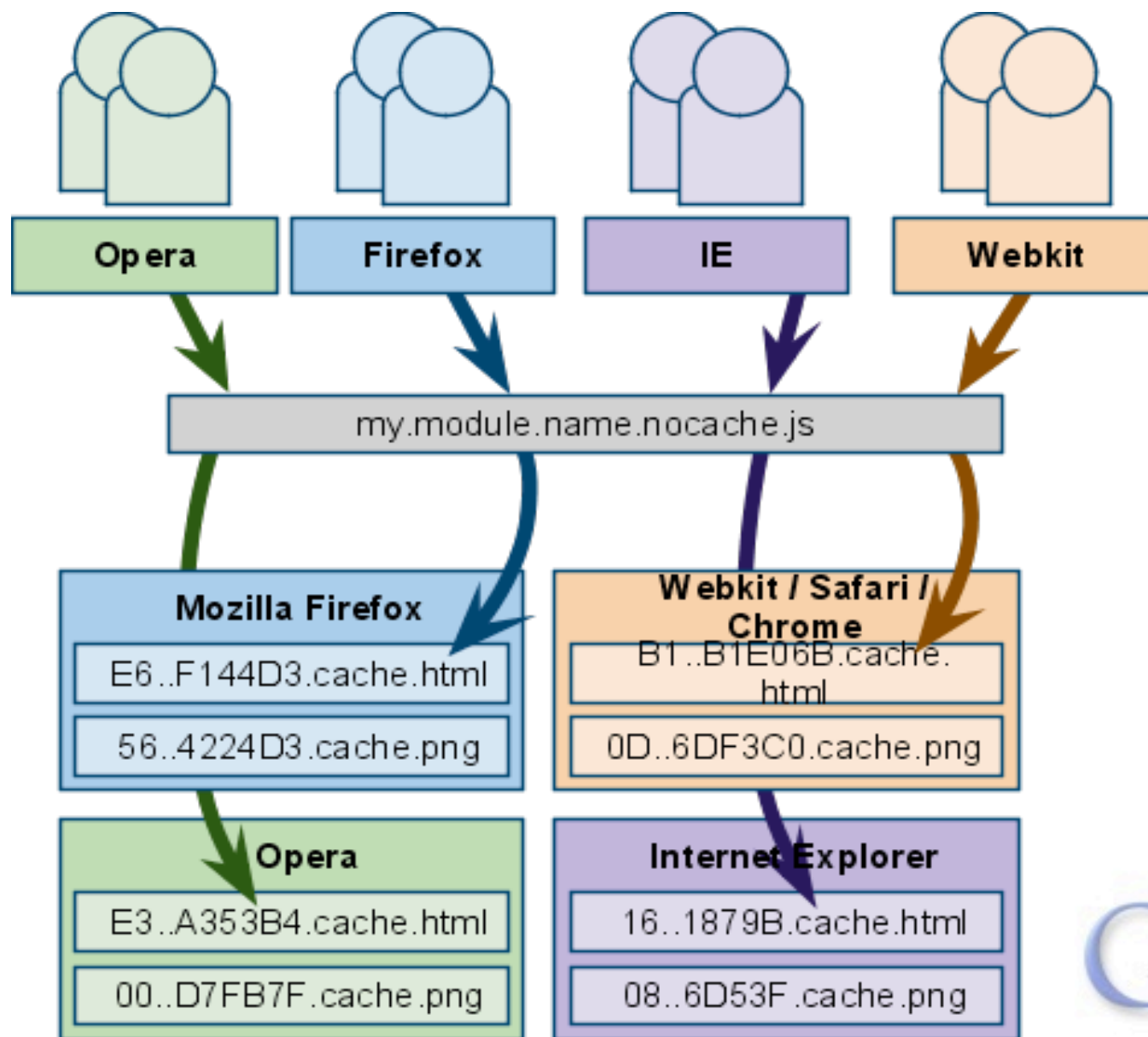
Improvement	14%	29%	32%	39%
-------------	-----	-----	-----	-----



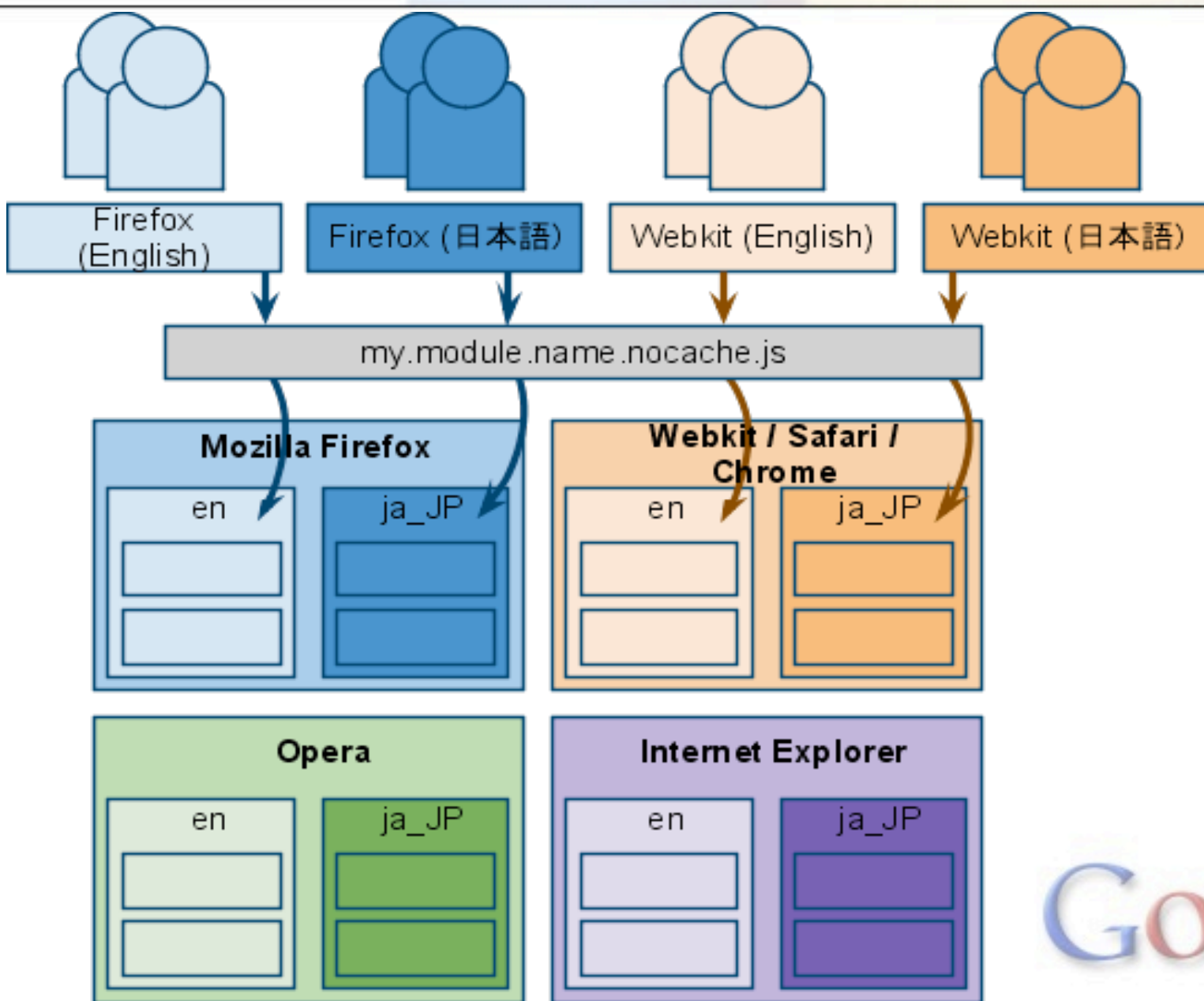
Deferred Binding at compile time



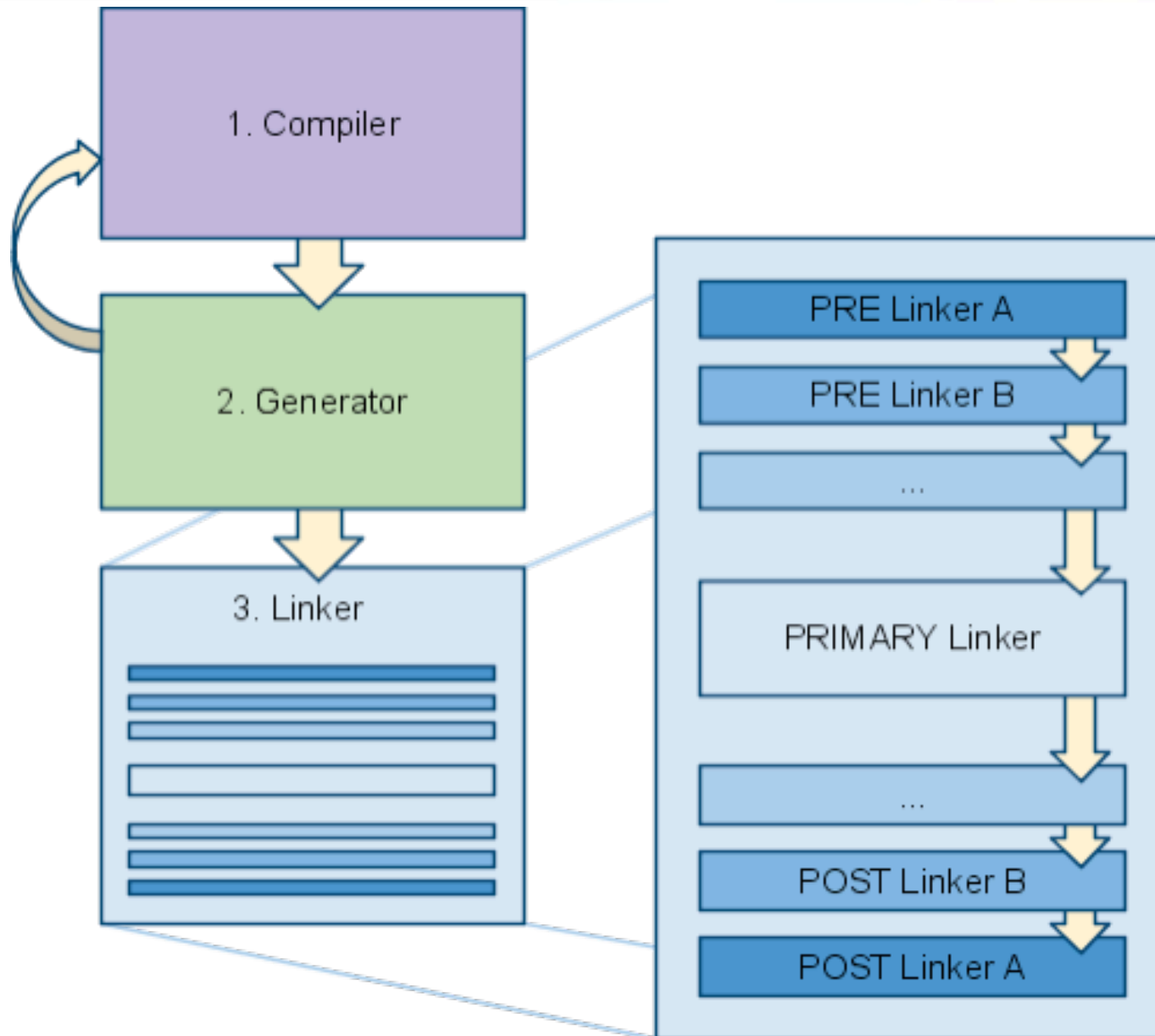
Deferred Binding at runtime



Deferred Binding at runtime



Pluggable architecture

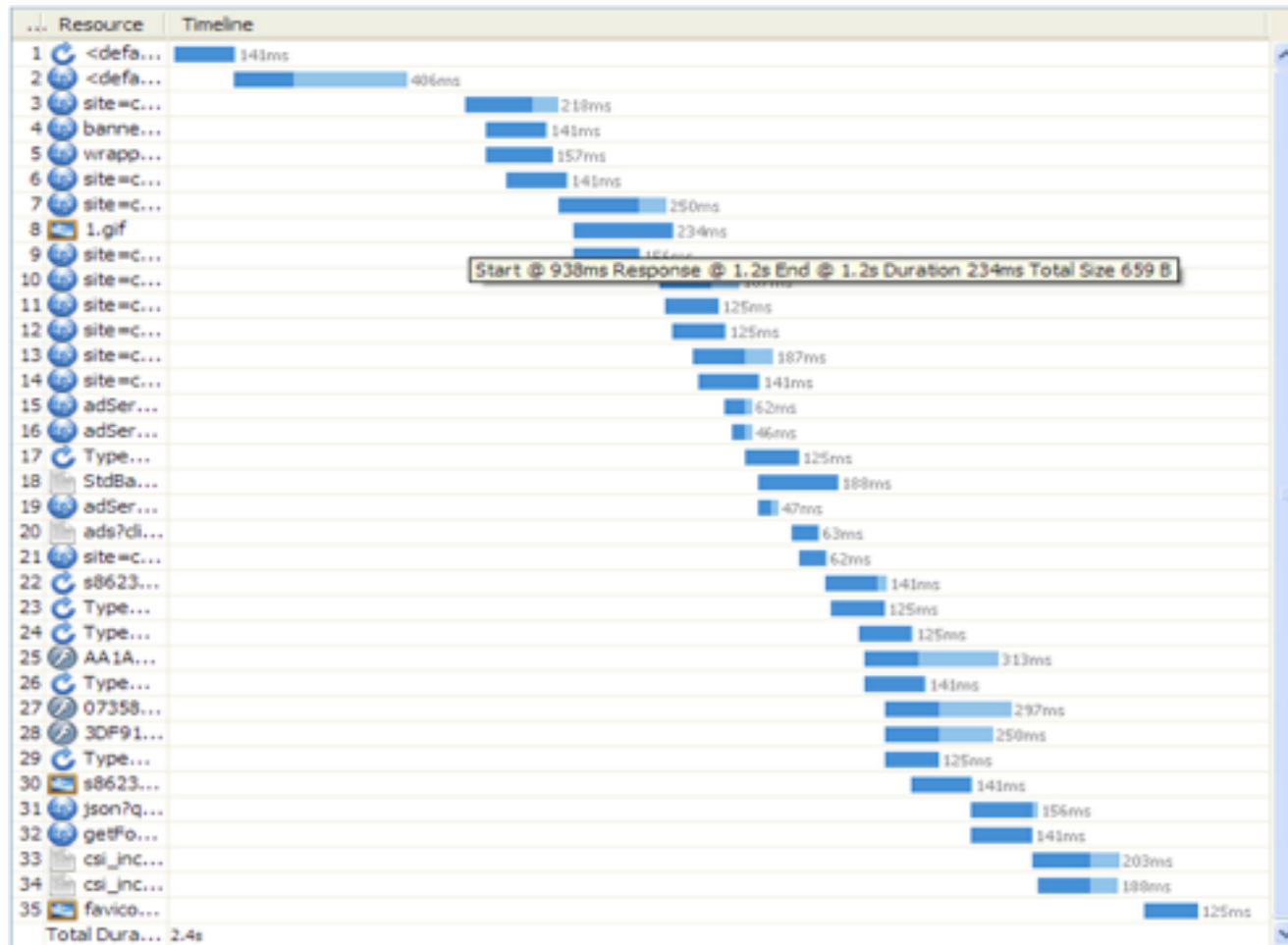


Coming in GWT 2.0 - ClientBundle > ImageBundle



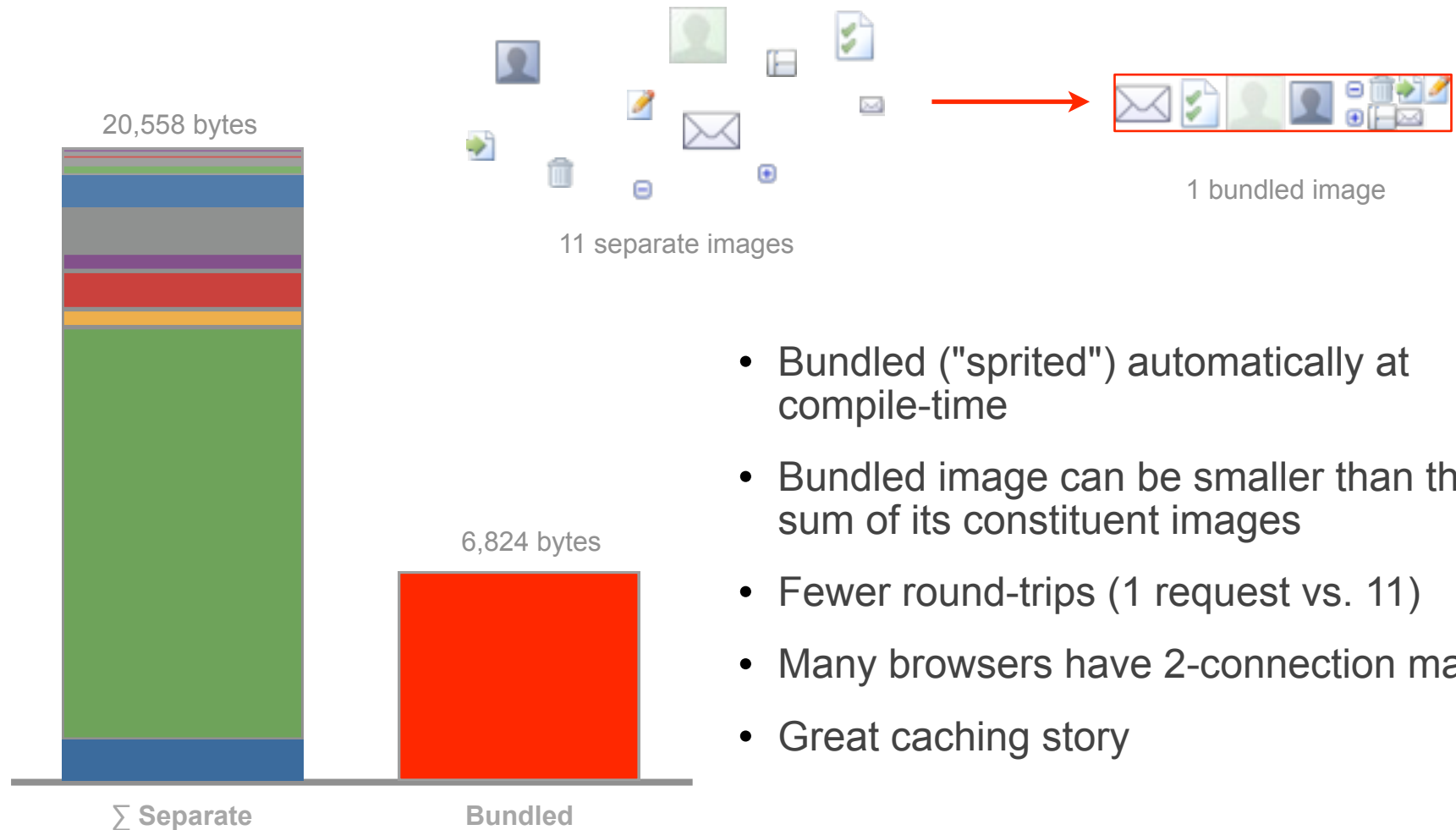
HTTP request times add up quickly

or why sprites matter and resource combining helps



ImageBundle (Redux)

ImageBundle was only the beginning



- Bundled ("sprited") automatically at compile-time
- Bundled image can be smaller than the sum of its constituent images
- Fewer round-trips (1 request vs. 11)
- Many browsers have 2-connection max
- Great caching story

Meet ClientBundle

ClientBundle generalizes ImageBundle to arbitrary resource types

```
interface MyBundle extends ClientBundle {  
    public static final MyBundle INSTANCE = GWT.create(MyBundle.class);  
  
    @Source("smiley.gif")  
    ImageResource smileyImage();  
  
    @Source("frowny.png")  
    ImageResource frownyImage();  
  
    @Source("app_config.xml")  
    TextResource appConfig();  
  
    @Source("wordlist.txt")  
    ExternalTextResource wordlist();  
  
    @Source("manual.pdf")  
    DataResource ownersManual();  
  
    @Source("super-fancy.css")  
    CssResource superFancy();  
}
```

A Simple Example: TextResource

```
interface MyBundle extends ClientBundle {  
    public static final MyBundle INSTANCE = GWT.create(MyBundle.class);  
    @Source("app_config.xml") TextResource appConfig();  
}
```

Figure 1 – Declaration

```
<app-config animation-speed="1500" failover-strategy="give-up" ... />
```

Figure 2 – Text Resource (app_config.xml) found on your classpath at compile-time

```
void configureMyApp() {  
    MyBundle bundle = MyBundle.INSTANCE;  
    TextResource txtres = bundle.appConfig();  
    String xml = txtres.getText();  
    Document doc = XMLParser.parse(xml);  
    // ...configure application using XML DOM...  
}
```

Figure 3 – Point of Use

- Guaranteed to succeed because the text resource is compiled in
- Use the file format that is most appropriate; separate data from code if desired
- No HTTP request required

ClientBundle's Killer Feature: CssResource

Compiles CSS with an enhanced syntax

- Define and use constants in CSS

```
@def hardToMissThickness 8px;  
@def scaryColor #F00;  
.error-border {  
  border: hardToMissThickness solid scaryColor;  
}
```

- Conditional rules for user agent, locale, or...anything

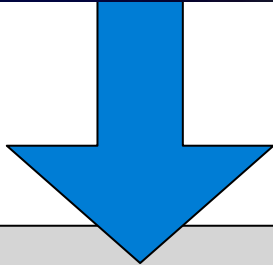
```
@if user.agent safari {  
  .error-border {  
    -webkit-border-radius: 4px;  
  }  
}  
@elif user.agent gecko {  
  .error-border {  
    -moz-border-radius: 4px;  
  }  
}
```

- More: minify, obfuscate, fancy spriting, ...

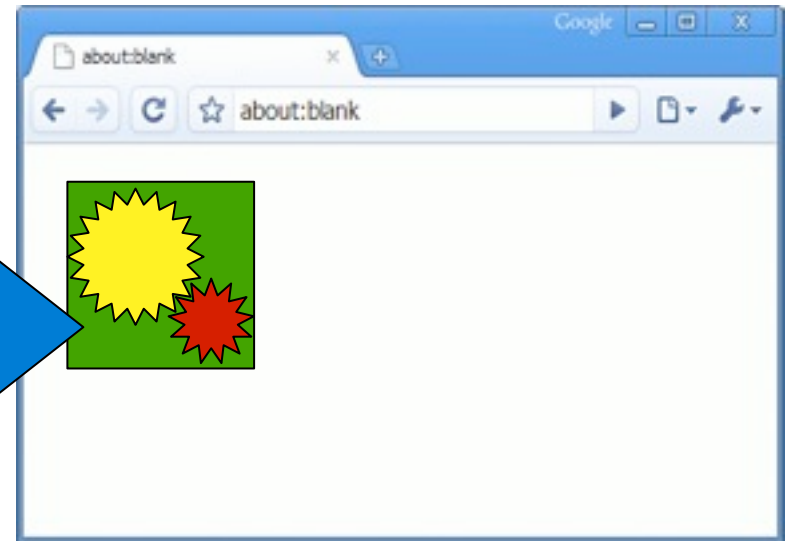
Coming in GWT 2.0 - In-browser debugging



In-browser debugging



**Java Virtual
Machine**



Coming in GWT 2.0 -

-XdisableClassMetadata



-XdisableClassMetadata

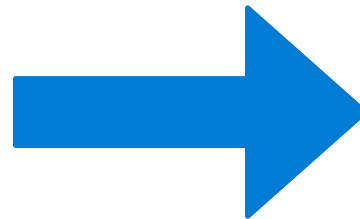
- Calling `obj.getClass()` or `clazz.getName()` forces Class objects and their names to be generated into JavaScript
- But if you don't really care what `Class#getName()` returns...

Showcase metadata before

```
...
    public static void main(String[] args) {
        Class c = Class.forName("org.apache.commons.lang.StringUtils");
        System.out.println(c.getName());
    }
}
...

```

5% - 10%
script reduction



Showcase metadata after

```
...
    public static void main(String[] args) {
        Class c = Class.forName("org.apache.commons.lang.StringUtils");
        System.out.println(c.getName());
    }
}
...

```

- Size, speed, and obscurity benefits

-XdisableCastChecking

- Nobody actually catches `ClassCastException` in app code

```
void makeItQuack(Animal animal) {  
    try {  
        ((Quacker) animal).quack();  
    } catch (ClassCastException c) {  
        Window.alert("This doesn't quack.");  
    }  
}
```

- The above example generates a call like this (compiled JS):

```
dynamicCast(animal, 2).quack();
```

- But with the flag turned on, you get only this (compiled JS):

```
animal.quack();
```

- In a real-world (and very large) Google app...
 - 1% script size reduction
 - 10% speed improvement in performance-sensitive code

Coming in GWT 2.0 - Overlays Types++, and more...

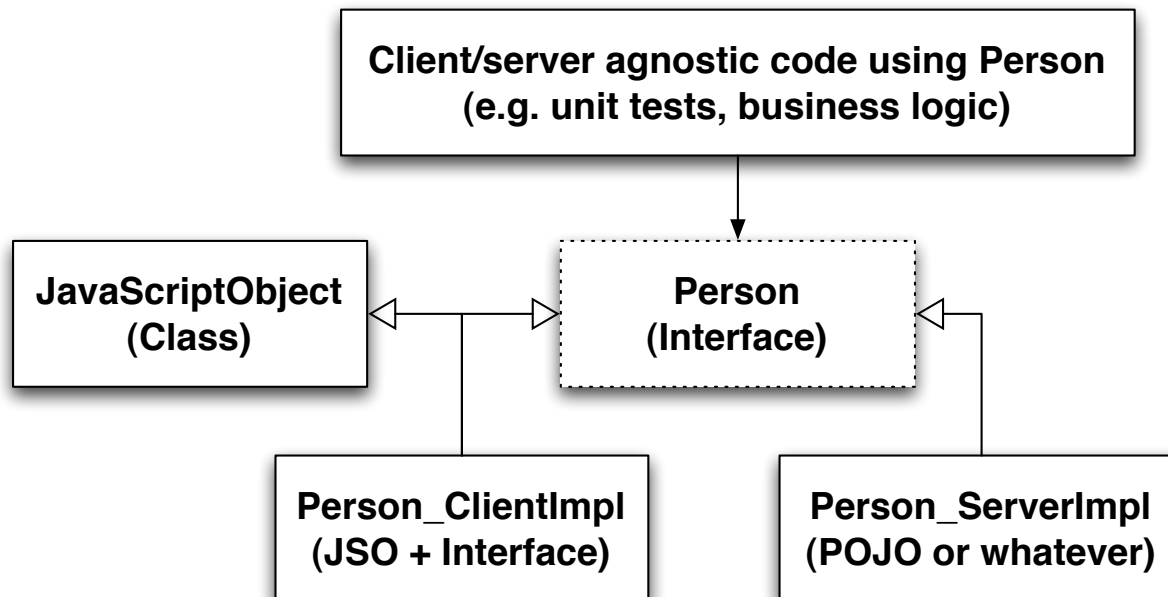


Interfaces on JavaScript Overlay Types (JSOs)

- In GWT 1.6, JSOs are nifty but tied to JavaScript:

```
final class Person extends JavaScriptObject {  
    protected Person() {}  
    public native String getFirstName() /*-{ return this.firstName; }-*/;  
    public native String getLastName() /*-{ return this.lastName; }-*/;  
}
```

- Server code can't handle JSNI on JSOs
- So introduce an interface:



More Tidbits

- RPC blacklist: Tell the RPC subsystem to skip types that you know aren't ever sent across the wire

```
<extend-configuration-property name="rpc.blacklist"
    value="com.example.myapp.client.WidgetList"/>
<extend-configuration-property name="rpc.blacklist"
    value="com.example.myapp.client.TimerList"/>
...
```

- RpcRequestBuilder: Customize XHRs for all RPCs in a service

```
ServiceDefTarget sdt = (ServiceDefTarget)myService;
sdt.setRpcRequestBuilder(myBuilderWithCustomHttpHeaders);
...
// All calls will use the same XHR settings
// (e.g. custom HTTP request headers)
myService.doSomethingOnTheServer(a, b, c);
```

- Client-side stack traces on some browsers
(`Throwable#getStackTrace()` actually does something sometimes)
- Interfaces on JavaScript Overlay Types

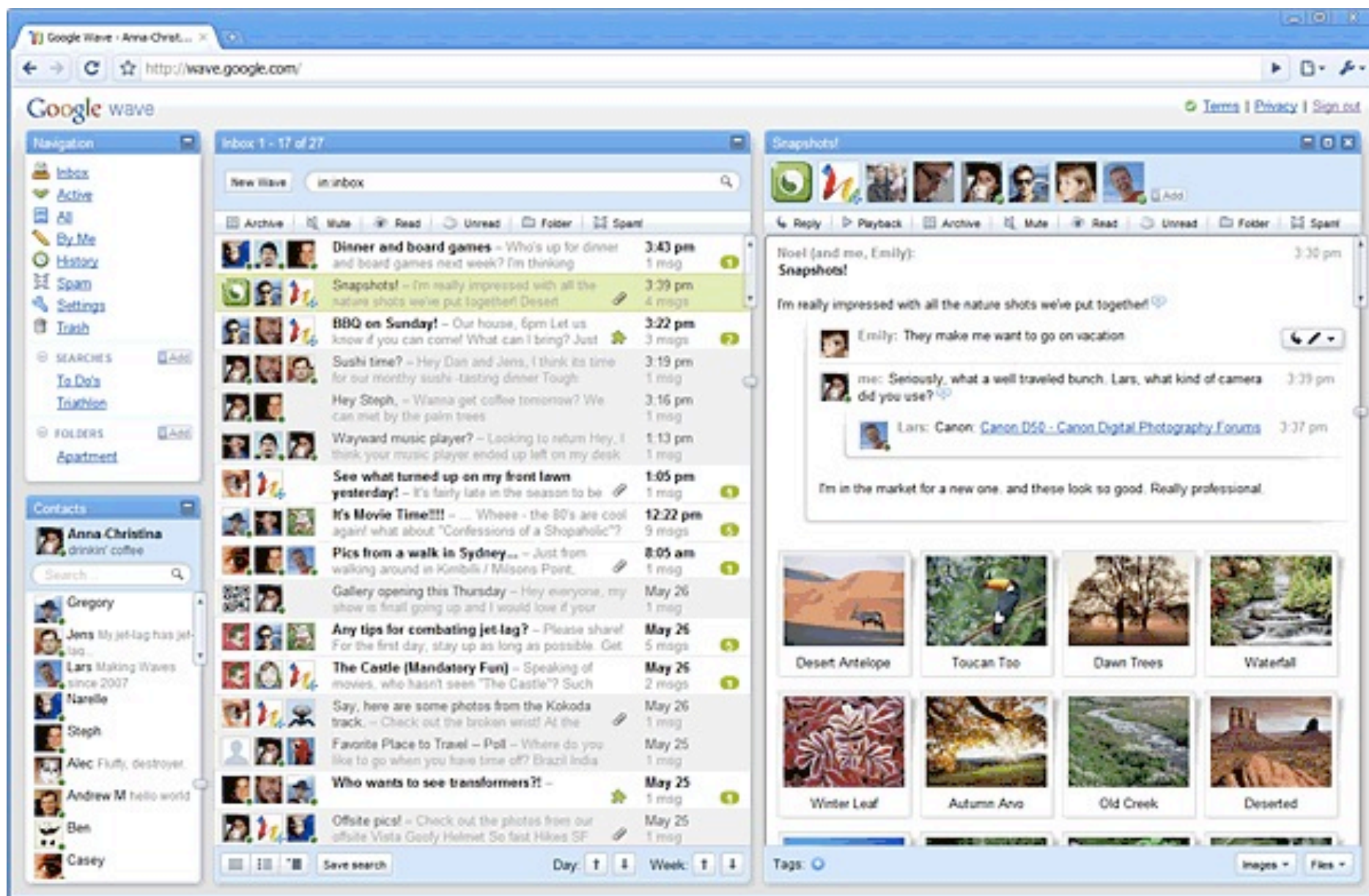
Coming in GWT 2.0 (Recap)

Feature	Productivity for you	Performance for your users
• In-browser hosted mode	Debug in real browsers	You ship sooner
• Faster compilation	Less thumb-twiddling	You ship sooner
• Script size reductions and speed improvements	Simple flags enable size/speed gains	Apps start faster; run faster
• Code splitting	High-leverage, low-risk way to spread download time	Apps start faster; stay interactive
• ClientBundle (w/ CssResource!)	Project organization != deployment organization	Fewer HTTP round-trips
• Layout you can count on	Less time fighting with CSS and layout	Faster, smoother layout and resizing

Who's using GWT?



Google Wave



Google Health

samsample@gmail.com | [Feedback](#) | [Settings](#) | [Help](#) | [Sign out](#)



Sam

- [Notices](#)
- [Drug interactions](#) 
- [Profile details](#)
 - [Age, sex, height...](#)
 - [Conditions](#)
 - [Medications](#)
 - [Allergies](#)
 - [Procedures](#)
 - [Test results](#)
 - [Immunizations](#)
- [Add to this profile](#)
- [Import medical records](#)
- [Online health tools](#)
- [Medical contacts](#)
- [Find a doctor](#)
- [Create a new profile](#)

[Add to this Google Health profile](#)

Learn about your health issues and find helpful resources

[Import medical records](#)

Copy and get automatic updates of your records

[Discover more health tools](#)

Find online tools for managing your health

[Find a doctor](#)

Search by name, location, and specialty

Profile updates

This profile is now linked with:

Cleveland Clinic MyConsult

**Cleveland Clinic**
MyConsult

[Request an appointment](#)
[Log in to your Cleveland Clinic account](#)
[Find a Cleveland Clinic Physician](#)

Profile summary

Conditions

- Type 2 Diabetes [Reference](#)
- High blood pressure [Reference](#)
- Hyperthyroidism [Reference](#)
- Low Back Pain
- Migraine headaches [Reference](#)

Medications

- Amoxicillin
- Lisinopril
- Glyburide
- Metformin
- Ibuprofen

Allergies

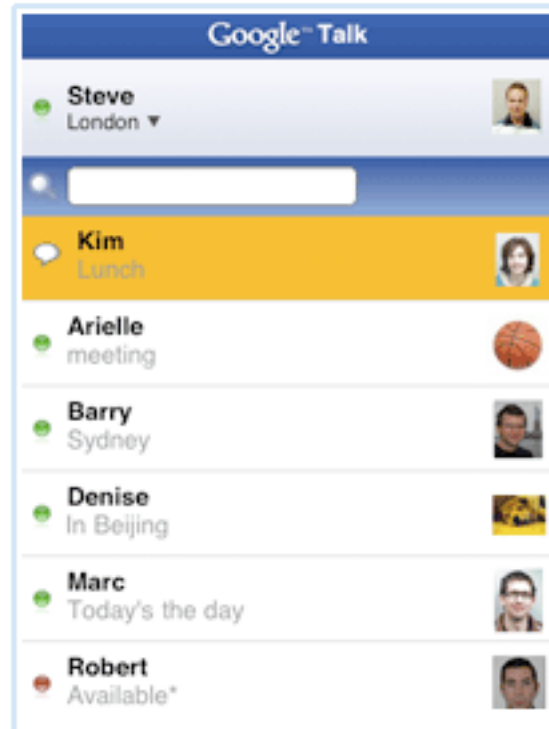
- Penicillins - Severe

Procedures

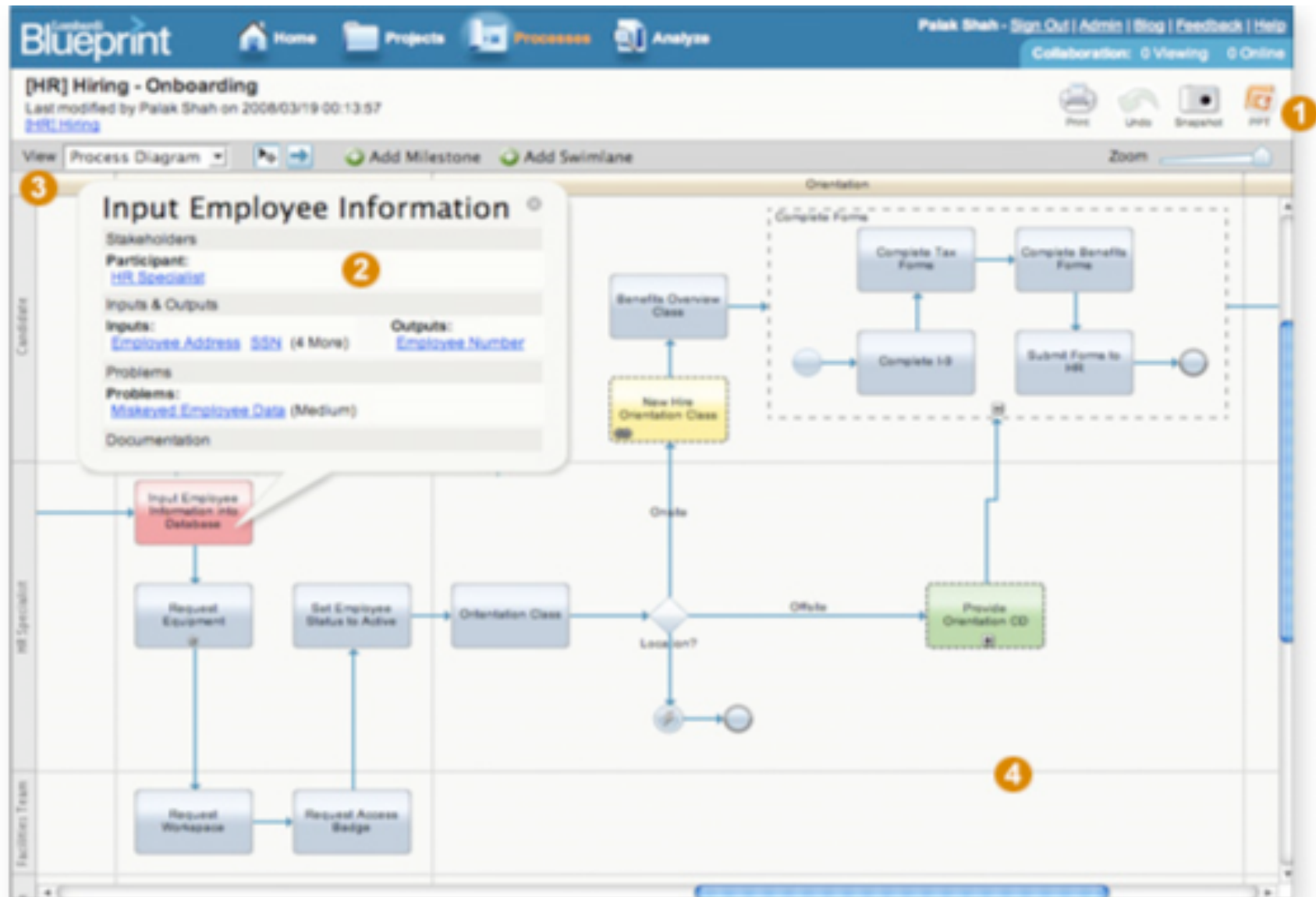
- Appendectomy

©2008 Google [Google Health privacy policy](#) - [Terms of service](#) - [Google home](#)

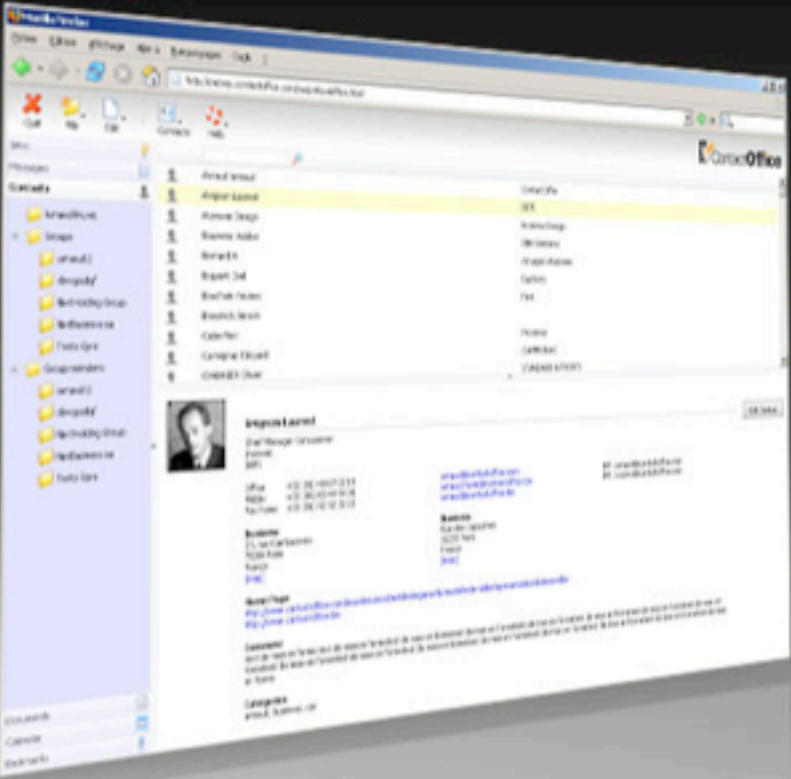
Mobile



Large GWT Apps - Lombardi Blueprint



Large GWT Apps – ContactOffice





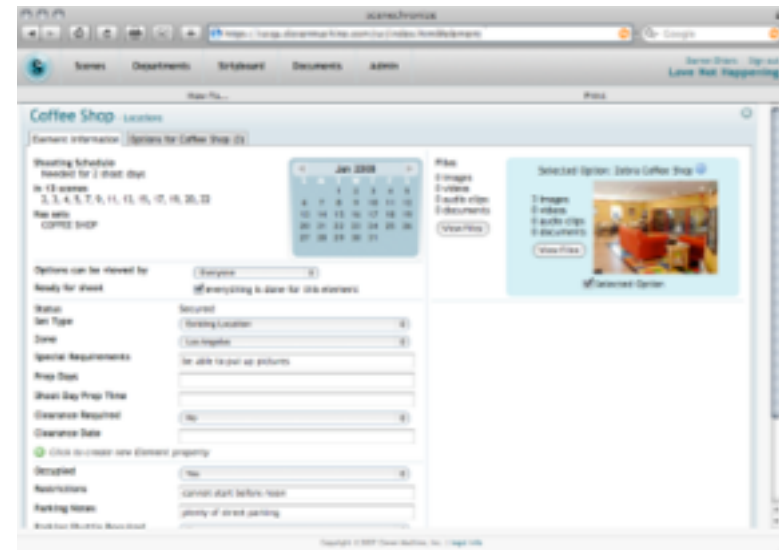
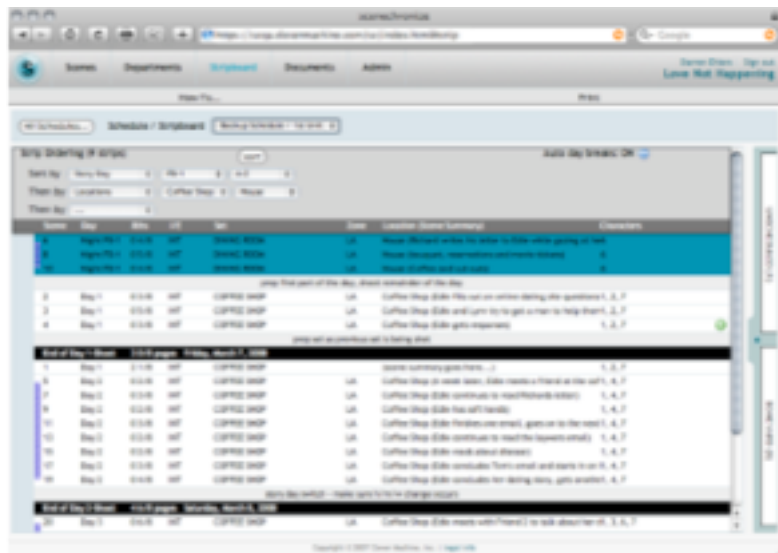
Drag and drop
Right click contextual menu
Ctrl click multi-select
Marquee selector
Folder auto-expansion
Contextual top menu
Sortable columns
Data scrolling
Resizable panels
and much more ...



Google Web Toolkit



Large GWT Apps - scenechronize



Google Web Toolkit



Many more in the GWT App Gallery

<http://gwtgallery.appspot.com/>

The screenshot shows a web browser window titled "Google Web Toolkit App Gallery - Google Code". The address bar displays the URL <http://gwtgallery.appspot.com/recent?recentapps=true&start=23&num=5>. The page features a "Google code" logo and a search bar with the text "e.g. 'java guide' or 'chromeless player'". A "Sign in" link is visible in the top right corner.

The main content area is titled "Google Web Toolkit - App Gallery" and "Project Gallery Search Results - Recent Apps". On the left, there is a sidebar with links: "GWT Application Gallery", "Gallery Home", "Submit Your App", and "GWT homepage".

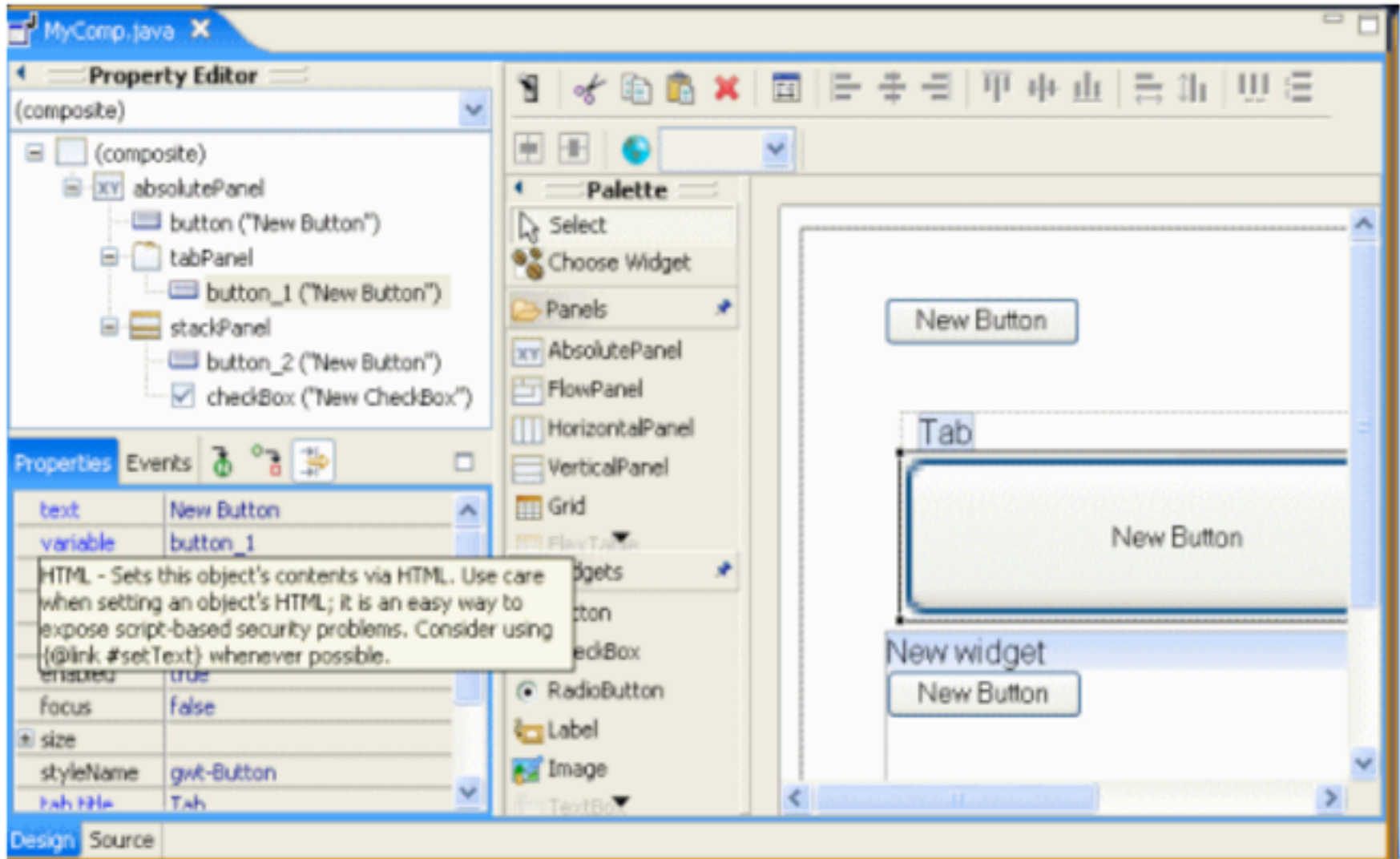
The search results list four apps:

- Citrix TV**: Citrix Systems - May 14, 2009 - ★★★★★
Citrix TV is a self-serve video offering for Citrix customers, partners and employees. Similar to YouTube, Citrix TV allows entitled users to watch and upload video content in support of the Citrix story.
<http://www.citrix.com/tv>
- MGIS web site**: Bioversity International (G. Sempere; M. Ruas; E. Arnaud) - May 14, 2009 - ★★★★★
MGIS stands for Musa Germplasm Information System. MGIS is a shared database between national & international agricultural research organisation storing information on Musa plants conserved in collections. From now 19 institutes are involved in this network. The idea of the web site is to offer a free access to information on material of interests to researchers, breeders, farmers.
<http://www.crop-diversity.org/banana/#Home>
- Wots4Dina**: James Heggs (eggily) - May 14, 2009 - ★★★★★
The Wots4Dina application allows people to quickly and easily search for recipes by ingredients/recipe name. After finding the recipes, users can easily see what ingredients the recipe needs and then when it comes to the time of creation you can follow through steps on creating their perfect recipe.
<http://www.wots4dina.com/wots4dinawidget/>
- Trabber - flight and hotel search engine**: Trabber - May 14, 2009 - ★★★★★
Trabber is a flight and hotel meta search engine which simultaneously searches on the main travel providers: online travel agencies, lowcost carriers, traditional airlines and hotel booking sites. Results are displayed in a rich interface page which simplifies their sorting, filtering, comparison and selection.
<http://www.trabber.com>

A search box on the right side of the page is labeled "Search for apps by tag" and contains a search button.

GWT Designer

by Instantiations



Google Web Toolkit



Brief history & roadmap



A brief history

May 2006	1.0	GWT launch at JavaOne
Aug 2006	1.1	Auto resource injection
Nov 2006	1.2	Mac OSX support added
Jan 2007	1.3	Completely open sourced
Mar 2008	1.4	1 million+ downloads
Oct 2008	1.5	Java 5 language support
Apr 2009	1.6	New war project layout



Roadmap beyond 1.6

- Developer Guided **Code Splitting**
- Story of Your Compile (**SOYC**)
- **In-browser hosted mode** (OOPHM)
- **UI Binder**
- **ClientBundle**
- Faster **GWT Compiler**
- Faster & more compact **RPC**
- **Much more..**



GWT talks at Google I/O

(<http://code.google.com/events/io/>)

- GWT can do WHAT? - Bruce Johnson
- Measure in Milliseconds - Kelly Norton
- Architecture Best Practices - Ray Ryan
- The Story of Your Compile / Reading Tea Leaves - Lex Spoon
- Effective GWT - Alex Moffat, Damon Lundin
- Progressively Enhance AJAX w/ GWT Query - Ray Cromwell
- Build Apps with Google APIs - Ray Cromwell
- Fireside Chat - GWT Team

Thank you

Read More

<http://code.google.com/webtoolkit/>

Contact Info

Fred Sauer

Developer Advocate

fredsa@google.com

Questions?

