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ПО РАЗРАБОТКА НА СОФТУЕР

AJAX Applications with Google Web Toolkit (GWT)

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What is Google Web Toolkit (GWT)?

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What is GWT?

- **Google Web Toolkit (GWT) is:**
  - **Open source framework for easy creating rich AJAX applications with Java**
  - **Powerful JavaScript code generator**
  - **You write code in Java and it is compiled to JavaScript**
    - **Pure JavaScript / DHTML at the client side**
    - **Supports Firefox, IE and Safari**
    - **Pure Java at the server side**

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Why GWT?

- No need to learn/use JavaScript language
  - Leverage existing Java skills
- No need to handle browser incompatibilities
  - GWT handles them for you
- No need to learn/use DOM APIs
  - Use pure Java APIs
- No need to handle forward/backward buttons
  - GWT handles this for you
- No need to build commonly used widgets
  - GWT provides most of them

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GWT Features

- GWT provides to developers:
  - API for creating GUI applications, similar to Swing and SWT
  - API for manipulating the Web browser's DOM (Document Object Model)
  - Java-to-JavaScript compiler
    - JavaScript skills not required
  - Environment for running and debugging GWT applications called **GWT Shell**

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Hosted and Web Mode

- GWT applications can run in hosted and Web mode
- Hosted mode
  - Java bytecode runs in the JVM, in the GWT Shell environment
  - Allows debugging
- Web mode
  - JavaScript/HTML runs in the Web browser

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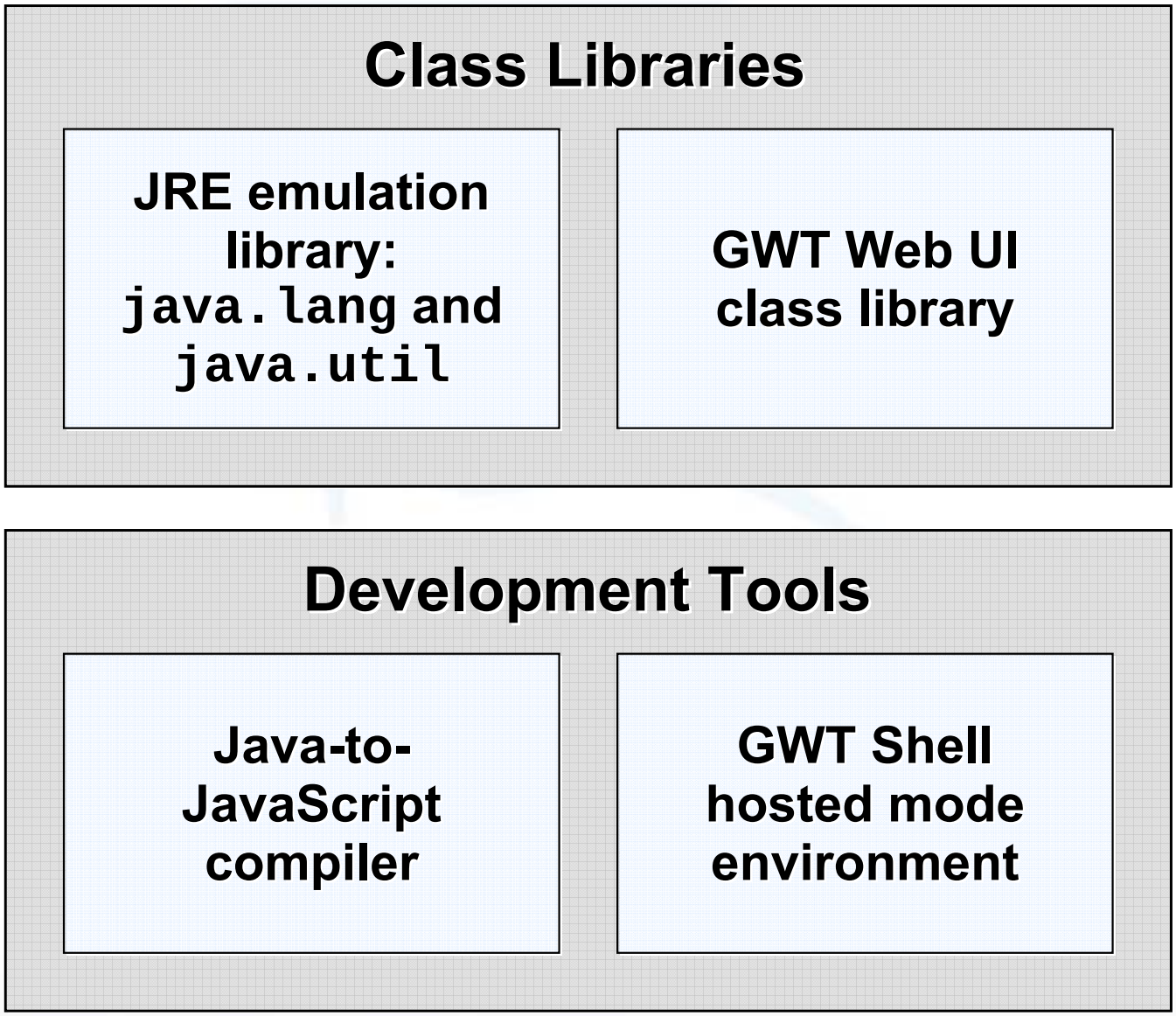
GWT Architectural Components



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

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Getting Started with GWT

Downloading and Installing GWT
Creating GWT Projects

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Download / Install GWT

- GWT is free and open source
- Download the latest version from: http://code.google.com/webtoolkit/
  - It is ZIP file, e.g. `gwt-windows-1.4.60.zip`
- Extract the archive. It contains:
  - `applicationCreator`, `projectCreator` – create Eclipse/Ant based GWT projects
  - `samples` directory – example apps
  - `doc` – reference docs and javadocs

Creating GWT Projects

- Creating GWT project for building with ant

```
projectCreator.cmd -ant MyProject -out c:\myproject
```

- Creating Eclipse project for GWT app

```
projectCreator.cmd -eclipse MyProject -out c:\myproject
```

- Creating GWT module and scripts for compilation and execution

```
applicationCreator.cmd -eclipse MyProject -out
c:\myproject example.client.MyProject
```

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Creating GWT Projects

Live Demo

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Creating GWT Modules

Creating Modules,
Adding Widgets, Handling Events

GWT Modules

- **GWT module** is a set of files that define the client side and server side of a GWT application or library
  - Client side
    - HTML, CSS and images
    - Java code that is compiled to JavaScript
  - Server side
    - Contains server side Java code, e.g. RPC services invoked from the client code

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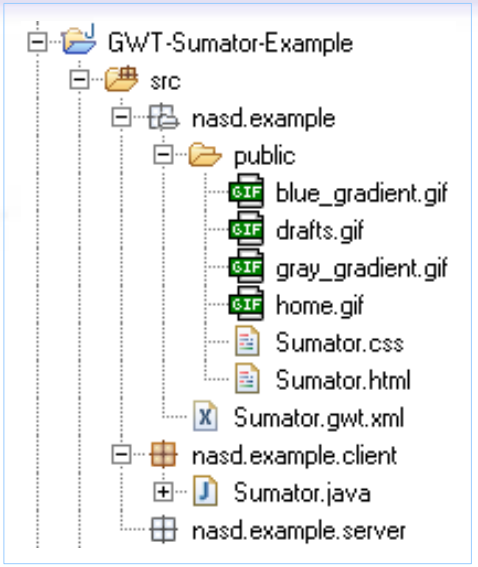
GWT Module Structure



- Each module has:
  - Name: `nasd.example.Sumator`
  - Base directory: `nasd.example`
    - Contains the module structure
  - Public directory: `nasd.example.public`
    - Contains HTML, CSS and images
  - Client code package: `nasd.example.client`
    - Compiled to JavaScript
  - Server code package: `nasd.example.server`
  - GWT module descriptor: `Sumator.gwt.xml`

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GWT – Example

- GWT Sumator is simple application for calculating sum of two integers
  - Adding widgets to the root panel

```
public class Sumator implements EntryPoint {

    private TextBox textBoxNumber1 = new TextBox();
    private TextBox textBoxNumber2 = new TextBox();
    private TextBox textBoxSum = new TextBox();

    public void onModuleLoad() {
        RootPanel rootPanel = RootPanel.get();

        rootPanel.add(textBoxNumber1, 12, 36);

        rootPanel.add(textBoxNumber2, 88, 35);

        rootPanel.add(textBoxSum, 168, 35);
```

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GWT – Example (2)

- **Handling events**

```
Button buttonCalSum = new Button();
buttonCalcSum.setText("Calculate Sum");
rootPanel.add(buttonCalcSum, 12, 64);

butonCalcSum.addClickListener(new ClickListener() {

    public void onClick(Widget sender) {
        int number1 = Integer.parseInt(
            textBoxNumber1.getText());
        int number2 = Integer.parseInt(
            textBoxNumber2.getText());
        int sum = number1 + number2;
        String sumStr = Integer.toString(sum);
        textBoxSum.setText(sumStr);
    }

});
```

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Creating GWT Sumator

Live Demo

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GWT Widgets and Panels

Creating and Using GWT Widgets

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GWT Widgets

- GWT widgets are UI components
  - Like Swing components but rendered to HTML, CSS and JavaScript
  - Written purely in Java
  - Can manipulate the DOM and modify it dynamically
  - CSS / HTML formatting rules still apply
- Widgets dramatically facilitate creating rich user interfaces in Web

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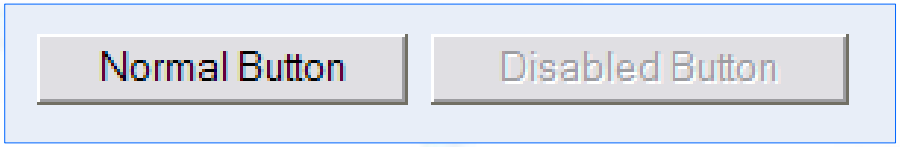
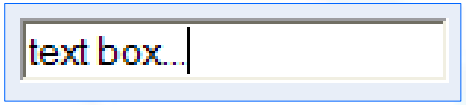
Standard GWT Widgets (1)

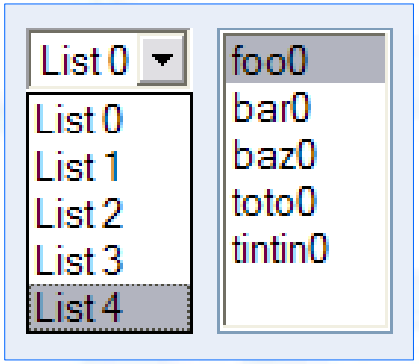
- **Button**



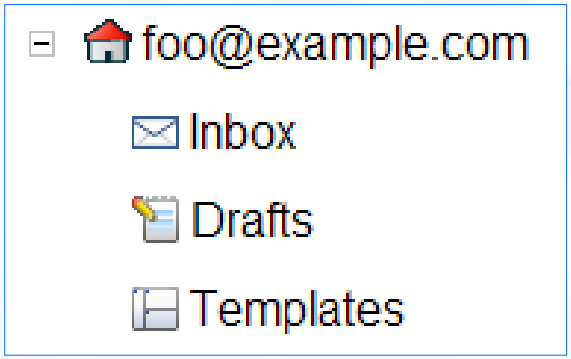
- **TextBox**



- **ListBox**



- **Tree**



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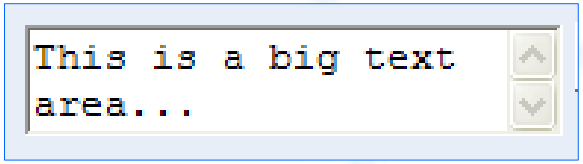
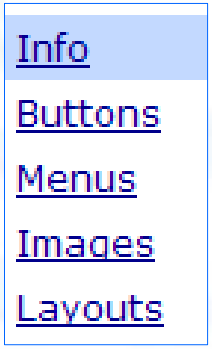
Standard GWT Widgets (2)

- **CheckBox**

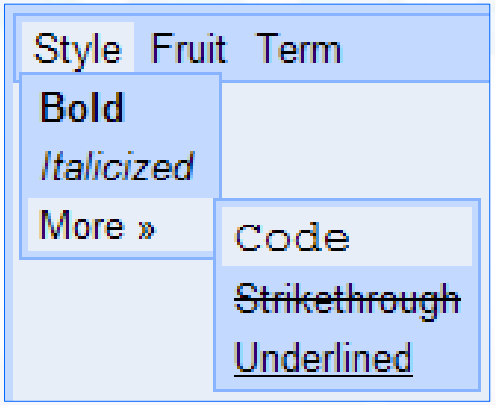
- **TextArea**



- **Hyperlink**



- **MenuBar**



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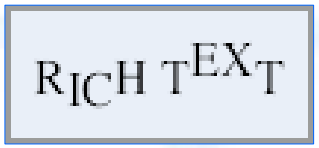
Standard GWT Widgets (3)

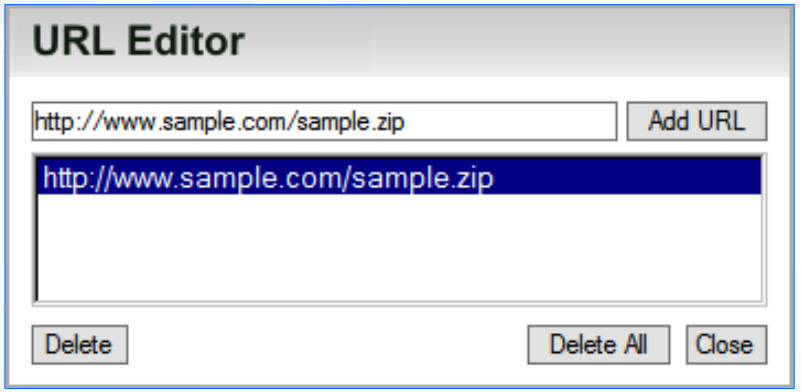
- **RichTextArea**



- **Table**

sender	email
markboland05	mark@example.com
Hollie Voss	hollie@example.com
boticario	boticario@example.com
Emerson Milton	emerson@example.com
Healy Colette	healy@example.com
Brigitte Cobb	brigitte@example.com
Elba Lockhart	elba@example.com

- **DialogBox**



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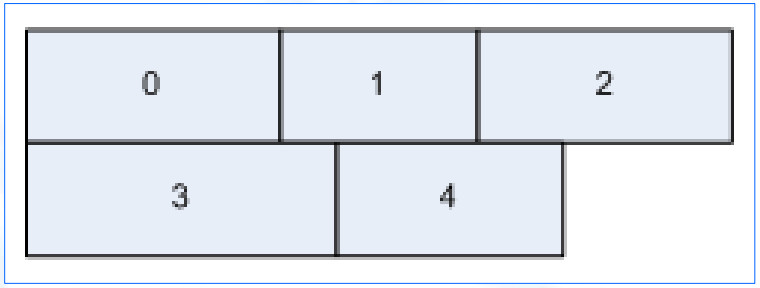
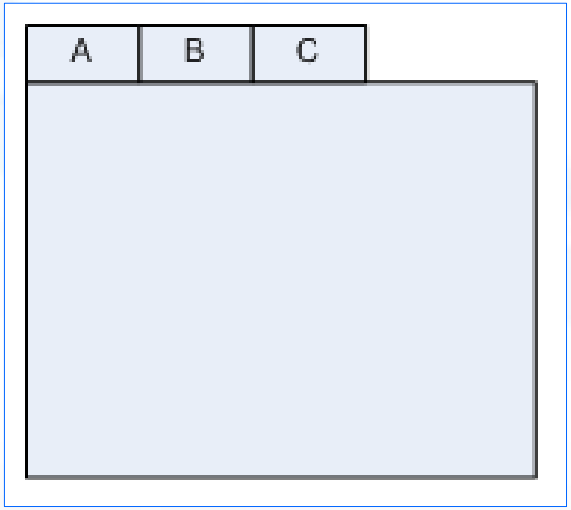
GWT Panels (1)

- GWT panels are container controls that layout widgets in various ways
- `FlowPanel`



- `TabPanel`



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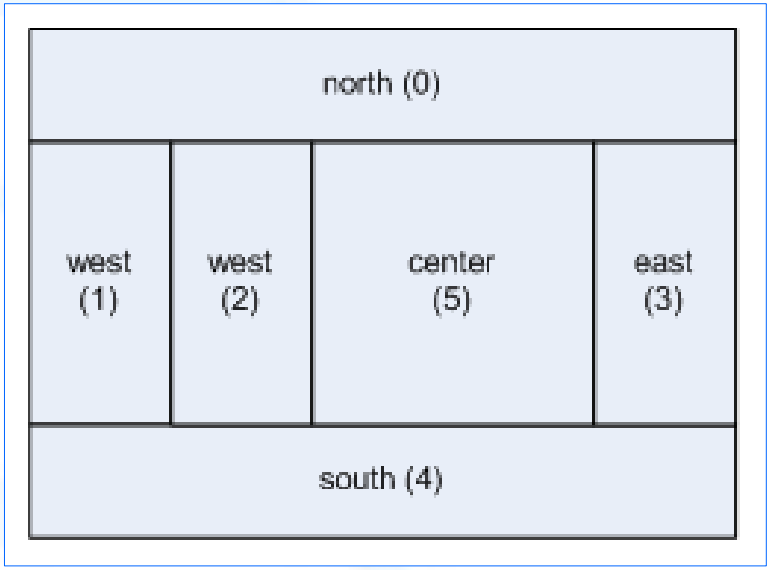
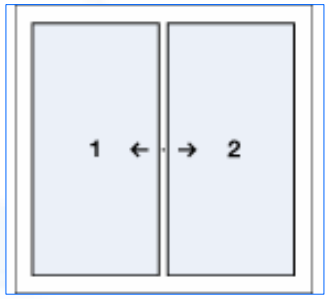
GWT Panels (2)

- **DockPanel**



- **HorizontalSplitPanel**



- **AbsolutePanel**

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GWT KitchenSink Sample

Live Demo

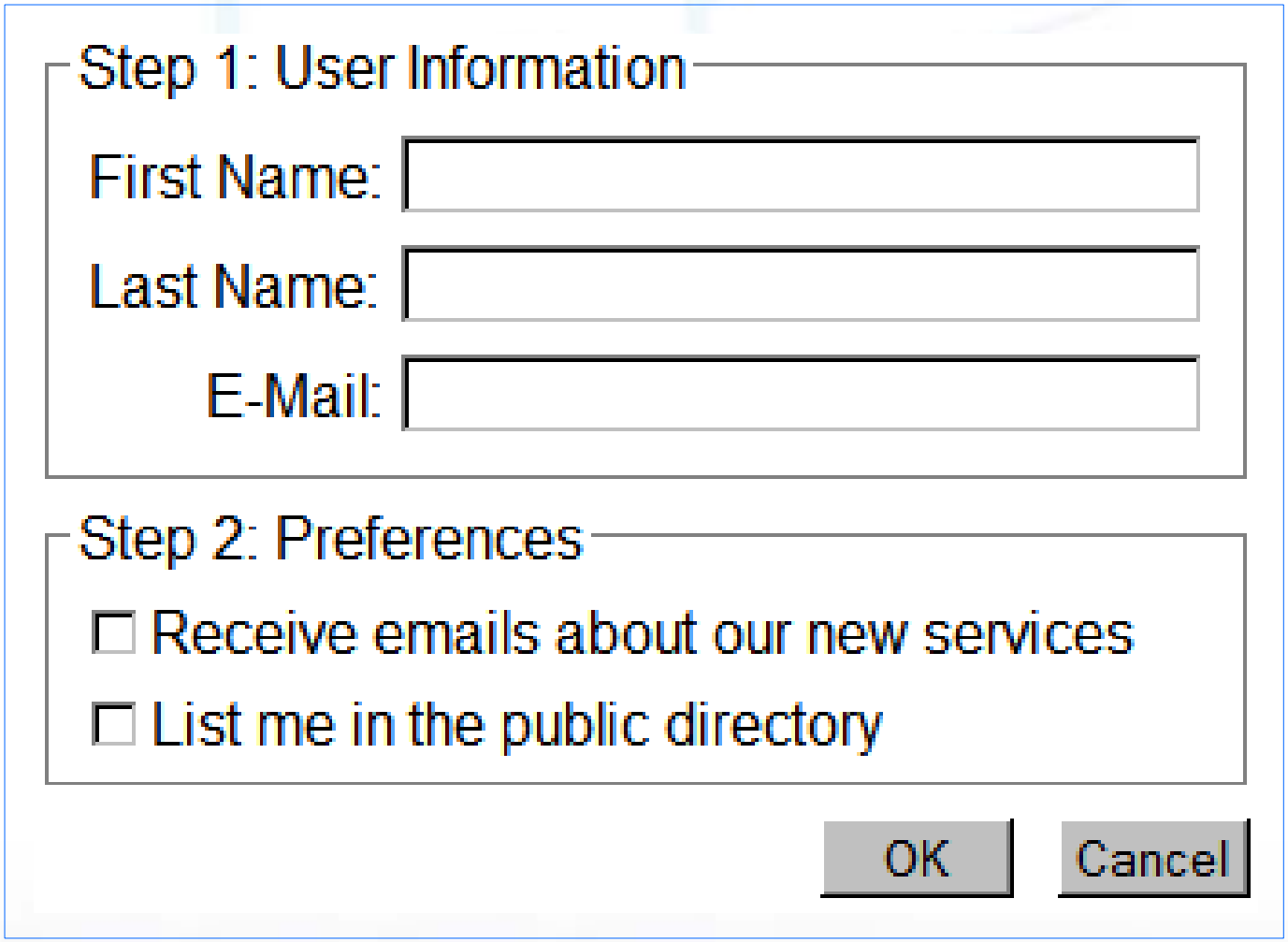
Creating Custom Widgets

- To create a custom widget you can extend the `Widget` or `Composite` class

```
public class GroupBoxPanel extends FlowPanel {
    private Element legend;
    public GroupBoxPanel() {
        Element fieldset = DOM.createFieldSet();
        this.legend = DOM.createLegend();
        DOM.appendChild(fieldset, legend);
        setElement(fieldset);
    }
    public String getCaption() {
        return DOM.getInnerText(this.legend);
    }
    public void setCaption(String caption) {
        DOM.setInnerText(this.legend, caption);
    }
}
```

GroupBoxPanel

- **Example of `GroupBoxPanel`**



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GroupBoxPanel

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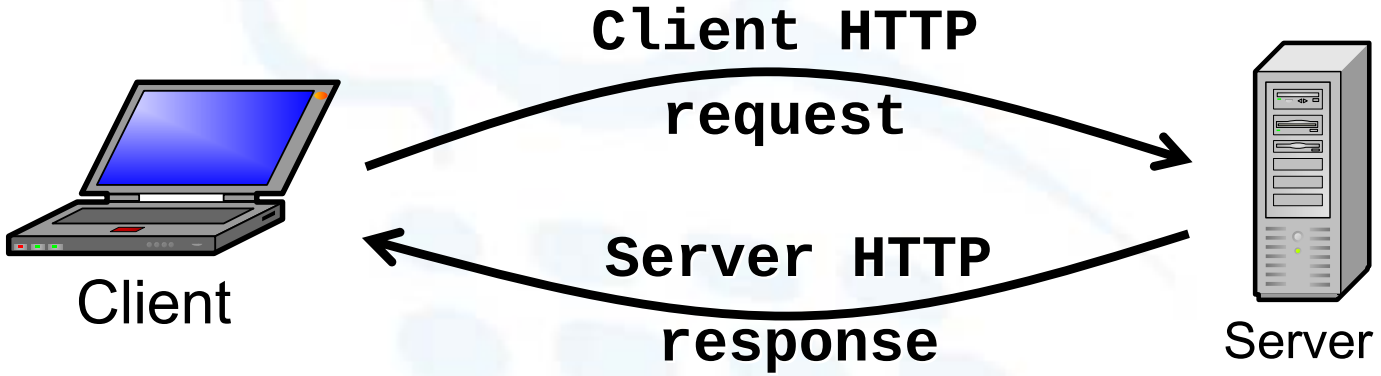
Invoking RPC Services

Creating and Invoking Server Side Functionality

What is RPC Service?

- **RPC = Remote Procedure Call**
  - **Invoke remote methods (through HTTP)**
  - **Unidirectional: clients calls the server**



- **RPC calls in GWT run asynchronously**
  - **The client is notified when the invocation complete (by callback)**

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Why RPC Calls?

- RPC allows dynamic interaction with the server side, e.g. retrieve data from database
- RPC allows separating the presentation and business logic
  - UI logic runs at the client side
  - Business logic runs on the server side
- RPC calls are fast, need low bandwidth
  - Only data is transferred, no UI elements
  - Efficient data format

Data Marshaling

- Data marshaling / unmarshaling
  - Java/JavaScript objects are serialized and transferred to the other side
  - On the other side the objects are deserialized and used
- You can marshal built-in types by default
  - `int`, `float`, `boolean`, `String`, etc.
- User defined types must implement `IsSerailizable` to be marshaled

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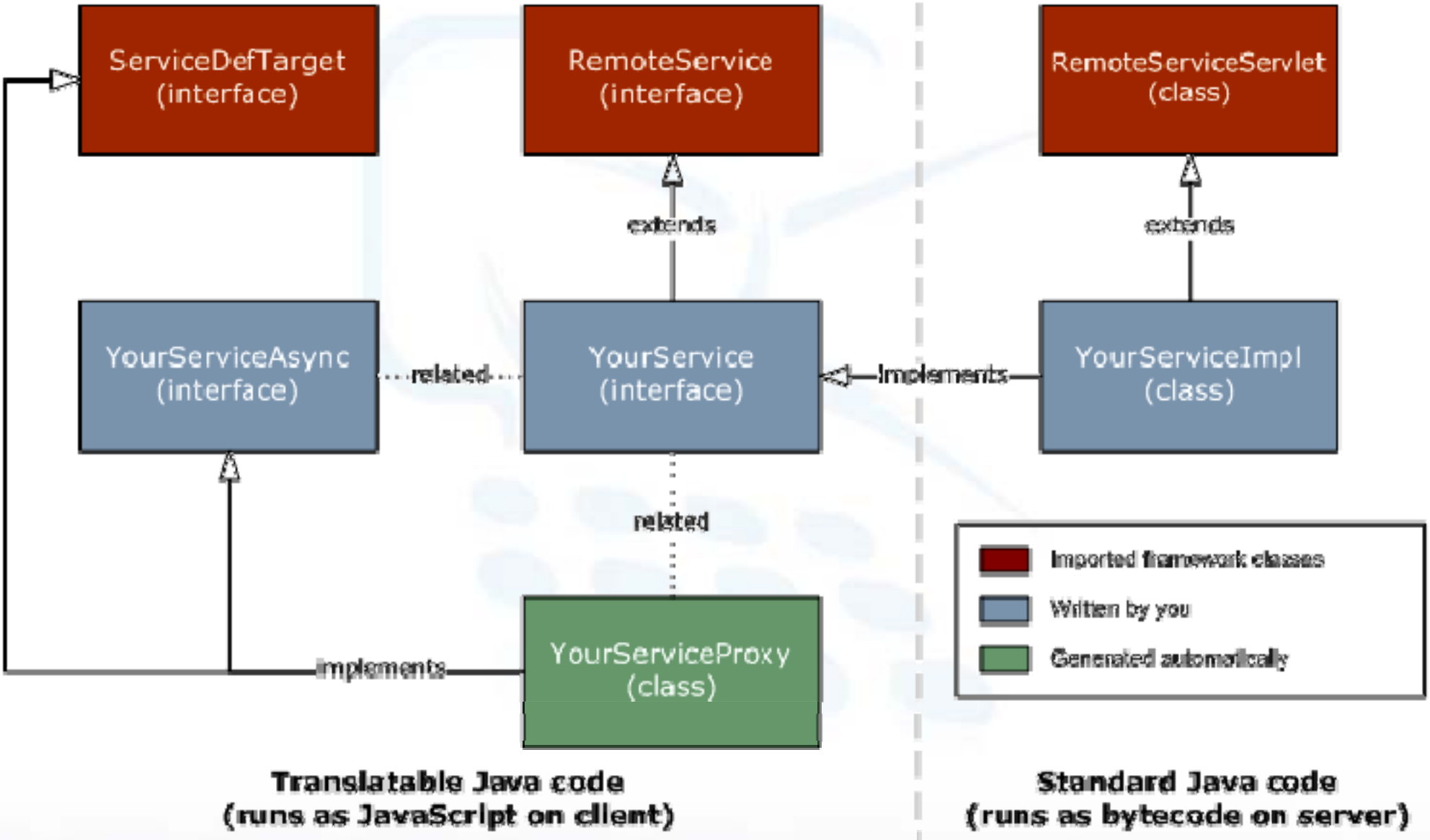
How RPC Works?



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

Creating RPC Service (1)

- **Define the service interface**

```
public interface TasksService extends RemoteService {
    public Task[] getAllTasks();
    public Task[] getTasksByCategory(String category);
    public void addTask(Task task);
}
```

- **Define the corresponding asynchronous interface**

```
public interface CategoriesServiceAsync {
    public void getAllTasks(AsyncCallback callback);
    public void getTasksByCategory(String category,
        AsyncCallback callback);
    public void addTask(Task task,
        AsyncCallback callback);
}
```

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Creating RPC Service (2)

- **Defining the data transfer objects (DTO)**

```
public class Task implements IsSerializable {
    private String title;
    private String description;
    private String category;

    public Task(String title, String description,
        String category)
    public String getTitle() { ... }
    public void setTitle(String title) { ... }
    public String getDescription() { ... }
    public void setDescription(String description){...}
    public String getCategory() { ... }
    public void setCategory(String category) { ... }
}
```

Creating RPC Service (3)

- **Defining the service implementation**

```
public class TasksServiceImpl
        extends RemoteServiceServlet
        implements TasksService {

    @Override
    public Task[] getAllTasks() { ... }

    @Override
    public Task[] getTasksByCategory(String category)
    { ... }

    @Override
    public void addTask(Task task) { ... }
}
```

Calling RPC Services (1)

- Register the service implementation class as RPC service servlet
  - In the `.gwt.xml` deployment descriptor:

```
<servlet path="/TasksService"
    class="nasd.example.server.SomeServiceImpl"/>
```

- Obtain the asynchronous service proxy:

```
TasksServiceAsync tasksServiceAsync =
    (TasksServiceAsync) GWT.create(TasksService.class);
```

  - This is slow operation!
  - Use caching if possible

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Calling RPC Services (2)

- **Assign service entry point servlet:**

```
ServiceDefTarget target =
    (ServiceDefTarget) tasksServiceAsync;
target.setServiceEntryPoint(
    GWT.getModuleBaseURL() + "/TasksService");
```

- **Call the service:**

```
tasksServiceAsync.getAllTasks(new AsyncCallback() {
    public void onSuccess(Object result) {
        Task[] tasks = (Task[]) result;
        // Process results here ...
    }
    public void onFailure(Throwable caught) {
        Window.alert("Error: " + caught.toString());
    }
});
```

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Invoking RPC Services

Live Demo

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GWT: The Dark Side

Frequent Problems with GWT

Drawbacks of GWT (1)

- Supports Java 1.4 only
  - No support for Java 5 generics, etc.
- Client can not import source files from directory which is not subdirectory of the "`client`" directory
  - Code duplication is sometimes required
- Runs very slowly in hosted mode
  - Startup time for large projects can reach 1-2 minutes

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Drawbacks of GWT (2)

- Standard widgets are not good enough
  - No good table, no good dialogs, no drag-and-drop, no , etc.
- RPC calls can not be run synchronous
  - GWT is AJAX-based technology!
- No good framework for modal dialogs
  - Issues not addressed: dialog creation, data validation, returning data, handling [OK] / [Cancel] buttons, glass panel, etc.

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Drawbacks of GWT (3)

- Not well established technology
  - The community is not very large
- Have bugs
  - Sometimes the GWT Shell hangs-up
- No backward compatibility
- Good free UI designers not available
  - Instantiations have commercial product GWT Designer
- Takes lots of resources on the client PC

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GWT Advanced Table

GWT Table Widget with Paging, Sorting and Data Filtering

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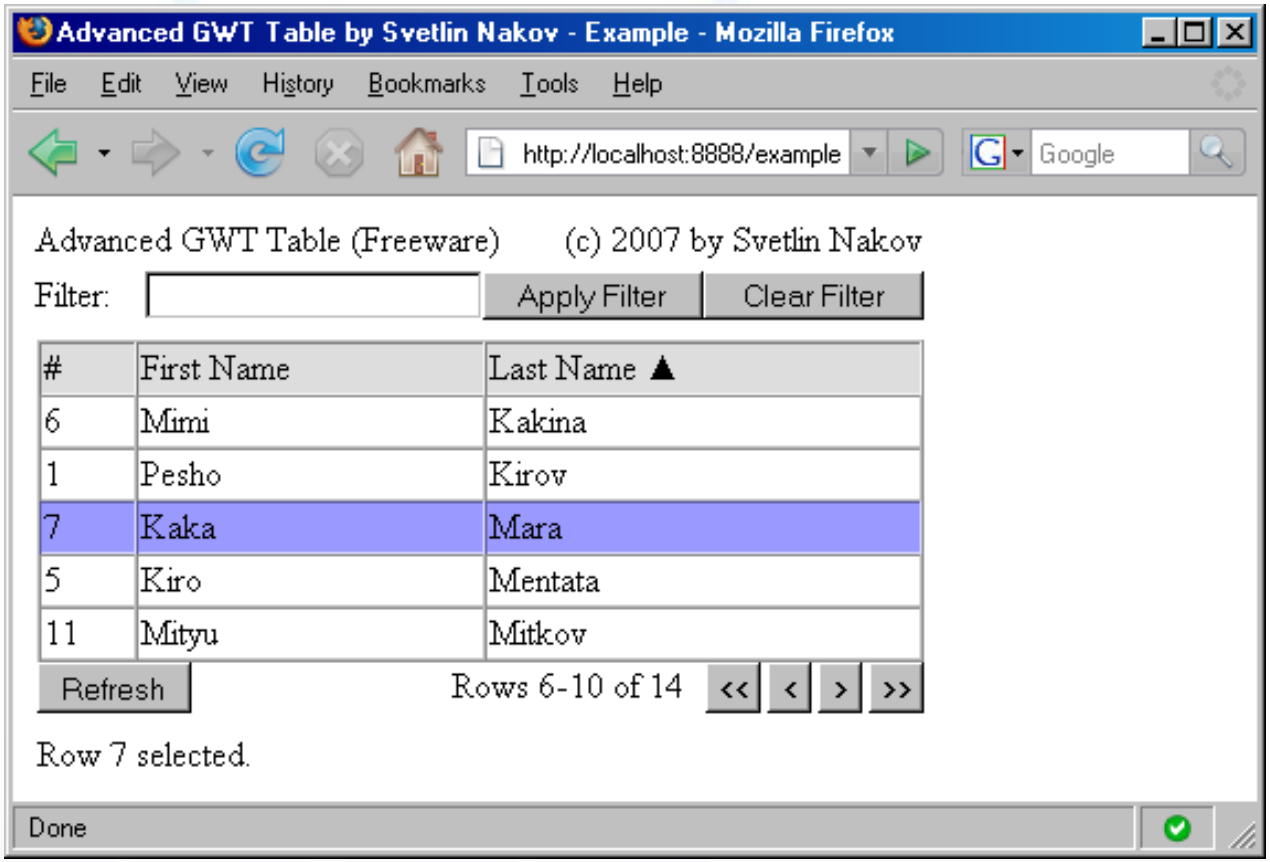
My Contribution

- GWT Advanced Table widget
  - Allows paging, sorting, data filtering



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GWT Advanced Table

Live Demo

Links

- Google Web Toolkit – Official Web Site
  - http://code.google.com/webtoolkit/
- GWT Advanced Table
  - http://code.google.com/p/gwt-advanced-table
- GWT Widget Library
  - http://gwt-widget.sourceforge.net/
- Svetlin Nakov's Blog
  - http://www.nakov.com/blog/

Google Web Toolkit

Questions?

http://www.nakov.com/blog/