Sakai and GWT

Toward Improved UX and Easy Web 2.0 Development all in Java

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OpenSyllabus:

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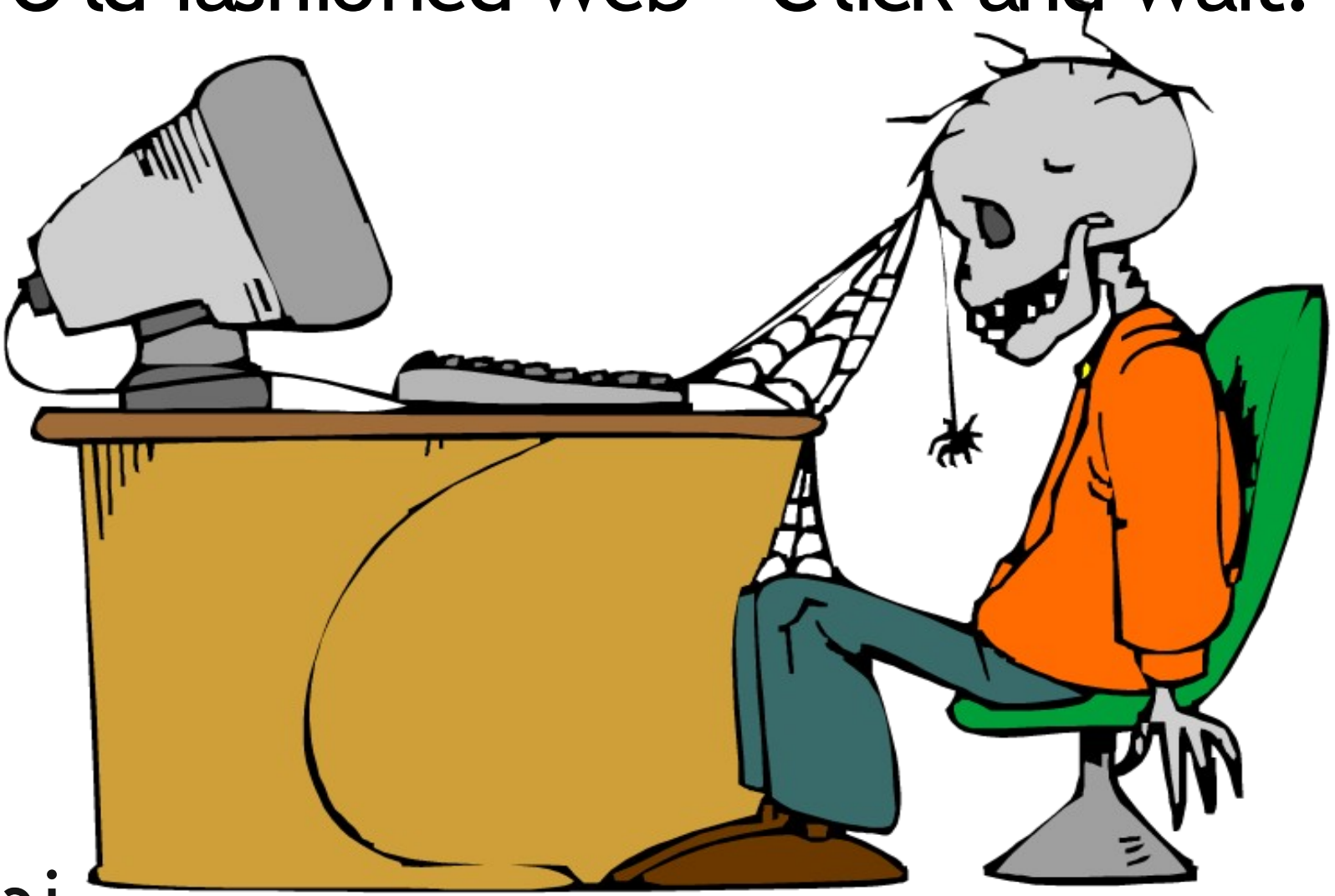
Old fashioned web - Click and wait!



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Web 2.0 : User Experience (UX)

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Web 2.0 : User Experience (UX)

- Perceived 2nd generation of web sites and services
- Improved UX is what Web 2.0 is all about
- Students ask for responsive and dynamic web interfaces and web interface similar to desktop interface
- Sakai must evolve toward Web 2 and deliver a better UX
- Improving UX ➔ more complex GUI ➔ more work for developers
- How to keep happy users & developers?
- But, great technology doesn't give great UX…
- The real magicians are the UI designers

OpenSyllabus - Short Demo

- What we have done with OpenSyllabus...

AJAX - A breakthrough!

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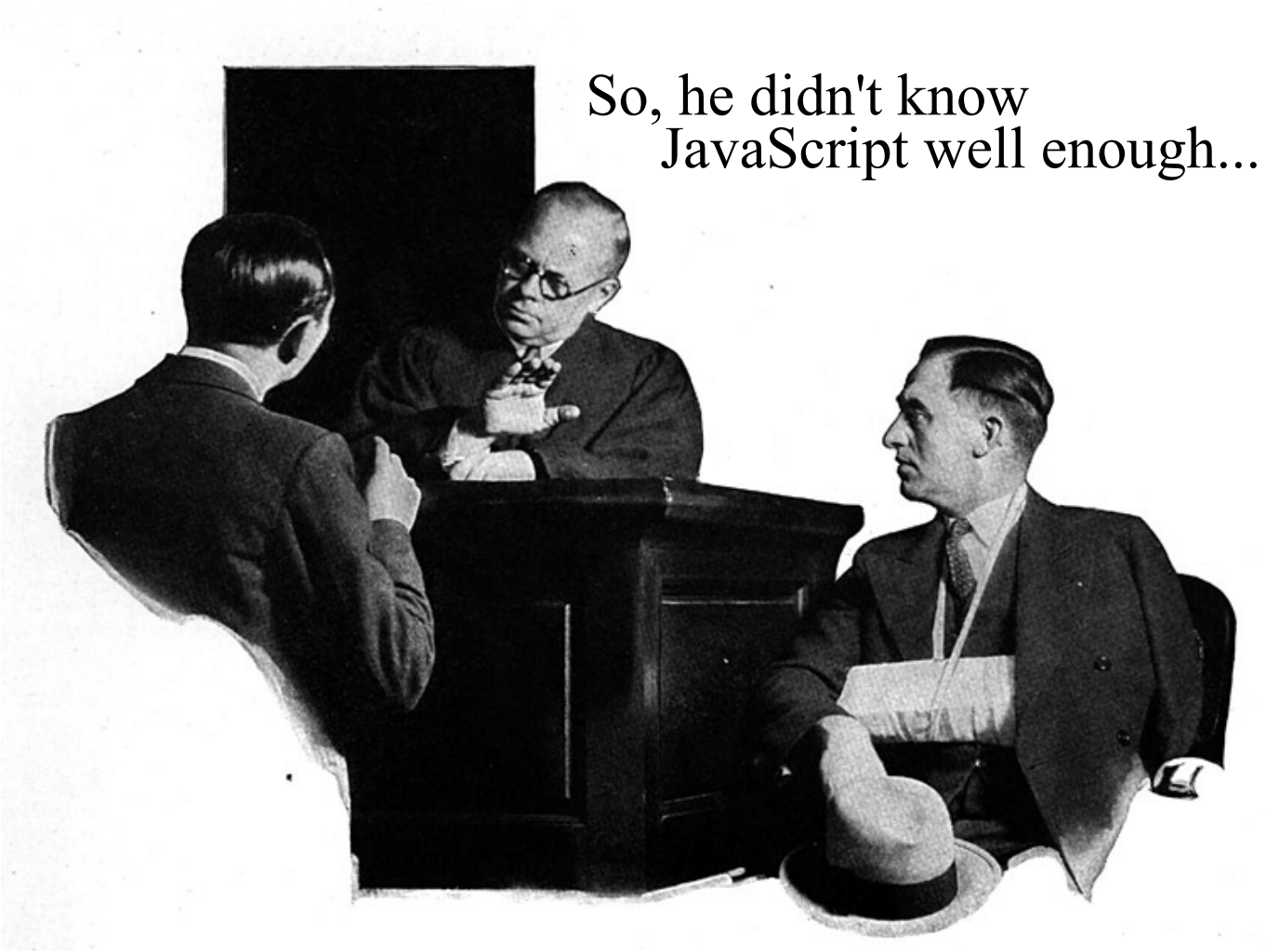
AJAX - A breakthrough!

- Ajax eliminates painful page loading!
- Ajax stands for Asynchronous JavaScript and XML
- XMLHttpRequest JavaScript Object allows asynchronous requests for data to the server and updates the web page without doing a full page reload
- Invented by Microsoft
- Without Ajax we were still stuck with click and wait interface
- The result is more responsive and dynamic Webapps
- But, Ajax is based on Client-side JavaScript

Looking for a silver bullet...

- Hundreds of JavaScript Libraries and Ajax Frameworks
- Which one will be the good one?
- Survey of Sakai's Ajax and alternative technologies:
  - UX Richness of the libraries
  - Easy dev, quick learning curve
  - Easy integration with Sakai
  - Open Source License
  - Documentation
  - Endorsement
  - Cross browsing compatibility
  - Java based
  - Dev tools / IDE (eclipse)
  - Debugging/Test

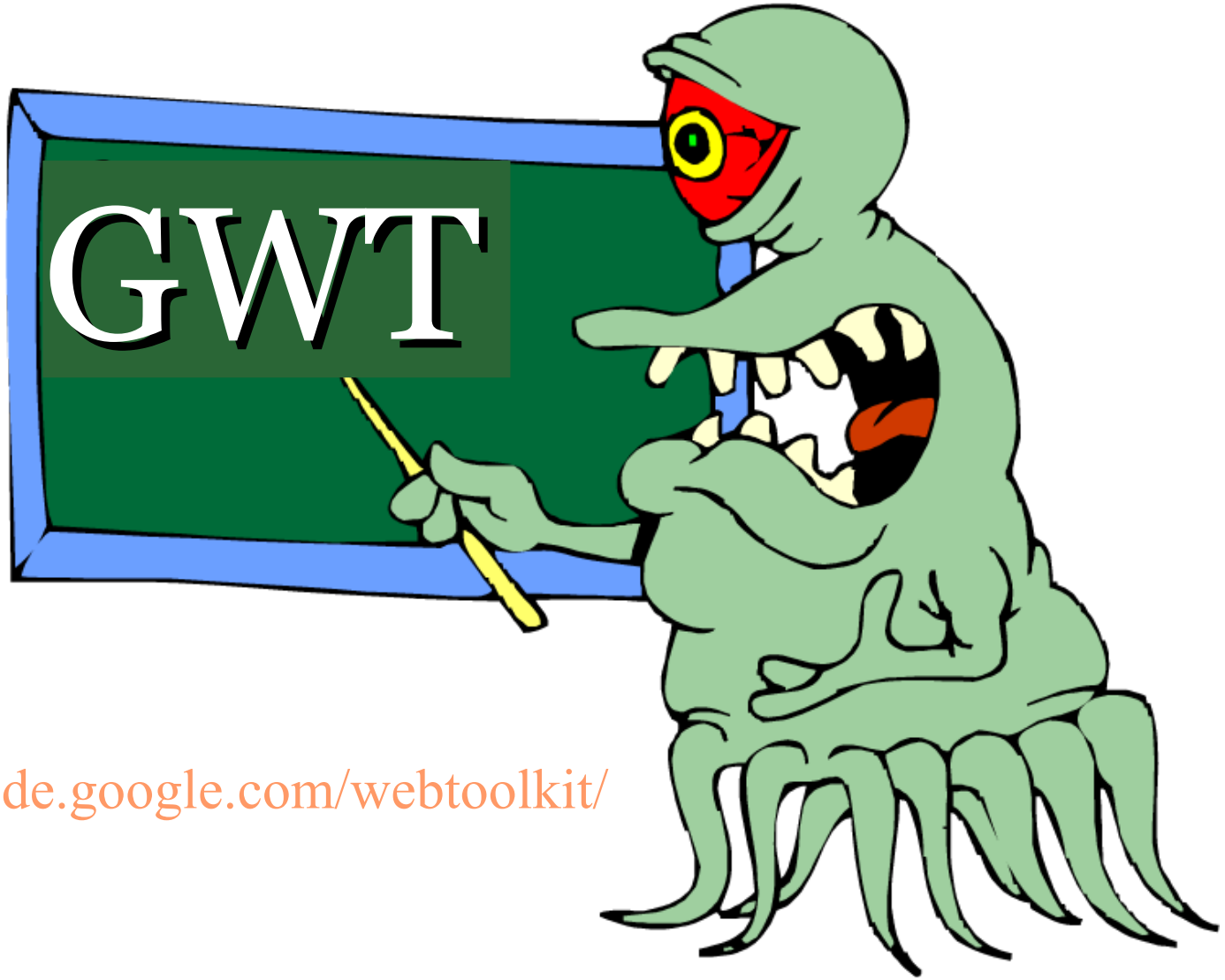
Problems with JavaScript...



Problems with JavaScript

- Real JavaScript gurus are rare.
- JS implies, working around browser quirks, memory leaks and long load times
- Not a real OO programming language
- Not designed for big programs
- Lack of modularity, scalability and development & debugging tools
- Some JS tools are good and some not very good.
- Good JS libraries like (JQuery or YUI) makes much easier to use JS but it's still JS coding.

What is GWT



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

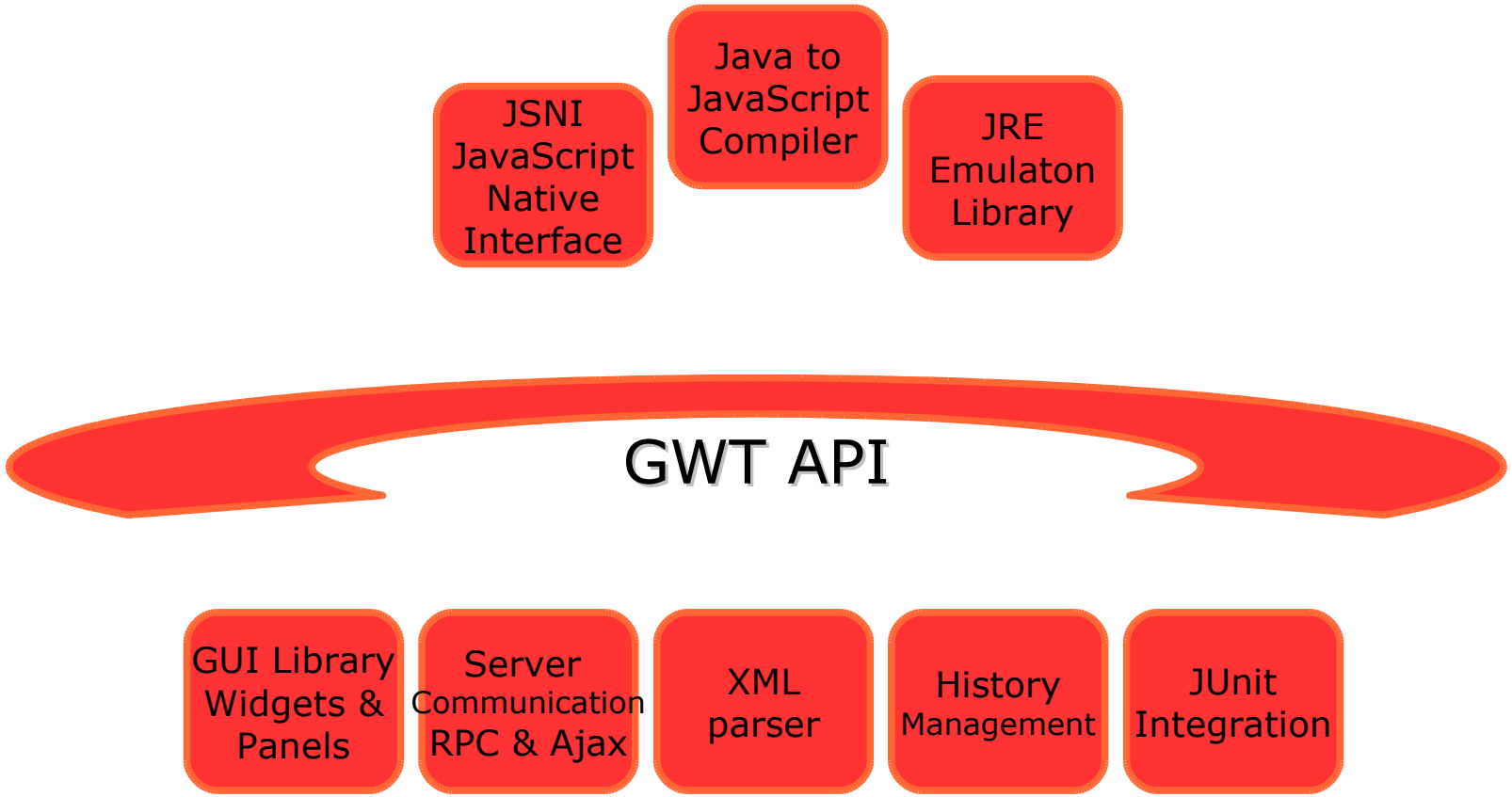
What is GWT

- GWT (Google Web Toolkit) is nothing less than a completely original approach to web development that allows Java developers to create Rich Webapps without having to write any JavaScript.
- GWT Cross-Compiler takes client side Java code and generates cross-browser JS.
- Support Internet Explorer, Firefox, Mozilla, Safari, and Opera browsers
- In short, you write, test and debug your client-side code in Java and let GWT cross-compiler convert it all into cross-browser JS.
- Client-side is then pure JS & HTML.

GWT is all Java

- JAVA to JS Cross-Compiler
- Friendly Open Source Apache 2 license
- Community support
- Improving quickly
- Hosted Mode using JVM for quick dev. cycle
- IDE integration Eclipse, Netbeans, IntelliJ
- Rich built-in Ajax library
- Rich UI libraries similar to SWING
- Only one language : JAVA

GWT - Architecture Overview



GWT - Cross-Compiler Java to JS

Write Once...

Java

JavaScript

Run Everywhere!

GWT version 1.5 supports :
* Firefox 1.0, 1.5, 2.x, 3.0
* Internet Explorer 6, 7
* Safari 2.0, 3.0
* Opera 9.0

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GWT - Communication library & Ajax

- RPC (Remote Procedure Call)
- REST (REpresentational State Transfer)
- Basic Ajax tools:
  - HTTPRequest
  - RequestBuilder
  - FormPanel
- Support for complex data
  - JAVA SERIALIZATION
- And also:
  - XML
  - JSON (JavaScript Object Notation)

GWT - JSNI: JavaScript Native Interface

- GWT simplifies integration with existing JS code
- JavaScript ⇔ Java
- Automatic inclusion of external JavaScript

GWT - User Interface Library

- Widgets & Panels
- Handling Events
- CSS support
- I18N

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Widgets & Panels

- Standard HTML tags, such as img, anchor, hyperlink
- Button, radio button, toggle button, checkbox button
- Menus, cascading-menus, drop down menus
- Text Box, Text Area
- Tabs, ListBox, Dialog Box
- Splitters
- Complex widgets such as Tables, File Upload boxe, Tree widgets, Rich Text Editor
- Panels helps for the layout

GWT - Handling Events

- Use the "listener interface"
- Similar to SWING

```
Button aButton = new Button("Click Me");
aButton.addClickListener(new ClickListener() {
        public void onClick(Widget sender) {
        // handle the click event
        }
});
```

GWT - CSS Support

- Separation of code and presentation
- 3 methods to manage style name
  - setStyleName
  - addStyleName
  - removeStyleName
- Java code :

```
public ListWidget(String Item) {
    ...
    setStyleName(¨gwt-ListWidget¨);
}
```

- CSS file :

```
.gwt-ListWidget {
    background-color:black;
    color:lime;
}
```

I18N

- Built-in I18N mechanism
- Based on properties files
- GWT generates different versions of your Webapp for each language
- At the runtime, GWT will choose the appropriate version

GWT – Browser's History Management

- Use the browser's "back" button correctly
- Simple History API based on a stack of tokens

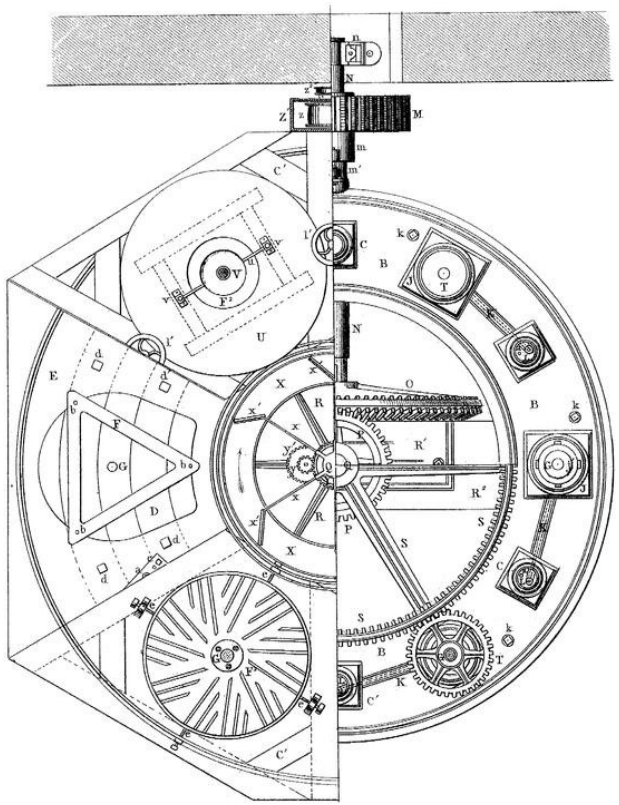
```
History.newItem("newToken")
```

- HistoryListener

```
History.addHistoryListener(controller)
```

GWT – Software Engineering for Ajax

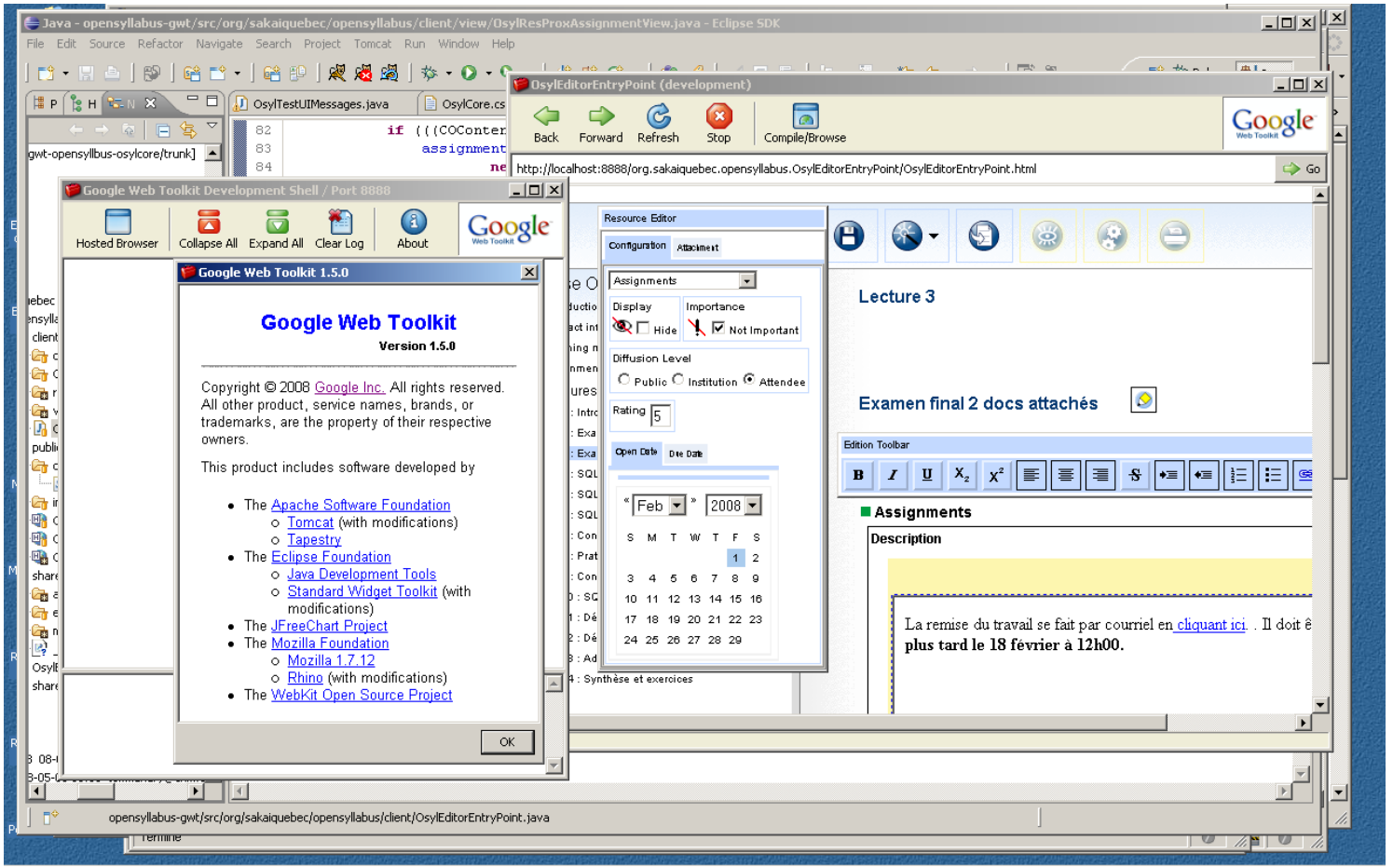
- Using advanced software engineering
- Using establish OO design patterns
- Using powerful Java IDE
  - Edit / test / debug / refactor cycle
  - Debugging support
  - Compile-time error checking
- Testing & Debugging in "Hosted Mode"
- Logging support
- JUnit support



GWT - "Hosted mode"

- GWT Webapp can run in "Hosted Mode"
- In "Hosted Mode", a JVM executes the GWT code inside an embedded browser window
- Running GWT Webapp in "Hosted Mode" makes debugging easy
  - Edit your source
  - Refresh
  - See the results

GWT - "Hosted mode"



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GWT - "Web Mode" / Deployment

- Once tested in "Hosted Mode", you can compile your Java source code to JavaScript
- When compiled the Client-side is now pure JavaScript and HTML
- To deploy your Webapp in production, you would move the files in your www/... directory to your web server

GWT integration into SAKAI

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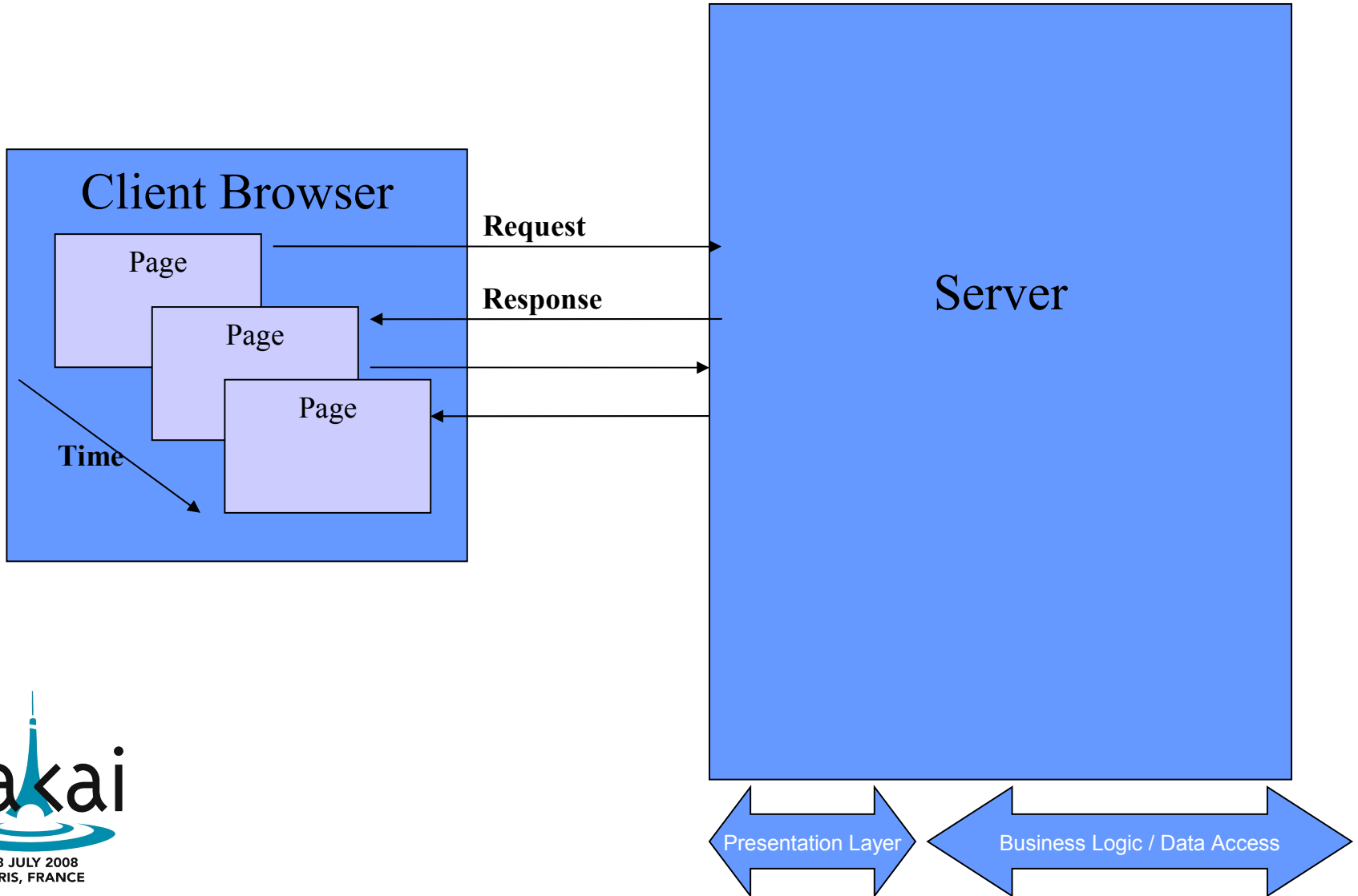
GWT integration into SAKAI

- A « Sakai tool » based on GWT
- Sakai platform used as Stateless Server (backend part of Sakai)
- JSP entry role
- RPC servlet
- Spring/Hibernate relations (difficulties … solutions)
- Client MVC Architecture
- SDATA

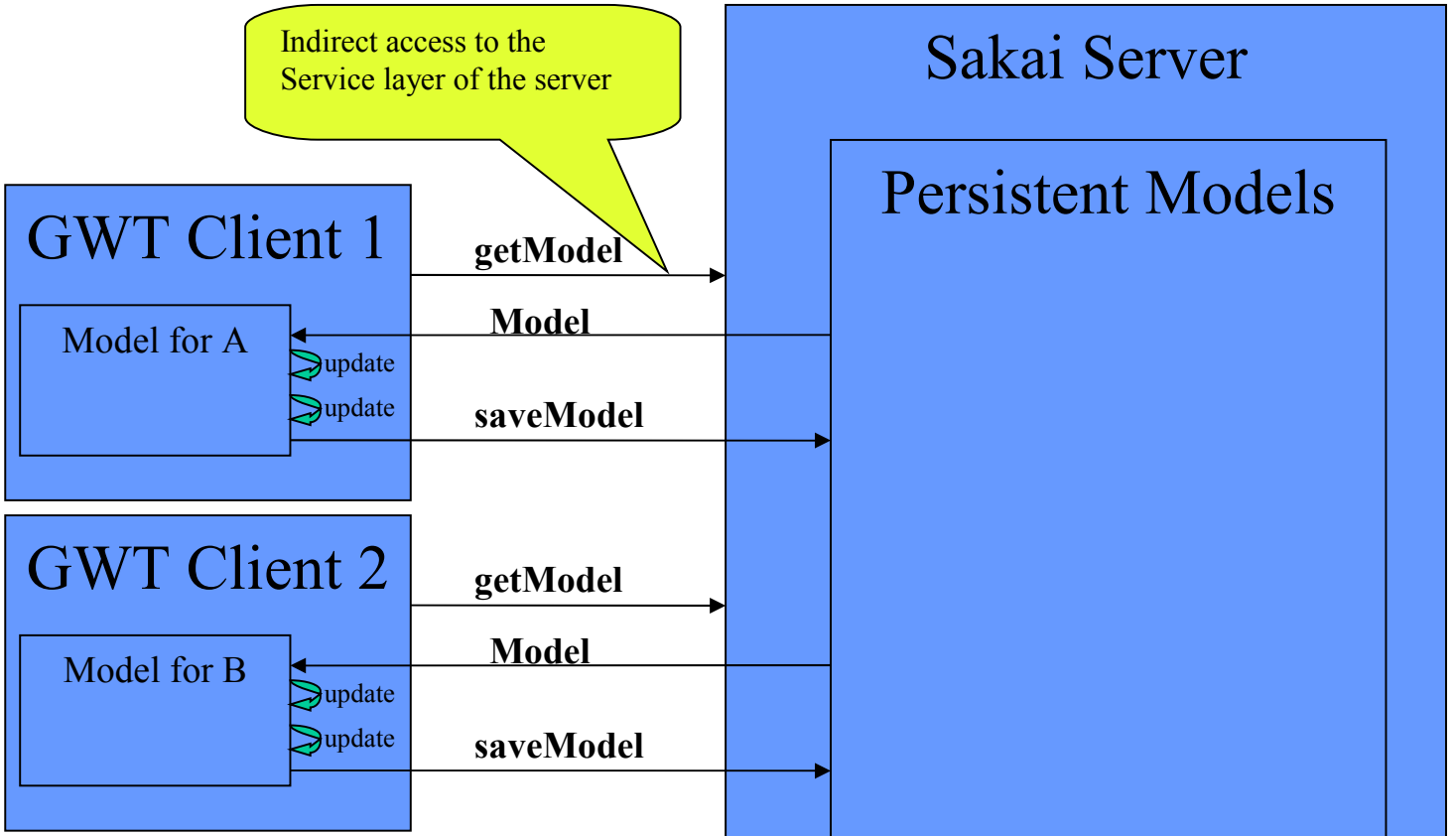
GWT integration into SAKAI

Traditional WebApp



GWT integration into SAKAI

Sakai platform used as Stateless Server (backend part of Sakai)



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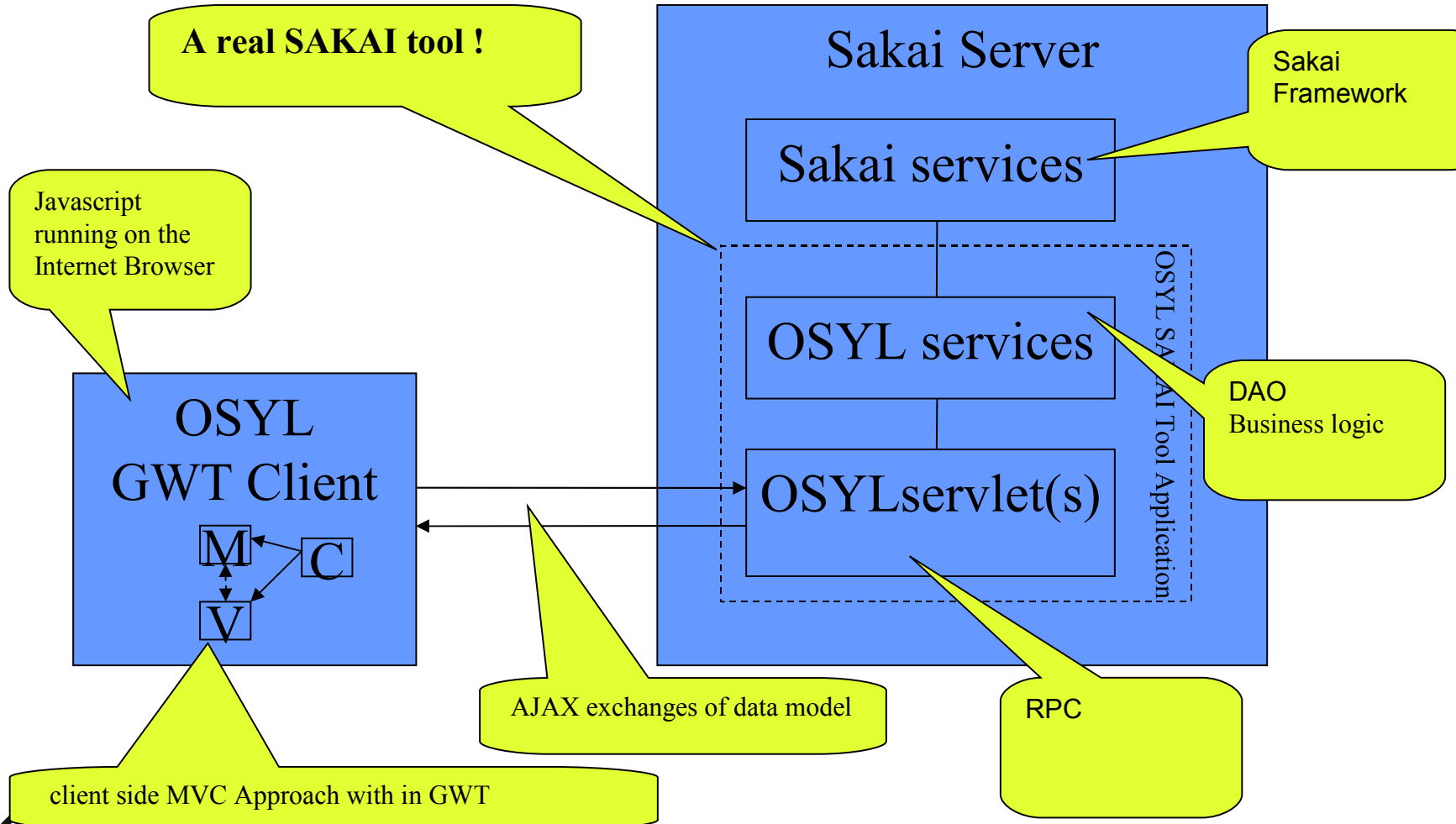
Presentation Layer

Business Logic / Data Access

GWT integration into SAKAI

Sakai platform used as Stateless Server (backend part of Sakai)



GWT integration into SAKAI

App File structure, what's new?

- 3 main directories
  - API(interfaces)
  - Impl(implementations)
  - Tool(webapp)
    - src/java
      - RPC servlets
      - RPC Interface
    - src/webapp
      - Index.jsp
      - Folder of the compiled GWT content (js,html...)

GWT integration into SAKAI

Where is GWT source code?

- 2 projects:
  - One for the backend part (sakai webapp shown previously).
  - One project for the presentation layer, the client part (i.e the GWT Source code).

GWT integration into SAKAI

Compilation/deployment scripts steps

- 3 possible use cases:

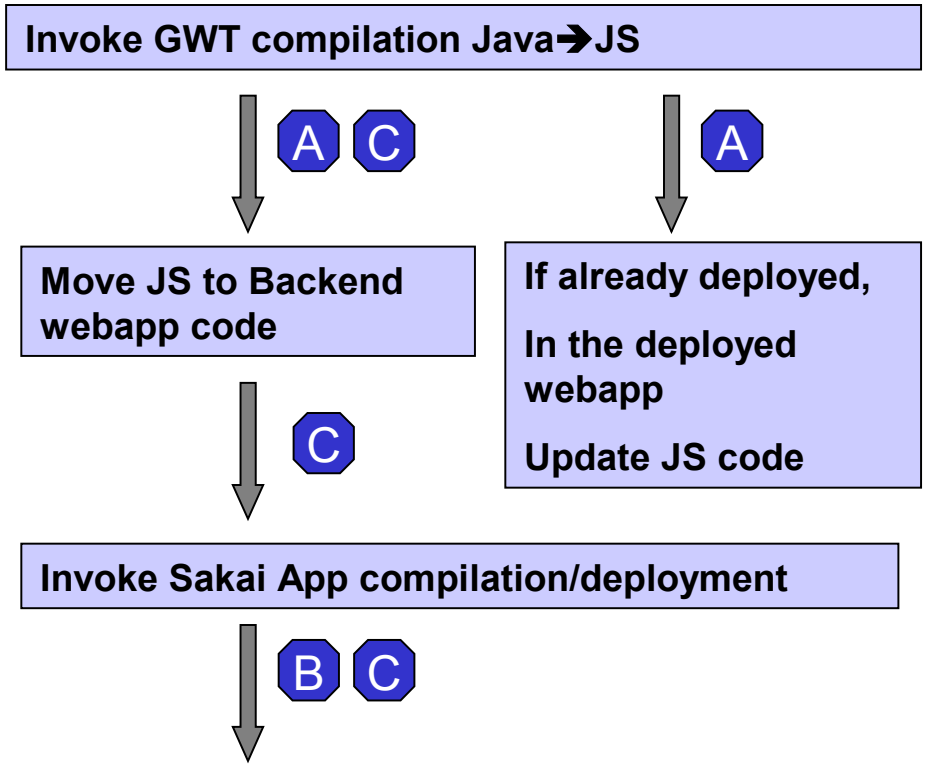
  A. Client update only

  B. Backend update only

  C. RPC interface update or Full compilation

  ➔ A only or B only make faster the developement cycle

  Note: A only can either run in hosted or web mode.



To save time, use hosted mode as much as possible for client code developments

GWT integration into SAKAI

JSP main roles

- Gives access to the GWT compiled JS (slots)
  - Can also use some logic to choose between different javascript compiled application

```
…
<!-- This script loads our GWT compiled module.                -->
<script language='javascript'
src='org.sakaiquebec.opensyllabus.OsylEditorEntryPoint/org.sakaiquebec.opensy
llabus.OsylEditorEntryPoint.nocache.js'></script>
```

GWT integration into SAKAI

JSP main roles

- Provides the CSS Link

```
<link rel="stylesheet" type="text/css"
href="osylcoconfigs/default/skin/osylcore.css" />
```

- Initializes some META to set the language (I18N)

```
…<%@ page import="org.sakaiproject.util.ResourceLoader"%>

…

<%

ResourceLoader rb = new ResourceLoader();

Locale sessionLocale = rb.getLocale();

String locale = sessionLocale.toString();
…

%>

<html>

<head>

<meta name="gwt:property" content="locale=<%=locale%>">
…
```

GWT integration into SAKAI

JSP main roles

- Controls the tool display size

```
...
<html>
<head>
...
<!-- Headers from Sakai                          -->
<%= request.getAttribute("sakai.html.head") %>
<script> // Size of the JS application
function myLoad() {
setTimeout("<%=request.getAttribute("sakai.html.body.onload") %>", 500);
}
</script>
</head>
<body onload="myLoad()">
```

GWT integration into SAKAI

Servlets main roles

Servlets are used for:

- RPC from GWT client
- Indirect Spring services access
- Security management
- Extra request information access

GWT integration into SAKAI

Servlet and tool configuration

- Sakai tool
  - Tool Registration is done by providing the tool xml file.

  Ex: webapp/tools/sakai.opensyllabus.tool.xml file
  - And configuring the web.xml

webapp/tools/sakai.opensyllabus.tool.xml

```
<?xml version="1.0"?>
<registration>
        <tool
                id="sakai.opensyllabus.tool"
                title="OpenSyllabus"
                description="Sakai OpenSyllabus Tool">
                <category name="course" />
                <category name="project" />
                <keyword name="GWT,syllabus" />
        </tool>
</registration>
```

```
…
<listener><listener-class>org.sakaiproject.util.ToolListener</listener-class></listener>
…
```

- GWTRPC Servlet:

```
public class OsylEditorGwtServiceImpl extends RemoteServiceServlet implements
        OsylEditorGwtService {
```

- Other web.xml configuration Sakai filters, servlet definitions …:

GWT integration into SAKAI

SPRING: How to join spring services from the RPC servlet?

3 explored possibilities:

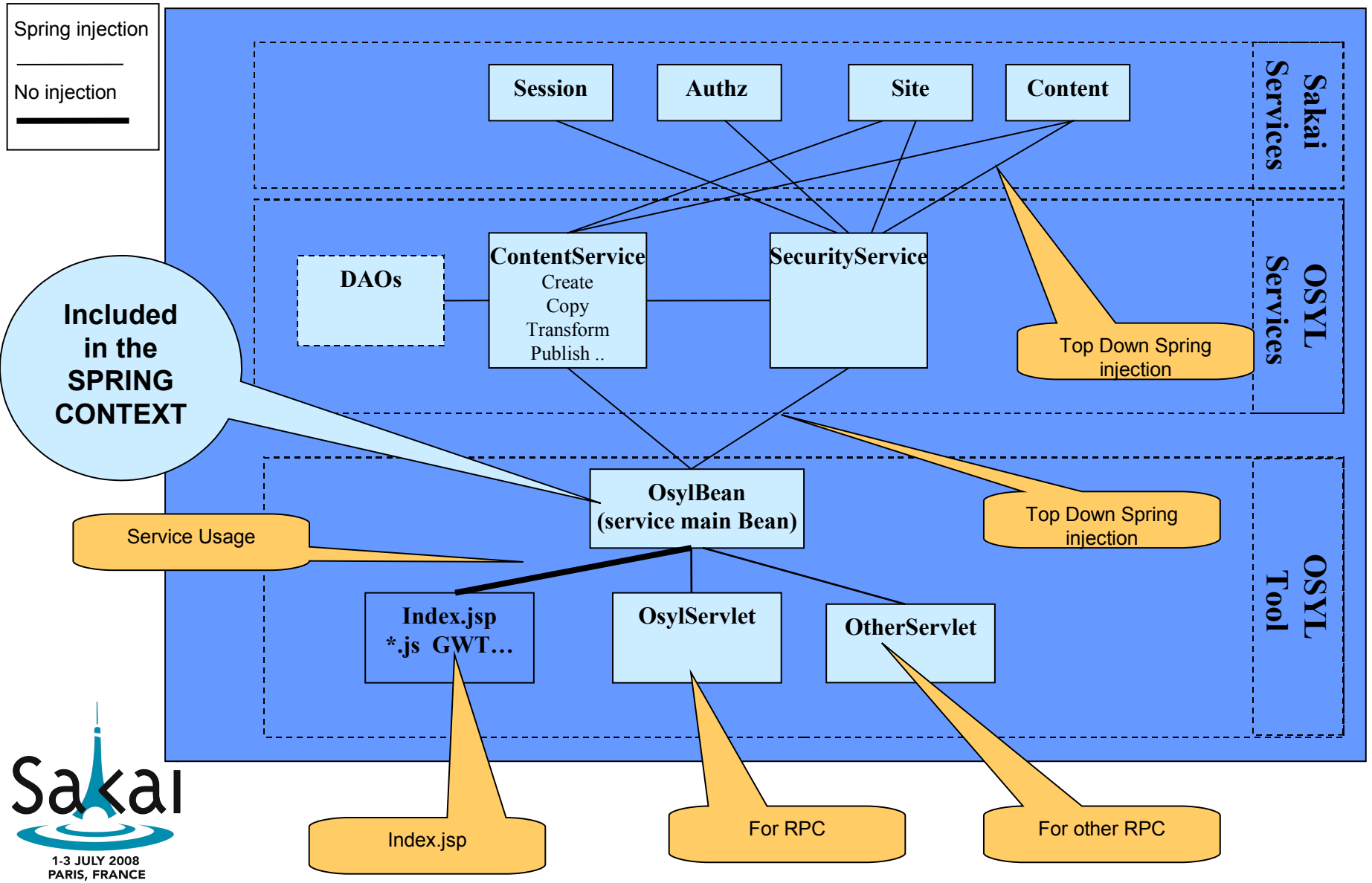
- Centralized approach: Using the applicationContext with one main backing bean able to join other services
- Not centralized: Call the Spring services as your need from your RPC servlet:

```
import org.springframework.web.context.WebApplicationContext;
...
void myRPCmethod(){
        WebApplicationContext context = WebApplicationContextUtils.getWebApplicationContext(getServletContext());
        osylSiteExplorerService = (OsylSiteExplorerService)
        context.getBean("org.sakaiquebec.osylsiteexplorer.api.OsylSiteExplorerService");
        …
}
```

- Other approach Spring service mapping: http://g.georgovassilis.googlepages.com/usingthespringgwtcontroller

GWT integration into SAKAI

SPRING: Centralized approach for Tool



GWT integration into SAKAI

Spring backing bean

- Main backing bean, included in Spring context
  - Define a webapps/WEB-INF/applicationContext.xml
  - Include a contextLoaderListener into your webapps/WEB-INF/web.xml:

```
<listener>
<listener-class>org.sakaiproject.util.ContextLoaderListener</listener-class>
</listener>
```

GWT integration
Client Design principles

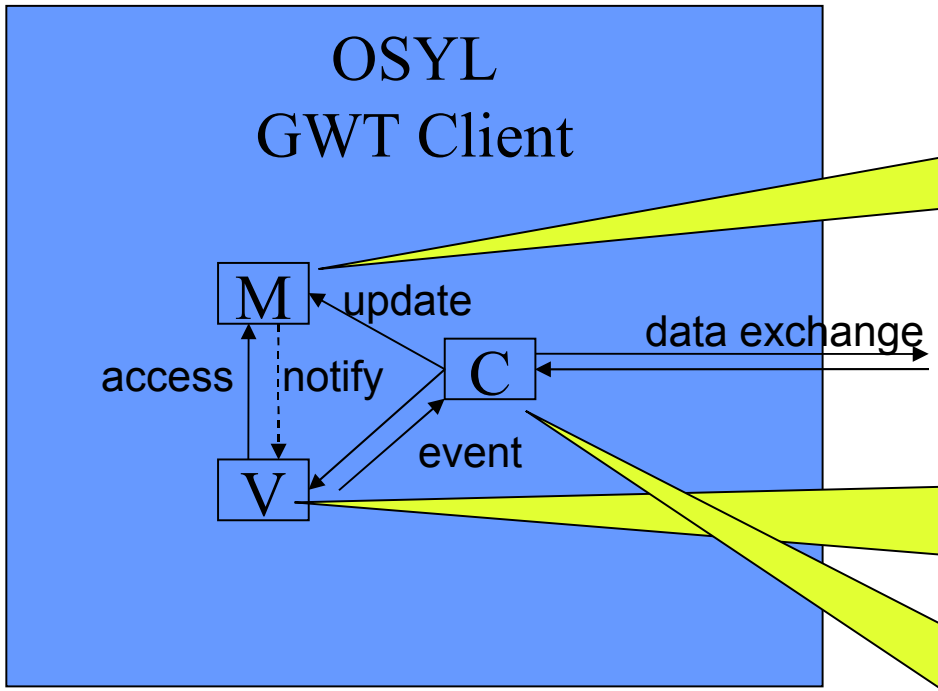
- Big paradigm shift for traditional web development (server based to client oriented)
- Main client design pattern MVC + Observer + Event driven
- Reusable views components (gwt.Composite)
- Client model as JAVA classes (DATA -> POJO)
- Asynchronous programming (Callbacks)
- RPC, REST / Java Serialization, XML, JSON
- Security: server based

GWT integration
GWT Composite class

- Reusable views components (gwt.Composite)
- Aggregation of GWT widgets but also Composites

```
…
import com.google.gwt.user.client.ui.Composite;
…
public class OsylTreeView extends Composite {
        private Tree osylTree;
…
}
```

GWT integration
Client MVC



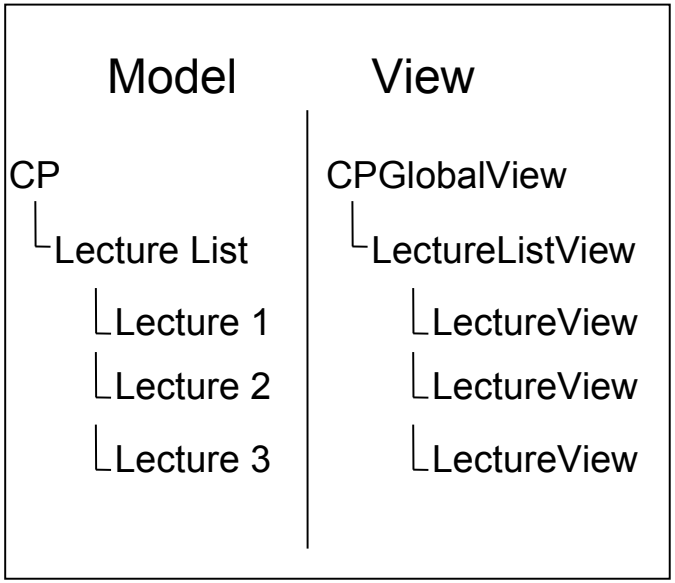
Model:
POJO(GWT)
Notify events to subscribers (views) on model update

View:
Display the data and manage the user event on GUI.
In GWT: composite

Controler:
Makes the relationship between models and views
Listen to view events and manage user's actions

GWT integration
Client MVC specific approach

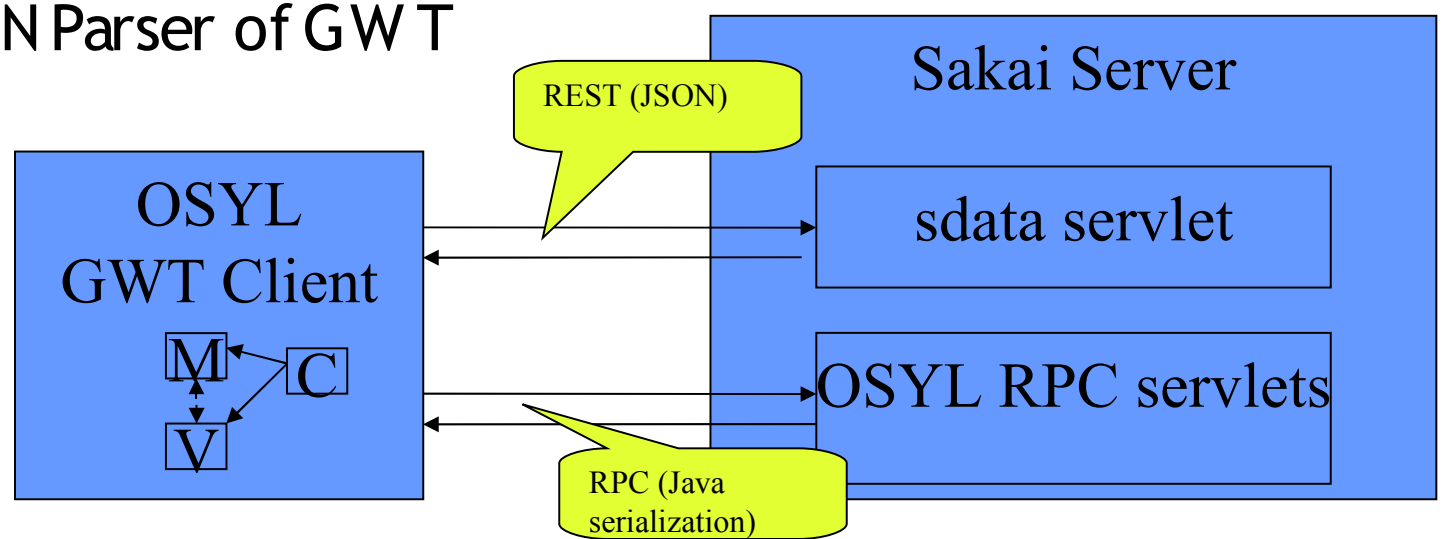
- More a M&VC approach
- Hierarchical nature of our data (tree) ➔ Hierachical views (HMVC)
  - Composite view aggregates other composite views and so on…
  - And each view are based on a sub-model part of the model
  - Tight relation between model update and related view update (thanks to events)



GWT integration into Sakai

Leveraging Sakai technology

- SDATA
  - A REST Servlet in Sakai, Data exchanges in JSON format (site data, resource data etc..)
  - Used to create or read data from the Sakai's resources repository
  - JSON Parser of GWT



GWT integration into Sakai
Difficulties & solutions

- Spring – GWT wiring ➔ ApplicationContext
- Dealing with Hosted Mode vs Web mode ➔Mockup data for the hosted mode
- I18N not dynamic ➔ develop our own mechanism
- CSS: still browser's dependent ➔ check with different browser
- GWT is a toolkit not a framework, this means that GWT does not prescribe a way to build an application ➔ established our own design guidelines
- Third party libraries : GWT-ext license change, different quality of components ➔ be careful
- Third party tools: GWT-Designer: very promising but ➔ we recommend to use it for mockup and UI design.

Pro & Cons

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Advantages

- Development time efficiency
- Quicker response to user's actions
- Powerful & efficient in resources usage both network & server
- Good to add Ajax to Webapps
- Good to build complex “desktop-like” applications
- Rapid development and debugging with common IDEs as Eclipse
- Open source, free and well documented
- Only one language : JAVA
- Rich libraries of components
- Familiar to Java developers
- Supported by GOOGLE...
- Not magic but has the potential to be the "next big thing"

Disadvantages

- Needs good knowledge of Java programming
- Components (Widgets) are from different sources and qualities
- Depends on cross-compiler performances
- Few cross-browser compatibility problems (really?)
- Need to learn CSS & restrictions of browser-based apps
- We have to keep an eye on security issues!
- GWT is a toolkit not a framework
- GWT won't solve every problem you may encounter creating Ajax or RIA

What's next ?

- Release our code to the SAKAI community
- Rewrite using Java 1.5 and generic types
- Experiment Sakai portal tool (OSYLSiteExplorer)
- Create SAKAI GWT library
- Explore Accessibility using GWT 1.5
- Improving performance
- SOLO mode (Google Gears)
- Improve benefit from the OpenSource Google API ecosystem
  - Simplified GWT APIs for : Ajax Search, Gears, Gadgets and Maps
  - http://code.google.com/p/gwt-google-apis/

SAKAI + GWT - The next big thing!

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Resources and books

- *Google Web Toolkit Applications*
  by Ryan Dewsbury
  Prentice Hall
  (December 15, 2007)
  www.gwtapps.com

- *Google Web Toolkit Solutions*
  by David Geary, Rob Gordon
  Prentice Hall
  (November 17, 2007)
  www.coolandusefulgwt.com