Software Engineering – 2022/2023

GanttProject Final Report

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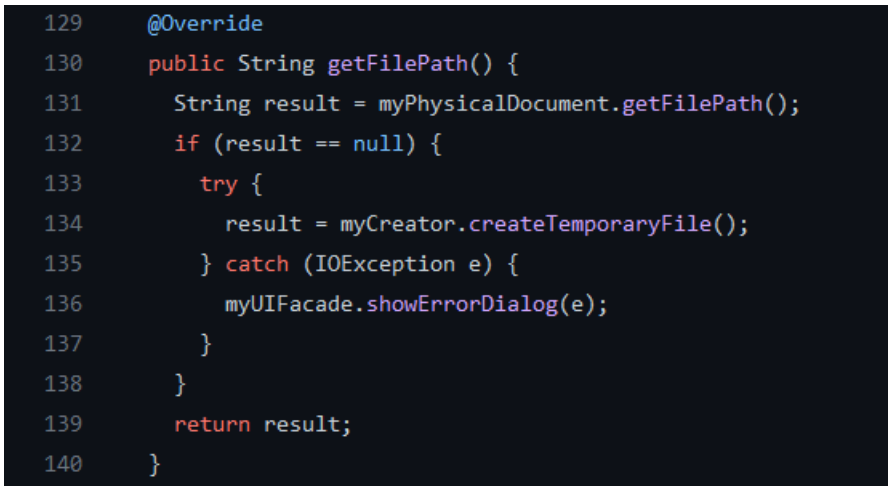
Phase 1

Design Patterns

Proxy

Illustrating code snippet



```
129     @Override
130     public String getFilePath() {
131       String result = myPhysicalDocument.getFilePath();
132       if (result == null) {
133         try {
134           result = myCreator.createTemporaryFile();
135         } catch (IOException e) {
136           myUIFacade.showErrorDialog(e);
137         }
138       }
139       return result;
140     }
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/document/ProxyDocument.java

Explanation

The ProxyDocument.java class performs the same tasks as Document object, but may delegate requests to the Document object to achieve them

Author

Guilherme Fernandes (60045)

Reviewer

Pedro Fernandes (60694)

Factory

Illustrating code snippet

```
42    public static GanttCalendar createGanttCalendar(Date date) {
43      return new GanttCalendar(date, ourLocaleApi);
44    }
45
46    public static GanttCalendar createGanttCalendar(int year, int month, int date) {
47      return new GanttCalendar(year, month, date, ourLocaleApi);
48    }
49
50    public static GanttCalendar createGanttCalendar() {
51      return new GanttCalendar(ourLocaleApi);
52    }
```

Class location

/biz.ganttproject.core/src/main/java/biz/ganttproject/core/time/CalendarFactory.java

Explanation

The CalendarFactory.java class hide the creation of GanttCalendar objects

Author

Guilherme Fernandes (60045)

Reviewer

Rafael Pereira (60700)

Façade

Illustrating code snippet

```
391     @Override
392     public void showNotificationDialog(NotificationChannel channel, String message) {
393       String i18nPrefix = channel.name().toLowerCase() + ".channel.";
394       getNotificationManager().addNotifications(
395           channel,
396           Collections.singletonList(new NotificationItem(i18n(i18nPrefix + "itemTitle"),
397               GanttLanguage.getInstance().formatText(i18nPrefix + "itemBody", message), new HyperlinkListener() {
398             @Override
399             public void hyperlinkUpdate(HyperlinkEvent e) {
400               if (e.getEventType() != EventType.ACTIVATED) {
401                 return;
402               }
403               if ("localhost".equals(e.getURL().getHost()) && "/log".equals(e.getURL().getPath())) {
404                 onViewLog();
405               } else {
406                 NotificationManager.DEFAULT_HYPERLINK_LISTENER.hyperlinkUpdate(e);
407               }
408             }
409           }));
410     }
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/UIFacadeImpl.java

Explanation

The UIFacadeImpl.java is a class that implements the UIFacade.java interface, and which encapsulates a subsystem to hide the complexity of the subsystem (for example, the showNotificationDialog method hides from the user how the notification will be created and displayed) and acts as a point of entry into a subsystem without adding more functionality itself (e.g. the showNotificationDialog method uses the NotificationManager subsystem and no extra functionality is added to the class)

Author

Guilherme Fernandes (60045)

Reviewer

Pedro Lopes (57514)

Abstract Factory

Illustrating code snippet

```
public abstract class StylesheetFactoryImpl {
  public List<Stylesheet> createStylesheets(Class<? extends Stylesheet> stylesheetInterface) {
    IExtensionRegistry extensionRegistry = Platform.getExtensionRegistry();
    IConfigurationElement[] configElements = extensionRegistry.getConfigurationElementsFor(stylesheetInterface.getName());
    List<Stylesheet> result = new ArrayList<>();
    for (int i = 0; i < configElements.length; i++) {
      try {
        // Object nextExtension =
        // configElements[i].createExecutableExtension("class");
        // assert nextExtension!=null && nextExtension instanceof HTMLStylesheet
        // :
        // "Extension="+nextExtension+" is expected to be instance of HTMLStylesheet";
        String localizedName = configElements[i].getAttribute( s: "name");
        String pluginRelativeUrl = configElements[i].getAttribute( s: "url");
        String namespace = configElements[i].getDeclaringExtension().getNamespaceIdentifier();
        URL stylesheetUrl = Platform.getBundle(namespace).getResource(pluginRelativeUrl);
        assert stylesheetUrl != null : "Failed to resolve url=" + pluginRelativeUrl;
        URL resolvedUrl = Platform.resolve(stylesheetUrl);
        assert resolvedUrl != null : "Failed to resolve URL=" + stylesheetUrl;
        result.add(newStylesheet(resolvedUrl, localizedName));
      } catch (Exception e) {
        if (!GPLogger.log(e)) {
          e.printStackTrace(System.err);
        }
      }
    }
    return result;
  }

  protected abstract Stylesheet newStylesheet(URL url, String localizedName);
}
```

Class location

/org.ganttproject.impex.htmlpdf/src/main/java/org/ganttproject/impex/htmlpdf/StylesheetFactoryImpl.java

Explanation

This class is responsible for constructing lists of Stylesheets potentially of different types that share similarities and can be constructed provided an implementation of Stylesheet.

Author

Pedro Fernandes (60694)

Reviewer

Guilherme Fernandes (60045)

Builder

Illustrating code snippet

```java
public class DependencySceneBuilder<T extends IdentifiableRow, D extends BarChartConnector<T, D>> {
  private final Canvas myTaskCanvas;
  private final Canvas myOutputCanvas;
  private final ChartApi myChartApi;
  private final TaskApi<T, D> myTaskApi;
  private int myBarHeight;
  private Canvas.Arrow myFinishArrow;

  public interface TaskApi<T extends IdentifiableRow, D> {
    boolean isMilestone(T task);
    Dimension getUnitVector(BarChartActivity<T> activity, D dependency);
    String getStyle(D dependency);
    Iterable<D> getConnectors(T task);
    List<T> getTasks();
  }

  public interface ChartApi {
    int getBarHeight();
  }

  public DependencySceneBuilder(Canvas taskCanvas, Canvas outputCanvas, TaskApi<T, D> taskApi, ChartApi chartApi) {
    myTaskApi = taskApi;
    myChartApi = chartApi;
    //myVisibleTasks = visibleTasks;
    myTaskCanvas = taskCanvas;
    myOutputCanvas = outputCanvas;
    myFinishArrow = Canvas.Arrow.FINISH;
    myBarHeight = -1;
  }

  public void build() {
    List<Connector> dependencyDrawData = prepareDependencyDrawData();
    drawDependencies(dependencyDrawData);
  }
```

Class location

/biz.ganttproject.core/src/main/java/biz/ganttproject/core/chart/scene/gantt/DependencySceneBuilder.java

Explanation

This class is responsible for building something from a complex set of actions, separating its construction from its representation, in this case, dependency lines between tasks.

Author

Pedro Fernandes (60694)

Reviewer

Rafael Pereira (60700)

Singleton

Illustrating code snippet

```java
public class GanttLookAndFeels {

  protected Map<String, GanttLookAndFeelInfo> infoByClass;

  protected Map<String, GanttLookAndFeelInfo> infoByName;

  protected static GanttLookAndFeels singleton;

  static {...}

  protected GanttLookAndFeels() {...}

  protected void addLookAndFeel(GanttLookAndFeelInfo info) {...}

  public GanttLookAndFeelInfo getInfoByClass(String className) {...}

  public GanttLookAndFeelInfo getInfoByName(String name) { return infoByName.get(name); }

  public GanttLookAndFeelInfo getDefaultInfo() {...}

  public GanttLookAndFeelInfo[] getInstalledLookAndFeels() {...}

  public static GanttLookAndFeels getGanttLookAndFeels() {
    if (singleton == null) {
      singleton = new GanttLookAndFeels();
    }
    return singleton;
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/gui/GanttLookAndFeels.java

Explanation

Limits the instantiation of its class to a single object, always providing the same underlying object on every call to *getGanttLookAndFeels()*.

Author

Pedro Fernandes (60694)

Reviewer

Rafael Martins (60602)

Builder

Illustrating code snippet

```
51 @  protected OffsetBuilderImpl(OffsetBuilder.Factory factory) {
52      myCalendar = factory.myCalendar;
53      myStartDate = factory.myStartDate;
54      myViewportStartDate = factory.myViewportStartDate;
55      myTopUnit = factory.myTopUnit;
56      myBottomUnit = factory.myBottomUnit;
57      myDefaultUnitWidth = factory.myAtomicUnitWidth;
58      myChartWidth = factory.myEndOffset;
59      myWeekendDecreaseFactor = factory.myWeekendDecreaseFactor;
60      myEndDate = factory.myEndDate;
61      baseUnit = factory.myBaseUnit;
62      myRightMarginBottomUnitCount = factory.myRightMarginTimeUnits;
63      myOffsetStepFn = factory.myOffsetStepFn;
64    }
65
        1 usage  dbarashev
66    private TimeUnit getBottomUnit() { return myBottomUnit; }
69
        1 usage  dbarashev
70    private TimeUnit getTopUnit() { return myTopUnit; }
73
```

Class location

/ganttproject/biz.ganttproject.core/src/main/java/bix/ganttproject/core/chart/grid/OffsetBuilderImpl.java

Explanation

In the OffsetBuilderImpl.java class the initialization of various constants is handled, step by step, y a creator that is not the class, this makes it easier to modify their creation and makes the code more understandable.

Author

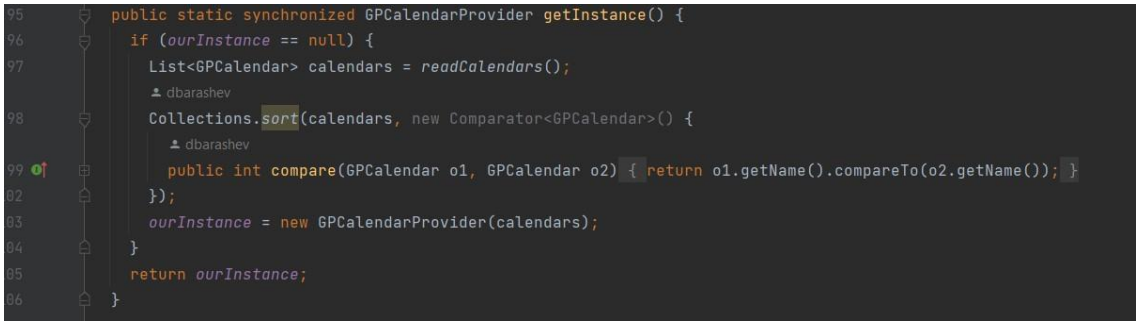
Pedro Lopes (57514)

Reviewer

Guilherme Fernandes (60045)

Singleton

Illustrating code snippet



Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/calendar/GPcalendarProvider.java

Explanation

The class provides access through a single instance (line 71), the constructor to the class is private (line 109) and the method that instantiates the class is public (line 95).

Author

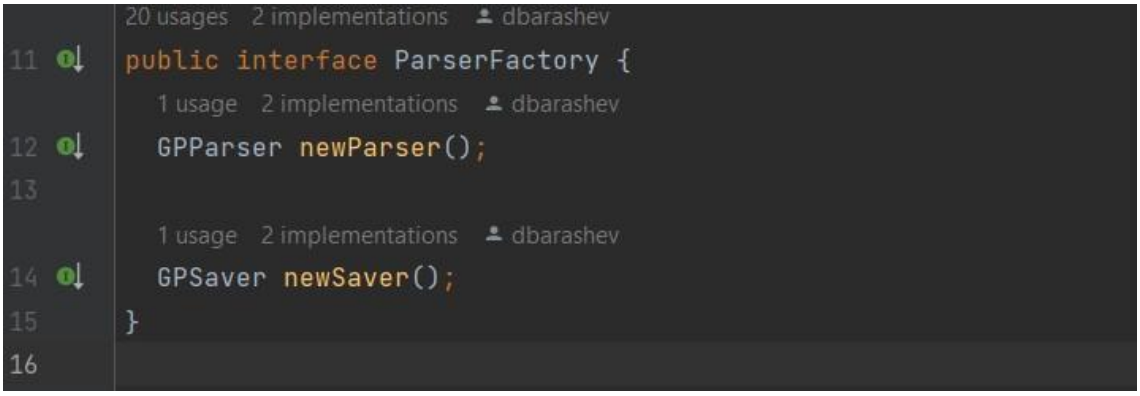
Pedro Lopes (57514)

Reviewer

Rafael Pereira (60700)

Factory

Illustrating code snippet



Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/parser/ParserFactory.java

Explanation

The interface ParserFactory.java declares 2 methods that return an object, the interface is implemented by the BufferProject.java class and the ParserFactoryImpl class in GanttProject.java. This allows the subclasses to alter the creation of the new objects to better fit their necessities.

Author

Pedro Lopes (57514)

Reviewer

Rafael Martins (60602)

Factory

Illustrating code snippet

```
public BeanFactory() {
}

public Class[] keyClasses() { return this.keyClasses; }

public String[] keyIds() { return null; }

public Registration insert(RootContext context, Context requestContext) {
    Object o = this.instantiateBean();
    return this.isRequestScope() ? requestContext.put(o) : context.put(o);
}
```

```
private Object instantiateBean() {
    try {
        return this.beanClass.newInstance();
    } catch (InstantiationException var2) {
        throw new RuntimeException(var2);
    } catch (IllegalAccessException var3) {
        throw new RuntimeException(var3);
    }
}
```

Class location

/biz.ganttproject.app.libs/lib/milton-api-2.7.4.4.jar/io/milton/context/BeanFactory.java

Explanation

This Class is used to create and setup new Bean instances, therefore it is being used as a Factory Class.

Author

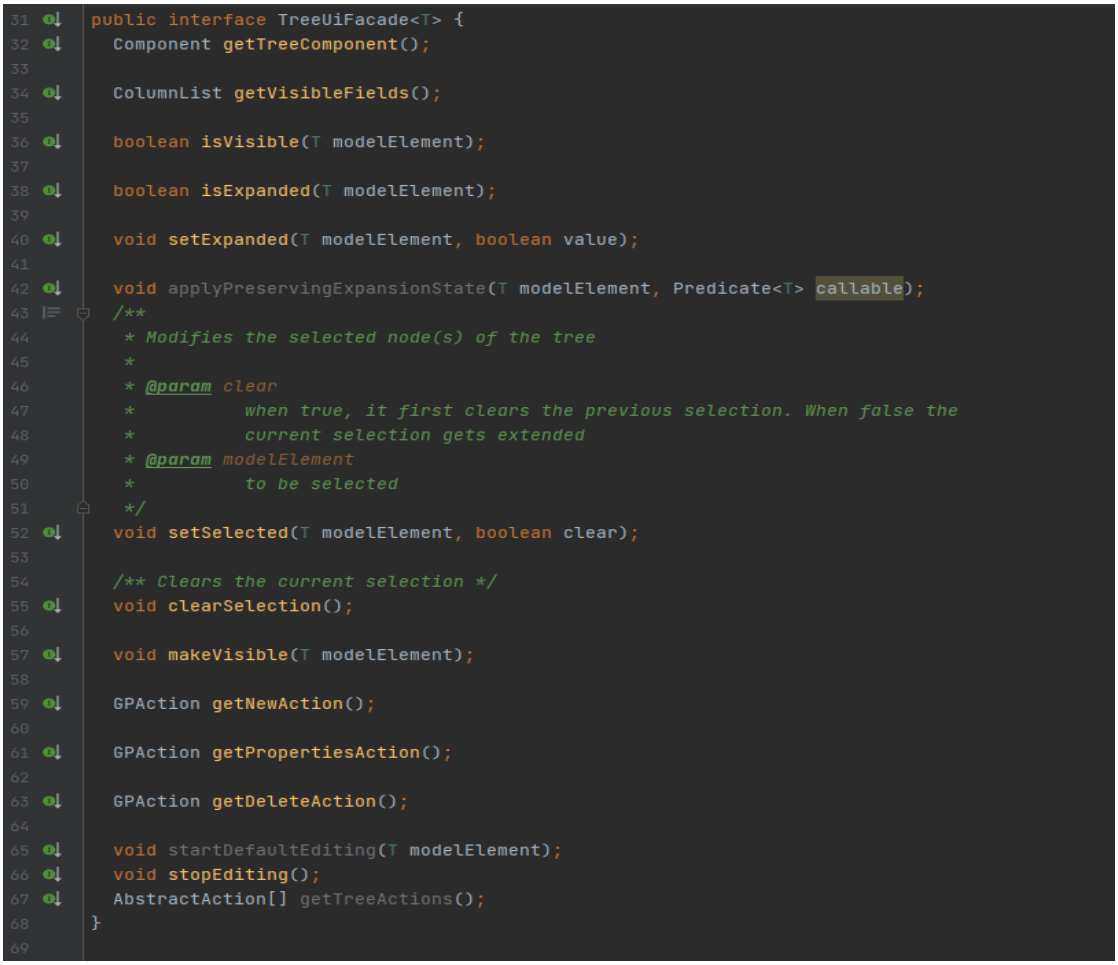
Rafael Martins (60602)

Reviewer

Guilherme Fernandes (60045)

Facade

Illustrating code snippet



```
public interface TreeUiFacade<T> {
  Component getTreeComponent();

  ColumnList getVisibleFields();

  boolean isVisible(T modelElement);

  boolean isExpanded(T modelElement);

  void setExpanded(T modelElement, boolean value);

  void applyPreservingExpansionState(T modelElement, Predicate<T> callable);
  /**
   * Modifies the selected node(s) of the tree
   *
   * @param clear
   *          when true, it first clears the previous selection. When false the
   *          current selection gets extended
   * @param modelElement
   *          to be selected
   */
  void setSelected(T modelElement, boolean clear);

  /** Clears the current selection */
  void clearSelection();

  void makeVisible(T modelElement);

  GPAction getNewAction();

  GPAction getPropertiesAction();

  GPAction getDeleteAction();

  void startDefaultEditing(T modelElement);
  void stopEditing();
  AbstractAction[] getTreeActions();
}
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/gui/TreeUiFacade

Explanation

This Interface is used to hide the complexity of the Tree subsystem, while it doesn't add new functionalities.

Author

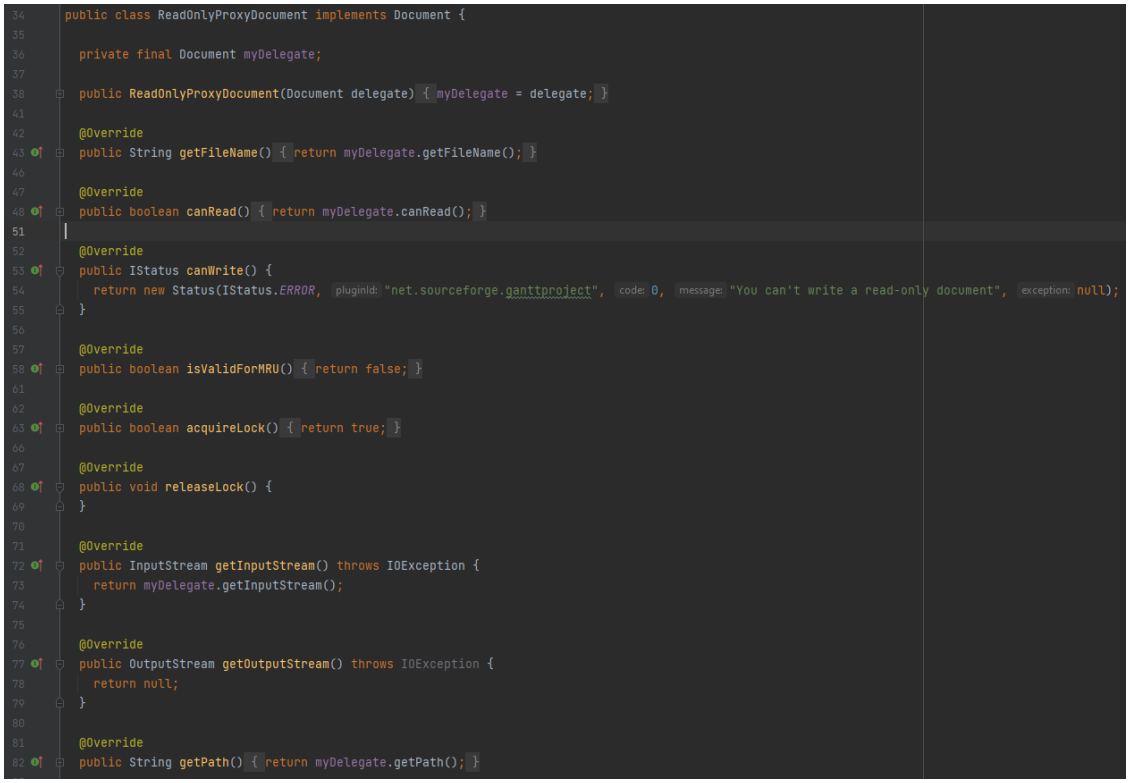
Rafael Martins (60602)

Reviewer

Pedro Fernandes (60694)

Proxy

Illustrating code snippet



```
public class ReadOnlyProxyDocument implements Document {

  private final Document myDelegate;

  public ReadOnlyProxyDocument(Document delegate) { myDelegate = delegate; }

  @Override
  public String getFileName() { return myDelegate.getFileName(); }

  @Override
  public boolean canRead() { return myDelegate.canRead(); }

  @Override
  public IStatus canWrite() {
    return new Status(IStatus.ERROR, pluginId: "net.sourceforge.ganttproject", code: 0, message: "You can't write a read-only document", exception: null);
  }

  @Override
  public boolean isValidForMRU() { return false; }

  @Override
  public boolean acquireLock() { return true; }

  @Override
  public void releaseLock() {
  }

  @Override
  public InputStream getInputStream() throws IOException {
    return myDelegate.getInputStream();
  }

  @Override
  public OutputStream getOutputStream() throws IOException {
    return null;
  }

  @Override
  public String getPath() { return myDelegate.getPath(); }
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/document/ReadOnlyProxyDocument.java

Explanation

This Class is used to perform the tasks that the "myDelegate" document would perform, using that same object to delegate some of the requests.

Author

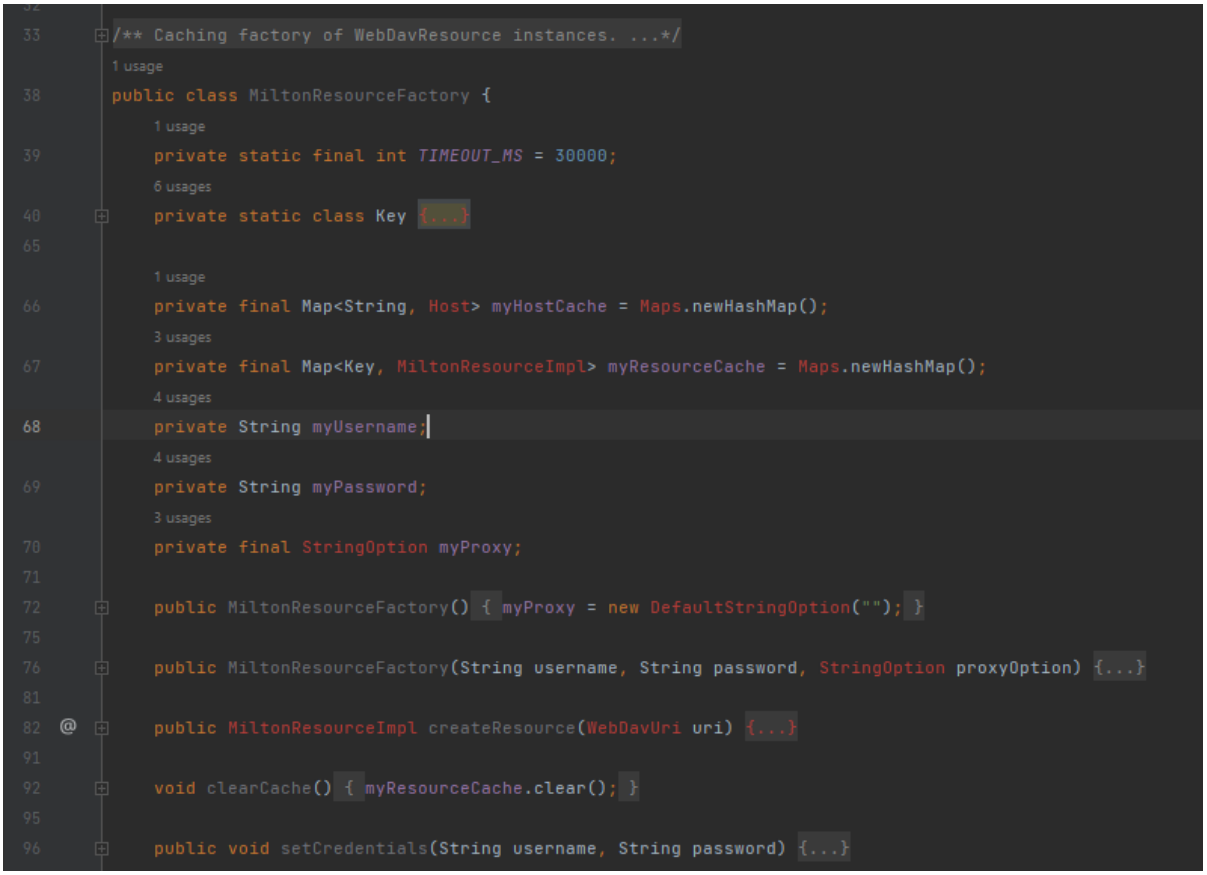
Rafael Martins (60602)

Reviewer

Pedro Lopes (57514)

Factory

Illustrating code snippet



```
33    /** Caching factory of WebDavResource instances. ...*/
      1 usage
38    public class MiltonResourceFactory {
          1 usage
39        private static final int TIMEOUT_MS = 30000;
          6 usages
40        private static class Key {...}
65
          1 usage
66        private final Map<String, Host> myHostCache = Maps.newHashMap();
          3 usages
67        private final Map<Key, MiltonResourceImpl> myResourceCache = Maps.newHashMap();
          4 usages
68        private String myUsername;
          4 usages
69        private String myPassword;
          3 usages
70        private final StringOption myProxy;
71
72        public MiltonResourceFactory() { myProxy = new DefaultStringOption(""); }
75
76        public MiltonResourceFactory(String username, String password, StringOption proxyOption) {...}
81
82    @   public MiltonResourceImpl createResource(WebDavUri uri) {...}
91
92        void clearCache() { myResourceCache.clear(); }
95
96        public void setCredentials(String username, String password) {...}
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/document/webdav/MiltonResourceFactory.java

Explanation

Here we have a “Factory” design pattern that has the purpose to hide and simplify the creation of instances of MiltonResourceImpl.

Author

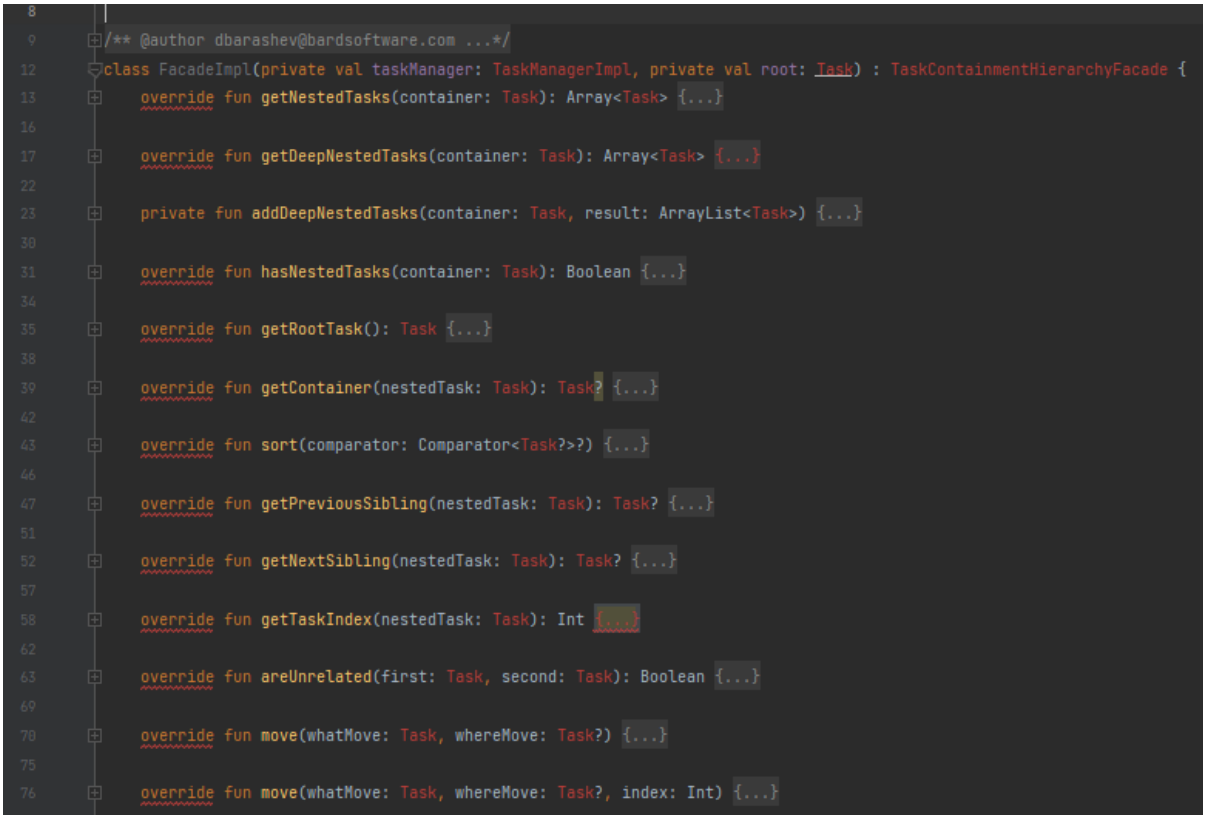
Rafael Pereira (60700)

Reviewer

Rafael Martins (60602)

Façade

Illustrating code snippet



```
/** @author dbarashev@bardsoftware.com ...*/
class FacadeImpl(private val taskManager: TaskManagerImpl, private val root: Task) : TaskContainmentHierarchyFacade {
    override fun getNestedTasks(container: Task): Array<Task> {...}

    override fun getDeepNestedTasks(container: Task): Array<Task> {...}

    private fun addDeepNestedTasks(container: Task, result: ArrayList<Task>) {...}

    override fun hasNestedTasks(container: Task): Boolean {...}

    override fun getRootTask(): Task {...}

    override fun getContainer(nestedTask: Task): Task? {...}

    override fun sort(comparator: Comparator<Task?>?) {...}

    override fun getPreviousSibling(nestedTask: Task): Task? {...}

    override fun getNextSibling(nestedTask: Task): Task? {...}

    override fun getTaskIndex(nestedTask: Task): Int {...}

    override fun areUnrelated(first: Task, second: Task): Boolean {...}

    override fun move(whatMove: Task, whereMove: Task?) {...}

    override fun move(whatMove: Task, whereMove: Task?, index: Int) {...}
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/task/TaskTreeFacade.kt

Explanation

Here we have a “Façade” design pattern that encapsulates the whole Task tree hiding its complexity and making it easy to access the functionality of this subsystem.

Author

Rafael Pereira (60700)

Reviewer

Pedro Fernandes (60694)

Adapter

Illustrating code snippet

```kotlin
open class TaskListenerAdapter(private val allEventsHandler: ()->Unit = {}) : TaskListener {
  var dependencyAddedHandler: ((TaskDependencyEvent) -> Unit)? = null
  var dependencyRemovedHandler: ((TaskDependencyEvent) -> Unit)? = null
  var dependencyChangedHandler: ((TaskDependencyEvent) -> Unit)? = null
  var taskAddedHandler: ((TaskHierarchyEvent) -> Unit)? = null
  var taskRemovedHandler: ((TaskHierarchyEvent) -> Unit)? = null
  var taskMovedHandler: ((TaskHierarchyEvent) -> Unit)? = null
  var taskPropertiesChangedHandler: ((TaskPropertyEvent) -> Unit)? = null
  var taskProgressChangedHandler: ((TaskPropertyEvent) -> Unit)? = null
  var taskScheduleChangedHandler: ((TaskScheduleEvent) -> Unit)? = null
  var taskModelResetHandler: (() -> Unit)? = null

  override fun taskScheduleChanged(e: TaskScheduleEvent) {
    taskScheduleChangedHandler?.also { it(e) } ?: allEventsHandler()
  }

  override fun dependencyAdded(e: TaskDependencyEvent) {
    dependencyAddedHandler?.also { it(e) } ?: allEventsHandler()
  }

  override fun dependencyRemoved(e: TaskDependencyEvent) {
    dependencyRemovedHandler?.also { it(e) } ?: allEventsHandler()
  }

  override fun dependencyChanged(e: TaskDependencyEvent) {
    dependencyChangedHandler?.also { it(e) } ?: allEventsHandler()
  }
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/task/event/TaskListenerAdapter.kt

Design pattern

Here we have a “Adapter” design pattern which facilitates the handling of the events by delegating a single handler for all them and allowing two different classes that use different types of interfaces to communicate with each other.

Author

Rafael Pereira (60700)

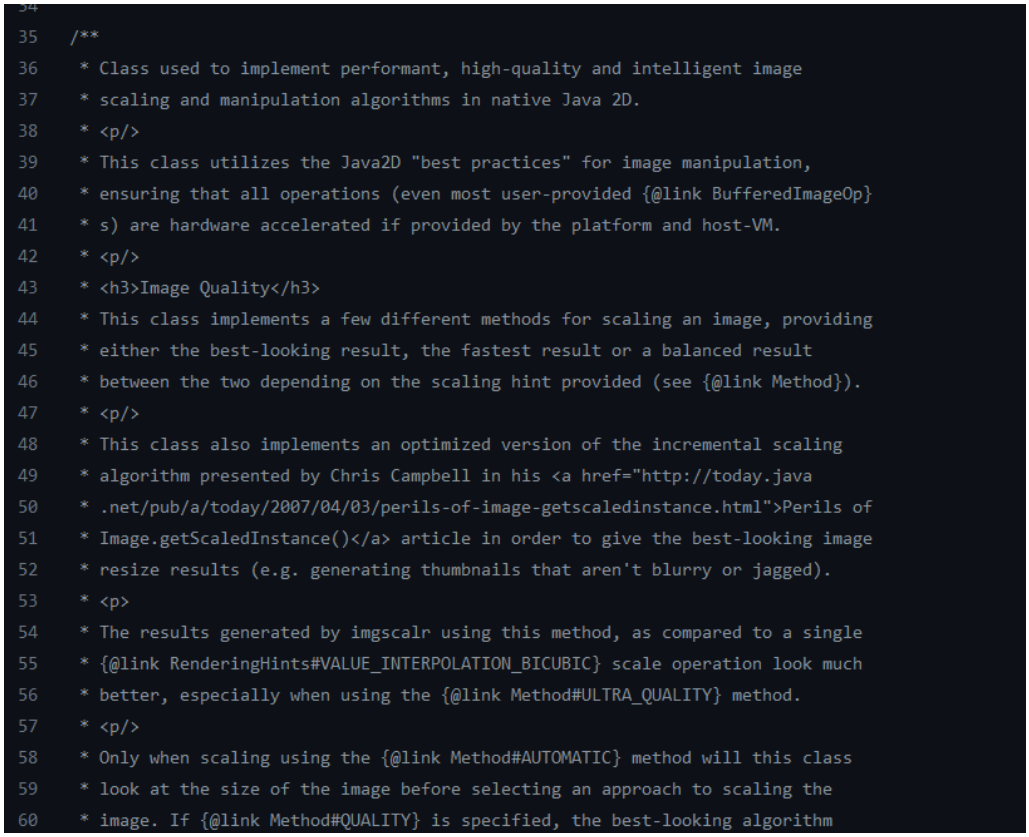
Reviewer

Pedro Lopes (57514)

Code Smells

Too many comments

Illustrating code snippet



```
35  /**
36   * Class used to implement performant, high-quality and intelligent image
37   * scaling and manipulation algorithms in native Java 2D.
38   * <p/>
39   * This class utilizes the Java2D "best practices" for image manipulation,
40   * ensuring that all operations (even most user-provided {@link BufferedImageOp}
41   * s) are hardware accelerated if provided by the platform and host-VM.
42   * <p/>
43   * <h3>Image Quality</h3>
44   * This class implements a few different methods for scaling an image, providing
45   * either the best-looking result, the fastest result or a balanced result
46   * between the two depending on the scaling hint provided (see {@link Method}).
47   * <p/>
48   * This class also implements an optimized version of the incremental scaling
49   * algorithm presented by Chris Campbell in his <a href="http://today.java
50   * .net/pub/a/today/2007/04/03/perils-of-image-getscaledinstance.html">Perils of
51   * Image.getScaledInstance()</a> article in order to give the best-looking image
52   * resize results (e.g. generating thumbnails that aren't blurry or jagged).
53   * <p>
54   * The results generated by imgscalr using this method, as compared to a single
55   * {@link RenderingHints#VALUE_INTERPOLATION_BICUBIC} scale operation look much
56   * better, especially when using the {@link Method#ULTRA_QUALITY} method.
57   * <p/>
58   * Only when scaling using the {@link Method#AUTOMATIC} method will this class
59   * look at the size of the image before selecting an approach to scaling the
60   * image. If {@link Method#QUALITY} is specified, the best-looking algorithm
```

Class location

/ganttproject/src/main/java/org/imgscalr/Scalr.java

Explanation

In the Scalr.java class there are very extensive comments (for example the comment of line 35 to 196) that explain the functioning of the methods and the class, which indicate that for the author the code is not very clear

Refactoring proposal

Summarize the comments to be smaller, clearer, and more direct

Author

Guilherme Fernandes (60045)

Reviewer

Pedro Fernandes (60694)

Large methods

Illustrating code snippet

```
34
35      private static Calendar getCalendar(String isodate)
36              throws InvalidDateException {
37          // YYYY-MM-DDThh:mm:ss.sTZD
38          StringTokenizer st = new StringTokenizer(isodate, "-T:.+Z", true);
39
40          Calendar calendar = new GregorianCalendar();
41          calendar.clear();
42          try {
43              // Year
44              if (st.hasMoreTokens()) {
45                  int year = Integer.parseInt(st.nextToken());
46                  calendar.set(Calendar.YEAR, year);
47              } else {
48                  return calendar;
49              }
50              // Month
51              if (check(st, "-") && (st.hasMoreTokens())) {
52                  int month = Integer.parseInt(st.nextToken()) - 1;
53                  calendar.set(Calendar.MONTH, month);
54              } else {
55                  return calendar;
56              }
57              // Day
58              if (check(st, "-") && (st.hasMoreTokens())) {
59                  int day = Integer.parseInt(st.nextToken());
60                  calendar.set(Calendar.DAY_OF_MONTH, day);
61              } else {
62                  return calendar;
63              }
```

Class location

/biz.ganttproject.core/src/main/java/org/w3c/util/DateParser.java

Explanation

In the DateParser.java class there are very extensive methods that are difficult to understand (for example the method from lines 35 to 156)

Refactoring proposal

The most appropriate solution would be to divide the method into sub methods

Author

Guilherme Fernandes (60045)

Reviewer

Rafael Pereira (60700)

Shotgun surgery

Illustrating code snippet

```
187     public static String getIsoDate(Date date) {
188         Calendar calendar = new GregorianCalendar();
189         calendar.setTime(date);
190         StringBuffer buffer = new StringBuffer(getIsoDateNoHours(date));
191         buffer.append("T");
192         buffer.append(twoDigit(calendar.get(Calendar.HOUR_OF_DAY)));
193         buffer.append(":");
194         buffer.append(twoDigit(calendar.get(Calendar.MINUTE)));
195         buffer.append(":");
196         buffer.append(twoDigit(calendar.get(Calendar.SECOND)));
197         buffer.append(".");
198         buffer.append(twoDigit(calendar.get(Calendar.MILLISECOND) / 10));
199         buffer.append("Z");
200         return buffer.toString();
201     }
202 
203     /**
204      * Generate a ISO 8601 date
205      *
206      * @param date
207      *            a Date instance
208      * @return a string representing the date in the ISO 8601 format
209      */
210     public static String getIsoDateNoMillis(Date date) {
211         Calendar calendar = new GregorianCalendar();
212         calendar.setTime(date);
213         StringBuffer buffer = new StringBuffer(getIsoDateNoHours(date));
214         buffer.append("T");
215         buffer.append(twoDigit(calendar.get(Calendar.HOUR_OF_DAY)));
216         buffer.append(":");
217         buffer.append(twoDigit(calendar.get(Calendar.MINUTE)));
218         buffer.append(":");
219         buffer.append(twoDigit(calendar.get(Calendar.SECOND)));
220         buffer.append("Z");
221         return buffer.toString();
```

Class location

/biz.ganttproject.core/src/main/java/org/w3c/util/DateParser.java

Code smell

In the DateParser.java class there are several equal constants scattered throughout the code, if one of them changed it would be necessary to change it in several places in the class

Refactoring proposal

The best way to deal with this problem would be to have a constant defined for each of these constants and if it was necessary to change its value, it would only be changed in one place.

Author

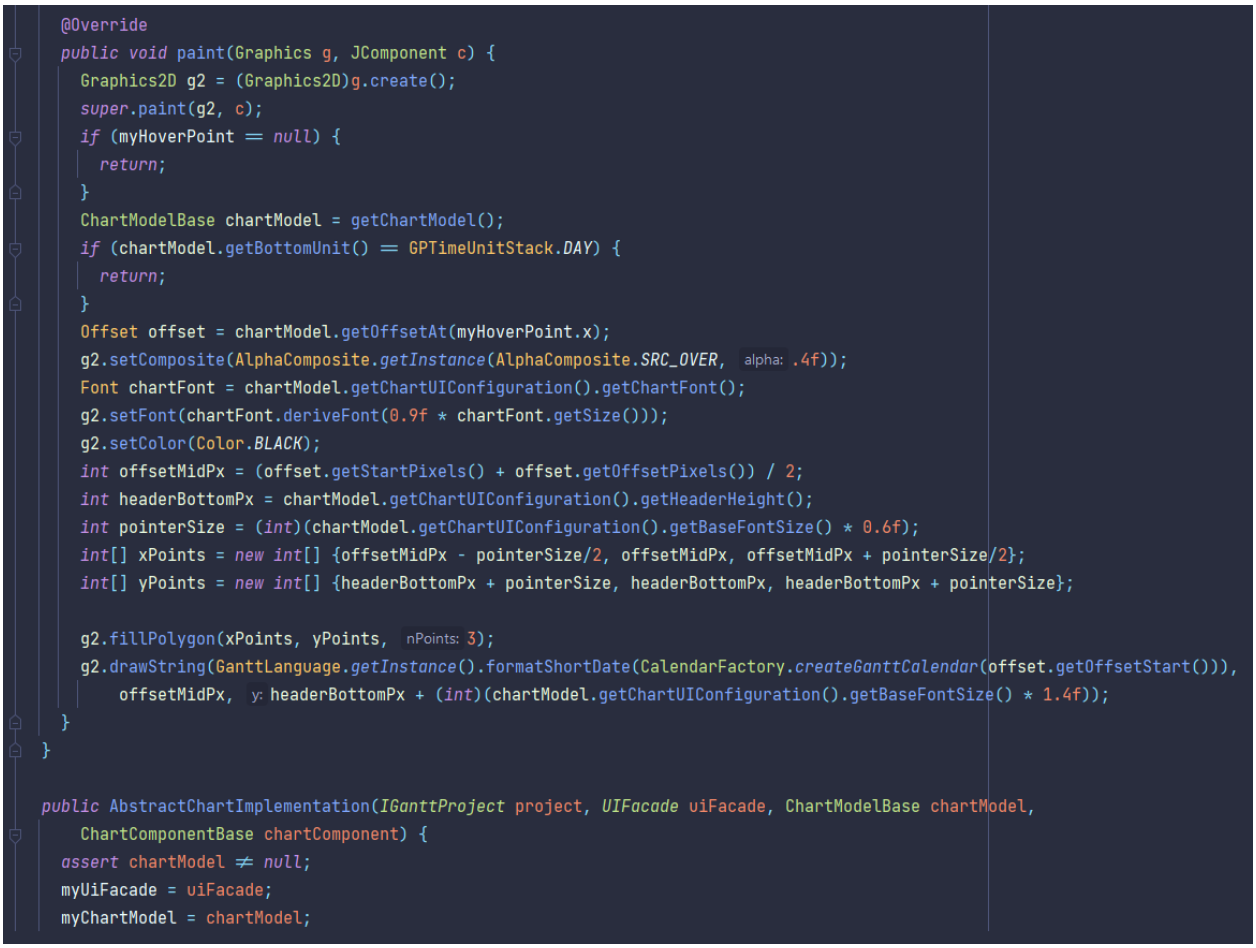
Guilherme Fernandes (60045)

Reviewer

Rafael Martins (60602)

No comments

Illustrating code snippet



```
  @Override
  public void paint(Graphics g, JComponent c) {
    Graphics2D g2 = (Graphics2D)g.create();
    super.paint(g2, c);
    if (myHoverPoint == null) {
      return;
    }
    ChartModelBase chartModel = getChartModel();
    if (chartModel.getBottomUnit() == GPTimeUnitStack.DAY) {
      return;
    }
    Offset offset = chartModel.getOffsetAt(myHoverPoint.x);
    g2.setComposite(AlphaComposite.getInstance(AlphaComposite.SRC_OVER, alpha: .4f));
    Font chartFont = chartModel.getChartUIConfiguration().getChartFont();
    g2.setFont(chartFont.deriveFont(0.9f * chartFont.getSize()));
    g2.setColor(Color.BLACK);
    int offsetMidPx = (offset.getStartPixels() + offset.getOffsetPixels()) / 2;
    int headerBottomPx = chartModel.getChartUIConfiguration().getHeaderHeight();
    int pointerSize = (int)(chartModel.getChartUIConfiguration().getBaseFontSize() * 0.6f);
    int[] xPoints = new int[] {offsetMidPx - pointerSize/2, offsetMidPx, offsetMidPx + pointerSize/2};
    int[] yPoints = new int[] {headerBottomPx + pointerSize, headerBottomPx, headerBottomPx + pointerSize};

    g2.fillPolygon(xPoints, yPoints, nPoints: 3);
    g2.drawString(GanttLanguage.getInstance().formatShortDate(CalendarFactory.createGanttCalendar(offset.getOffsetStart())),
        offsetMidPx, y: headerBottomPx + (int)(chartModel.getChartUIConfiguration().getBaseFontSize() * 1.4f));
  }
}

public AbstractChartImplementation(IGanttProject project, UIFacade uiFacade, ChartModelBase chartModel,
    ChartComponentBase chartComponent) {
  assert chartModel != null;
  myUiFacade = uiFacade;
  myChartModel = chartModel;
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/AbstractChartImplementation.java

Explanation

The class is missing any form of comments describing the functionality of its methods, making it harder to understand.

Refactoring proposal

Add descriptive enough comments to make it easier to read the code.

Author

Pedro Fernandes (60694)

Reviewer

Guilherme Fernandes (60045)

Large class

Illustrating code snippet

```
public class CalendarEditorPanel {
  private static String getI18NedEventType(CalendarEvent.Type type) {
    return GanttLanguage.getInstance().getText(
        key: "calendar.editor.column." + TableModelImpl.Column.TYPE.name().toLowerCase() + ".value." +
  }
  private static final List<String> TYPE_COLUMN_VALUES = Lists.transform(Arrays.asList(CalendarEvent.
  private static final Runnable NOOP_CALLBACK = () -> {
  };
  private final List<CalendarEvent> myOneOffEvents = Lists.newArrayList();
  private final List<CalendarEvent> myRecurringEvents = Lists.newArrayList();
  private final TableModelImpl myRecurringModel;
  private final TableModelImpl myOneOffModel;

  private final Runnable myOnChangeCallback;
  private final Runnable myOnCreate;
  private final UIFacade myUiFacade;



  private static Predicate<CalendarEvent> recurring(final boolean isRecurring) {
    return event -> event.isRecurring == isRecurring;
  }
  public CalendarEditorPanel(UIFacade uifacade, List<CalendarEvent> events, Runnable onChange) {
    myOneOffEvents.addAll(Collections2.filter(events, recurring( isRecurring: false)));
    myRecurringEvents.addAll(Collections2.filter(events, recurring( isRecurring: true)));
    myOnChangeCallback = onChange == null ? NOOP_CALLBACK : onChange;
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/calendar/CalendarEditorPanel.java

Explanation

This class is too large, indicating it has too many responsibilities and less organization.

Refactoring proposal

Creating more specific classes that take care of smaller sets of actions the original class was responsible for.

Author

Pedro Fernandes (60694)

Reviewer

Rafael Pereira (60700)

Shotgun surgery

Illustrating code snippet

```
public ChartUIConfiguration(UIConfiguration projectConfig) {
  mySpanningRowTextFont = Fonts.TOP_UNIT_FONT;
  mySpanningHeaderBackgroundColor = new Color( r: 0.93f,  g: 0.93f,  b: 0.93f);
  myHeaderBorderColor = new Color( r: 0.482f,  g: 0.482f,  b: 0.482f);
  myWorkingTimeBackgroundColor = Color.WHITE;
  myHolidayTimeBackgroundColor = new Color( r: 0.9f,  g: 0.9f,  b: 0.9f);
  myPublicHolidayTimeBackgroundColor = new Color( r: 240,  g: 220,  b: 240);
  // myHeaderBorderColor = new Color(0f, 1f, 0f);
  myBottomUnitGridColor = new Color( r: 0.482f,  g: 0.482f,  b: 0.482f);
  myProjectConfig = projectConfig;
  myChartStylesOption = new ChartPropertiesOption();
}
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/chart/ChartUIConfiguration.java

Explanation

Changing colors in any part of the code may be harder than intended given that there is no general definition for such.

Refactoring proposal

Create constants responsible for holding each color used throughout the code.

Author

Pedro Fernandes (60694)

Reviewer

Rafael Martins (60602)

Long parameter list

Illustrating code snippet

```
public static Offset createFullyClosed(TimeUnit timeUnit, Date anchor, Date closedStartDate, Date closedEndDate,
    int startPixels, int endPixels, int dayMask) {
  return new Offset(timeUnit, anchor, closedStartDate, closedEndDate, startPixels, endPixels, dayMask);
}
```

Class location

/ganttproject/biz.ganttproject.core/src/main/java/biz/ganttproject/core/chart/grid/Offset.java

Code smell (Large Parameter List)

In the Offset.java class there is a method with an extensive parameter list in line 109, this increases the chance of something going wrong.

Refactoring proposal

The best solution would be to introduce parameter objects.

Author

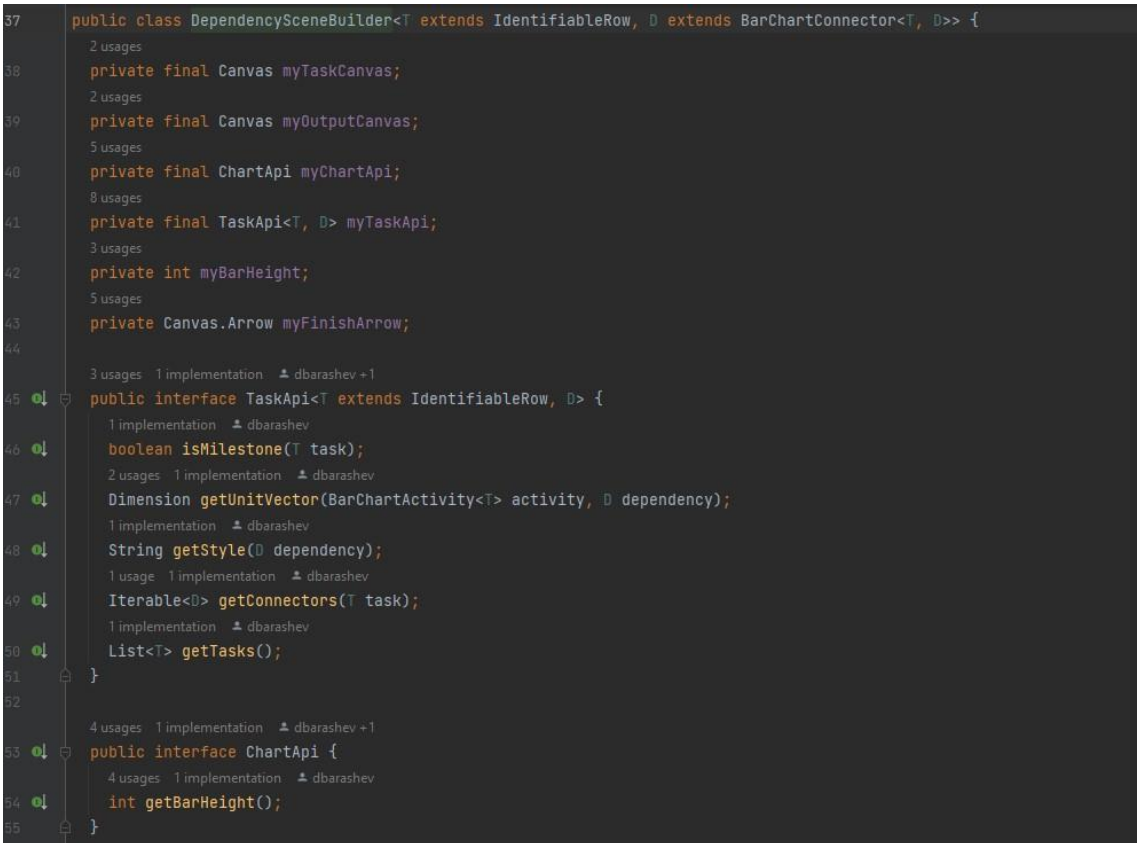
Pedro Lopes (57514)

Reviewer

Guilherme Fernandes (60045)

No comments

Illustrating code snippet



```
37  public class DependencySceneBuilder<T extends IdentifiableRow, D extends BarChartConnector<T, D>> {
      2 usages
38    private final Canvas myTaskCanvas;
      2 usages
39    private final Canvas myOutputCanvas;
      5 usages
40    private final ChartApi myChartApi;
      8 usages
41    private final TaskApi<T, D> myTaskApi;
      3 usages
42    private int myBarHeight;
      5 usages
43    private Canvas.Arrow myFinishArrow;
44
      3 usages  1 implementation  dbarashev +1
45    public interface TaskApi<T extends IdentifiableRow, D> {
        1 implementation  dbarashev
46      boolean isMilestone(T task);
        2 usages  1 implementation  dbarashev
47      Dimension getUnitVector(BarChartActivity<T> activity, D dependency);
        1 implementation  dbarashev
48      String getStyle(D dependency);
        1 usage  1 implementation  dbarashev
49      Iterable<D> getConnectors(T task);
        1 implementation  dbarashev
50      List<T> getTasks();
51    }
52
      4 usages  1 implementation  dbarashev +1
53    public interface ChartApi {
        4 usages  1 implementation  dbarashev
54      int getBarHeight();
55    }
```

Class location

/ganttproject/biz.ganttproject.core/src/main/java/biz/ganttproject/core/chart/scene/gantt/DependencySceneBuilder.java

Explanation

The DependencySceneBuilder.java does not contain any comments regarding what the implemented functions do. Considering their size this could cause confusion to someone that is not familiar with the code.

Refactoring proposal

Add enough comments so that at least the purpose of the most extensive functions is clear.

Author

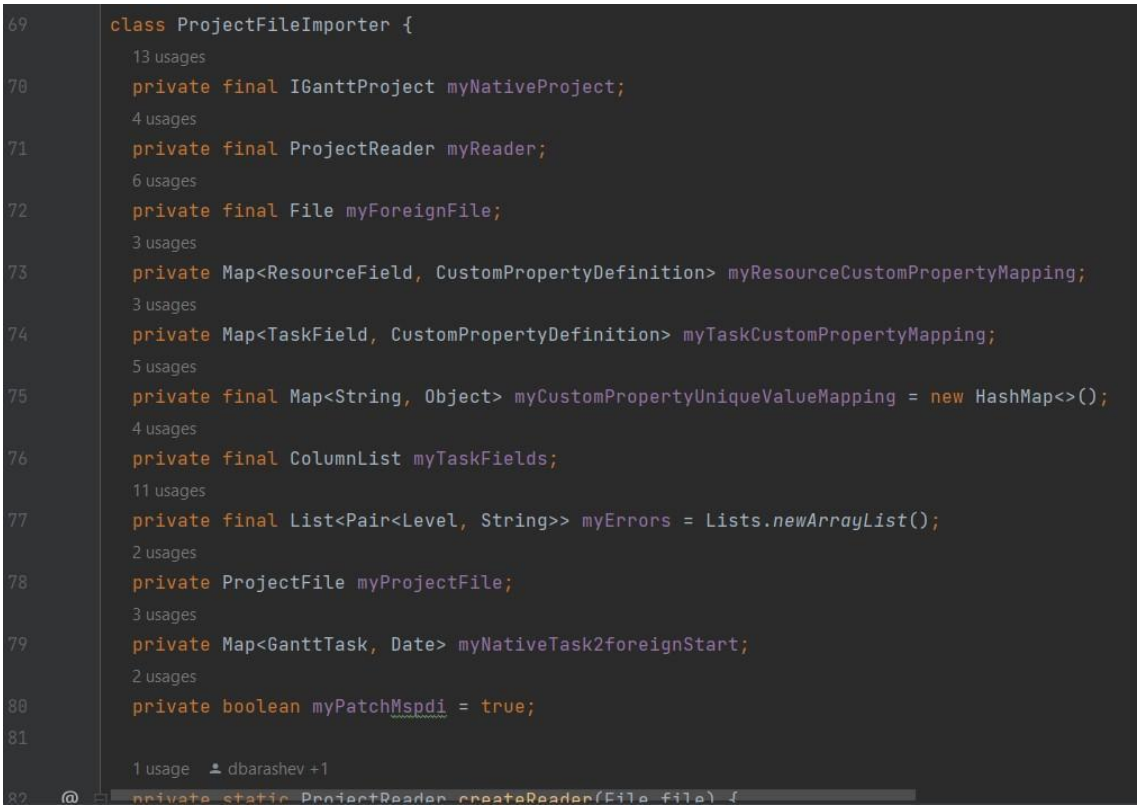
Pedro Lopes (57514)

Reviewer

Rafael Pereira (60700)

Large class

Illustrating code snippet



```
69      class ProjectFileImporter {
          13 usages
70        private final IGanttProject myNativeProject;
          4 usages
71        private final ProjectReader myReader;
          6 usages
72        private final File myForeignFile;
          3 usages
73        private Map<ResourceField, CustomPropertyDefinition> myResourceCustomPropertyMapping;
          3 usages
74        private Map<TaskField, CustomPropertyDefinition> myTaskCustomPropertyMapping;
          5 usages
75        private final Map<String, Object> myCustomPropertyUniqueValueMapping = new HashMap<>();
          4 usages
76        private final ColumnList myTaskFields;
          11 usages
77        private final List<Pair<Level, String>> myErrors = Lists.newArrayList();
          2 usages
78        private ProjectFile myProjectFile;
          3 usages
79        private Map<GanttTask, Date> myNativeTask2foreignStart;
          2 usages
80        private boolean myPatchMspdi = true;
81
            1 usage  dbarashev +1
82    @     private static ProjectReader createReader(File file) {
```

Class location

/ganttproject/biz.ganttproject.impex.msproject2/src/main/java/biz/ganttproject/impex/msproject2/ProjectFileImporter.java

Explanation

The ProjectFileImporter.java is a very extensive class (733 lines), this means it contains a lot of responsabilities and would require a lot of comments to document it's functionalities.

Refactoring proposal

The proper way to handle this is to divide the responsibilities into subclasses and hide the implementation from the large class.

Author

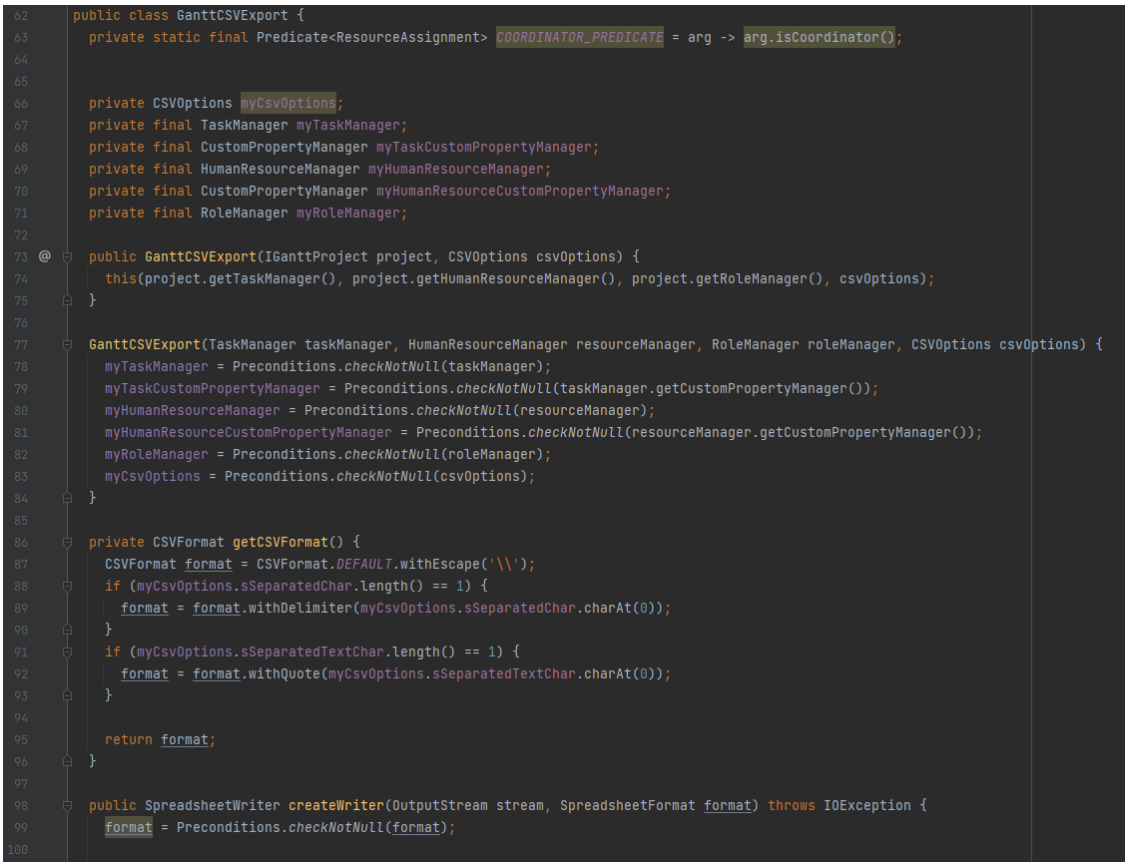
Pedro Lopes (57514)

Reviewer

Rafael Martins (60602)

No comments

Illustrating code snippet



```java
public class GanttCSVExport {
  private static final Predicate<ResourceAssignment> COORDINATOR_PREDICATE = arg -> arg.isCoordinator();


  private CSVOptions myCsvOptions;
  private final TaskManager myTaskManager;
  private final CustomPropertyManager myTaskCustomPropertyManager;
  private final HumanResourceManager myHumanResourceManager;
  private final CustomPropertyManager myHumanResourceCustomPropertyManager;
  private final RoleManager myRoleManager;

@ public GanttCSVExport(IGanttProject project, CSVOptions csvOptions) {
    this(project.getTaskManager(), project.getHumanResourceManager(), project.getRoleManager(), csvOptions);
  }

  GanttCSVExport(TaskManager taskManager, HumanResourceManager resourceManager, RoleManager roleManager, CSVOptions csvOptions) {
    myTaskManager = Preconditions.checkNotNull(taskManager);
    myTaskCustomPropertyManager = Preconditions.checkNotNull(taskManager.getCustomPropertyManager());
    myHumanResourceManager = Preconditions.checkNotNull(resourceManager);
    myHumanResourceCustomPropertyManager = Preconditions.checkNotNull(resourceManager.getCustomPropertyManager());
    myRoleManager = Preconditions.checkNotNull(roleManager);
    myCsvOptions = Preconditions.checkNotNull(csvOptions);
  }

  private CSVFormat getCSVFormat() {
    CSVFormat format = CSVFormat.DEFAULT.withEscape('\\');
    if (myCsvOptions.sSeparatedChar.length() == 1) {
      format = format.withDelimiter(myCsvOptions.sSeparatedChar.charAt(0));
    }
    if (myCsvOptions.sSeparatedTextChar.length() == 1) {
      format = format.withQuote(myCsvOptions.sSeparatedTextChar.charAt(0));
    }

    return format;
  }

  public SpreadsheetWriter createWriter(OutputStream stream, SpreadsheetFormat format) throws IOException {
    format = Preconditions.checkNotNull(format);

```

Class Location

/ganttproject/src/main/java/biz/ganttproject/impex/csv/GanttCSVExport.java

Explanation

This Class has almost no comments explaining the code, making it confusing for someone who is looking at the code for the first time.

Refactoring Proposal

Adding more comments explaining what each method does.

Author

Rafael Martins (60602)

Reviewer

Guilherme Fernandes (60045)

Long method

Illustrating code snippet

```
153 @   private String i18n(String key) { return InternationalizationKt.getRootLocalizer().formatText(key); }
156
157     private void writeTasks(SpreadsheetWriter writer) throws IOException {
158       List<CustomPropertyDefinition> customFields = writeTaskHeaders(writer);
159       for (Task task : myTaskManager.getTasks()) {
160         for (Map.Entry<String, BooleanOption> entry : myCsvOptions.getTaskOptions().entrySet()) {
161           if (!entry.getValue().isChecked()) {
162             continue;
163           }
164           TaskDefaultColumn defaultColumn = TaskDefaultColumn.find(entry.getKey());
165           if (defaultColumn == null) {
166             if ("webLink".equals(entry.getKey())) {
167               writer.print(getWebLink((GanttTask) task));
168               continue;
169             }
170             if ("notes".equals(entry.getKey())) {
171               writer.print(task.getNotes());
172               continue;
173             }
174           } else {
175             switch (defaultColumn) {
176               case ID:
177                 writer.print(task.getTaskID());
178                 break;
179               case NAME:
180                 writer.print(getName(task));
181                 break;
182               case BEGIN_DATE:
183                 writer.print(task.getStart());
184                 break;
185               case END_DATE:
186                 writer.print(task.getDisplayEnd());
187                 break;
188               case DURATION:
189                 writer.print(task.getDuration().getLength());
190                 break;
191               case COMPLETION:
192                 writer.print(task.getCompletionPercentage());
```

Class Location

/ganttproject/src/main/java/biz/ganttproject/impex/csv/GanttCSVExport.java

Explanation

This method is too long (line 157 to 228) making it confusing and hard to read.

Refactoring Proposal

Creating sub methods that help dividing the writeTasks method into smaller methods.

Author

Rafael Martins (60602)

Reviewer

Pedro Fernandes (60694)

Large class

Illustrating code snippet

```
  private class ParserFactoryImpl implements ParserFactory {
    @Override
    public GPParser newParser() { return new GanttXMLOpen(prjInfos, getTaskManager(), getUIFacade()); }

    @Override
    public GPSaver newSaver() {
      return new GanttXMLSaver( project: GanttProject.this, getArea(), getUIFacade(),
          () -> myTaskTableSupplier.get().getColumnList(), () -> myTaskFilterManager);
    }
  }

  @Override
  public int getViewIndex() {
    if (getTabs() == null) {
      return -1;
    }
    return getTabs().getSelectedIndex();
  }

  @Override
  public void setViewIndex(int viewIndex) {
    if (getTabs().getTabCount() > viewIndex) {
      getTabs().setSelectedIndex(viewIndex);
    }
  }

  public static void setApplicationQuitCallback(Consumer<Boolean> callback) { ourQuitCallback = callback; }

  public static void doQuitApplication(boolean withSystemExit) { ourQuitCallback.accept(withSystemExit); }
  @Override
  public void refresh() {
    getResourcePanel().getResourceTreeTableModel().updateResources();
    getResourcePanel().getResourceTreeTable().setRowHeight(getResourceChart().getModel().calculateRowHeight());
    for (Chart chart : PluginManager.getCharts()) {
      chart.reset();
    }
    super.repaint();
  }
}
```

Class Location

/ganttproject/src/main/java/net/sourceforge/ganttproject/GanttProject.java

Explanation

This class is too long (900 lines of code). This is bad because this way it holds too many responsibilities and has to communicate with a lot of other classes.

Refactoring Proposal

Creating smaller classes, where each one holds less responsabilities, but, when they're all put together, serve the same purpose as the GanttProject class.

Author

Rafael Martins (60602)

Reviewer

Pedro Lopes (57514)

Long method

Illustrating code snippet

```
private void doSave(OutputStream out) throws Exception {
    final TransformerHandler handler = ((SAXTransformerFactory) SAXTransformerFactory.newInstance()).newTransformerHandler();
    Transformer serializer = handler.getTransformer();
    serializer.setOutputProperty(OutputKeys.ENCODING, value: "UTF-8");
    serializer.setOutputProperty(OutputKeys.INDENT, value: "yes");
    serializer.setOutputProperty( name: "{http://xml.apache.org/xslt}indent-amount", value: "4");
    handler.setResult(new StreamResult(out));
    handler.startDocument();
    // handler.startDTD("ganttproject.sourceforge.net",
    // "-//GanttProject.org//DTD GanttProject-1.x//EN",
    // "http://ganttproject.sourceforge.net/dtd/ganttproject.dtd");
    // handler.endDTD();

    final AttributesImpl attrs = new AttributesImpl();
    addAttribute("version", GPVersion.getCurrentVersionNumber(), attrs);
    handler.startElement( uri: "", localName: "ganttproject-options", qName: "ganttproject-options", attrs);

    attrs.clear();
    // write the task Color

    // Color color = getUIConfiguration().getTaskColor();
    // attrs.addAttribute("", "red", "red", "CDATA", "" + color.getRed());
    // attrs.addAttribute("", "green", "green", "CDATA", ""
    // + color.getGreen());
    // attrs.addAttribute("", "blue", "blue", "CDATA", ""
    // + color.getBlue());
    // handler.startElement("", "task-color", "task-color", attrs);
    // handler.endElement("", "task-color", "task-color"); attrs.clear();

    Color resourceColor = myUIConfig.getResourceColor();
    if (resourceColor != null) {
        attrs.addAttribute( uri: "", localName: "resources", qName: "resources", type: "CDATA", ColorConvertion.getColor(resourceColor));
    }
    Color resourceOverloadColor = myUIConfig.getResourceOverloadColor();
    if (resourceOverloadColor != null) {
        attrs.addAttribute( uri: "", localName: "resourcesOverload", qName: "resourcesOverload", type: "CDATA",
                ColorConvertion.getColor(resourceOverloadColor));
    }
    Color resourceUnderloadColor = myUIConfig.getResourceUnderloadColor();
    if (resourceUnderloadColor != null) {
        attrs.addAttribute( uri: "", localName: "resourcesUnderload", qName: "resourcesUnderload", type: "CDATA",
                ColorConvertion.getColor(resourceUnderloadColor));
    }
    Color weekEndColor = myUIConfig.getWeekEndColor();
    if (weekEndColor != null) {
```

Class location

/ganttproject/src/main/java/net/sourceforge/ganttproject/GanttOptions.java

Explanation

In GanttOptions.java the method is too extensive (line 210 to line 358) which makes it too complex and hard to understand.

Refactoring proposal

This method should be broken down into smaller methods to make the code simpler.

Author

Rafael Pereira (60700)

Reviewer

Pedro Fernandes (60694)

Large class

Illustrating code snippet

```
100  public abstract class GPTreeTableBase extends JXTreeTable implements CustomPropertyListener {
101    private final IGanttProject myProject;
102    private final UIFacade myUiFacade;
103    private final TableHeaderUiFacadeImpl myTableHeaderFacade = new TableHeaderUiFacadeImpl();
104    private final CustomPropertyManager myCustomPropertyManager;
105    private final JScrollPane myScrollPane = new JScrollPane() {
106      @Override
107      public void applyComponentOrientation(ComponentOrientation o) {
108        super.applyComponentOrientation(ComponentOrientation.RIGHT_TO_LEFT);
109      }
110    };
111
112    private GPAction myEditCellAction = new GPAction("tree.edit") {
113      @Override
114      public void actionPerformed(ActionEvent e) {
115        JTable t = getTable();
116        if (t.getSelectedRow() < 0) {
117          return;
118        }
119        if (t.getSelectedColumn() < 0) {
120          t.getColumnModel().getSelectionModel().setSelectionInterval(0, 0);
121        }
122        editCellAt(t.getSelectedRow(), t.getSelectedColumn());
123      }
124    };
125    private GPAction myManageColumnsAction = new GPAction("columns.manage.label") {
126      @Override
127      public void actionPerformed(ActionEvent e) {
128        ColumnManagerKt.showResourceColumnManager(myTableHeaderFacade,
129            myCustomPropertyManager, getUiFacade().getUndoManager(), getProject().getProjectDatabase(), Apply
130      }
131    };
132    private GPAction myNewRowAction;
```

Class location

/biz.ganttproject.core/src/main/java/net/sourceforge/ganttproject/GPTreeTableBase.java

Explanation

The GPTreeTableBase.java class is long, having 1271 lines of code, which is a sign that it has too many responsibilities.

Refactoring proposal

The most appropriate solution would be to split the class into subclasses and redistribute the responsibilities.

Author

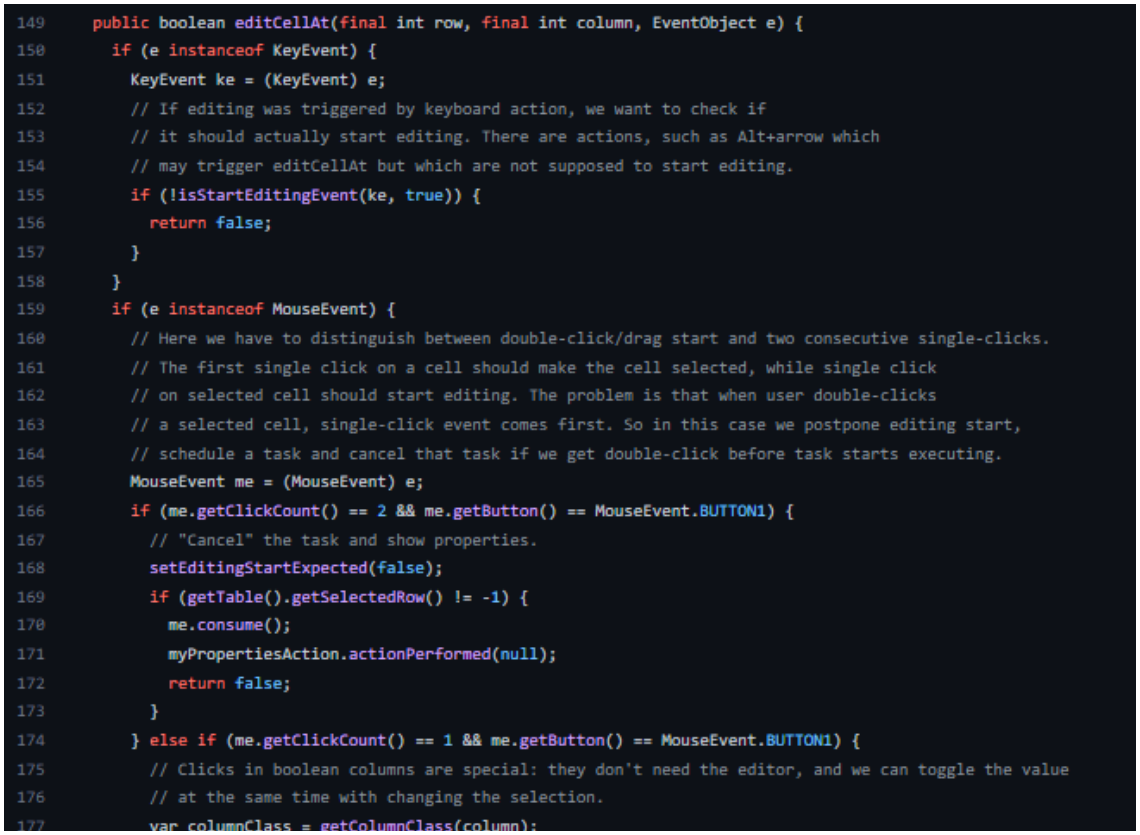
Rafael Pereira (60700)

Reviewer

Rafael Martins (60602)

Too many comments

Illustrating code snippet



```
149   public boolean editCellAt(final int row, final int column, EventObject e) {
150     if (e instanceof KeyEvent) {
151       KeyEvent ke = (KeyEvent) e;
152       // If editing was triggered by keyboard action, we want to check if
153       // it should actually start editing. There are actions, such as Alt+arrow which
154       // may trigger editCellAt but which are not supposed to start editing.
155       if (!isStartEditingEvent(ke, true)) {
156         return false;
157       }
158     }
159     if (e instanceof MouseEvent) {
160       // Here we have to distinguish between double-click/drag start and two consecutive single-clicks.
161       // The first single click on a cell should make the cell selected, while single click
162       // on selected cell should start editing. The problem is that when user double-clicks
163       // a selected cell, single-click event comes first. So in this case we postpone editing start,
164       // schedule a task and cancel that task if we get double-click before task starts executing.
165       MouseEvent me = (MouseEvent) e;
166       if (me.getClickCount() == 2 && me.getButton() == MouseEvent.BUTTON1) {
167         // "Cancel" the task and show properties.
168         setEditingStartExpected(false);
169         if (getTable().getSelectedRow() != -1) {
170           me.consume();
171           myPropertiesAction.actionPerformed(null);
172           return false;
173         }
174       } else if (me.getClickCount() == 1 && me.getButton() == MouseEvent.BUTTON1) {
175         // Clicks in boolean columns are special: they don't need the editor, and we can toggle the value
176         // at the same time with changing the selection.
177         var columnClass = getColumnClass(column);
```

Class location

/biz.ganttproject.core/src/main/java/net/sourceforge/ganttproject/GPTreeTableBase.java

Explanation

In this section of the GPTreeTableBase.java class there is an excessive use of comments to explain the editCellAt() method which indicates poor design.

Refactoring proposal

The best way to deal with this problem would be to decompose the method into simpler to understand submethods and decrease the use of comments within the methods.

Author

Rafael Pereira (60700)

Reviewer

Pedro Lopes (57514)

Phase 2

New Functionalities

User Stories

1. **Tasks description:**

   As a user, I want to be able to see the description of all tasks at the same time, so I can have an overview of what each one is.

2. **Reorder tasks:**

   As a casual user, I want to have a keybind that allows me to drag tasks around so I can easily reorder them using the mouse.

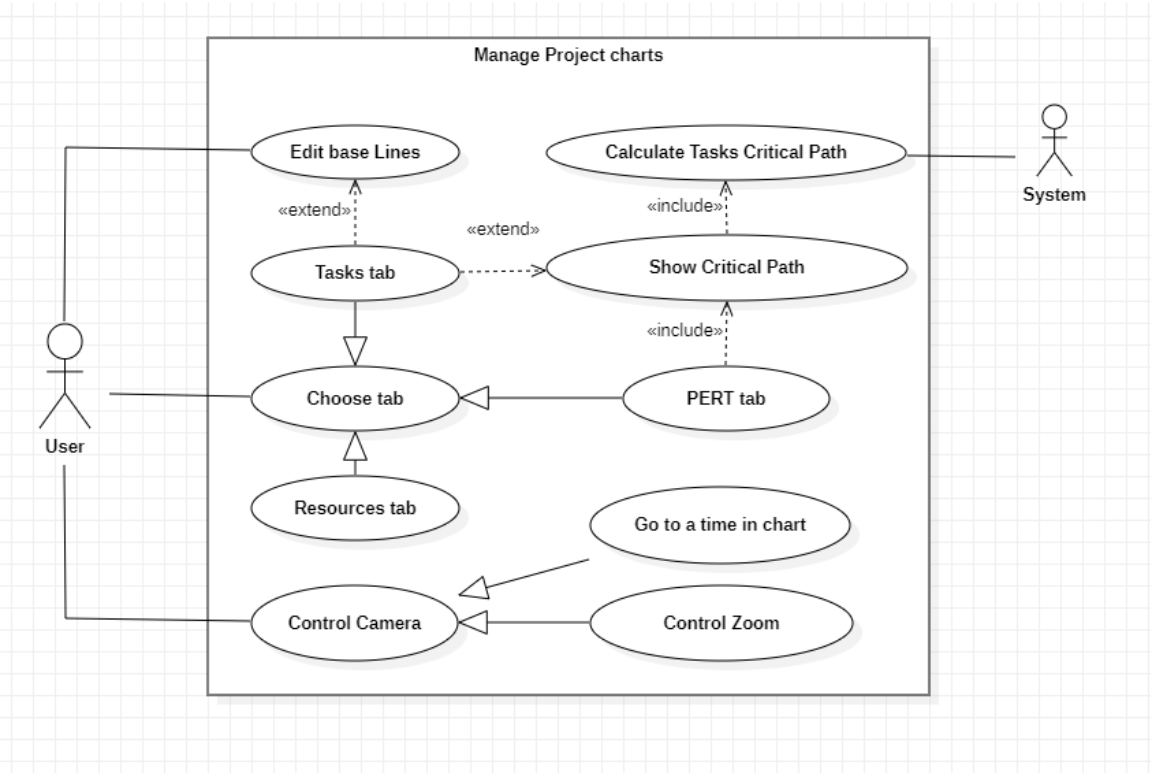
Demo Video

https://www.youtube.com/watch?v=n16S9HPf7no

Use Cases

Manage Project Charts

Author: Guilherme Fernandes



User Stories

1. Show critical path

As a user, I want to be able to see the critical path, so can I have an idea in case of delay which will be the tasks that will delay the final date of the project.

2. Go To Time in Chart and Control Zoom

As a user, I want to be able to navigate through time and see what tasks I have to do at that time and what tasks were done in the past and I want to be able to zoom in so that it's easier to see the tasks on the timeline, so I can organize myself more easily.

3. Resources Tab

As a user, I want to be able to see all the resources in one window, so I can manage who is working on the tasks.

4. Tasks Tab

As a user, I want to be able to see all the tasks in one window, so I can manage all tasks easily.

5. Pert Tab

As a user, I want to be able to create a graph that shows all the tasks and the dependencies between them, so I can get a general sense of how the tasks are organized.

6. Edit base lines

As a user, I want to be able to move tasks position in the task window by dragging them, so I can change their organization easily.

Description

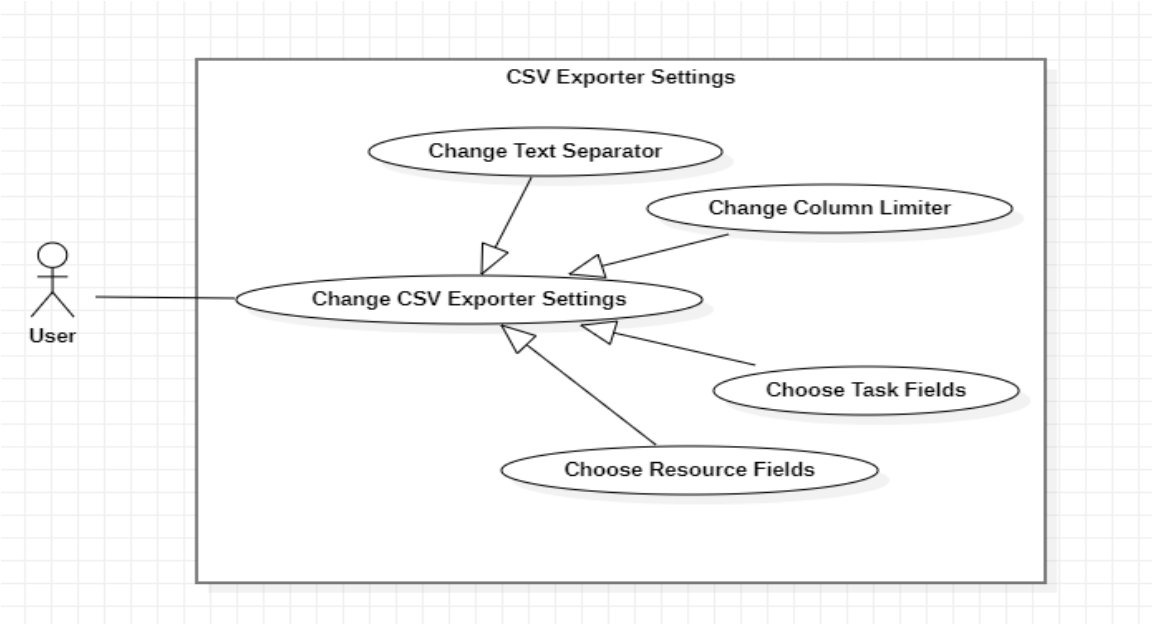
The User can choose the chart that is shown in the application window, and can control the zoom and the camera position on the diagram. In the case of the tasks chart the user can also edit the baselines and make the critical path be shown or not.

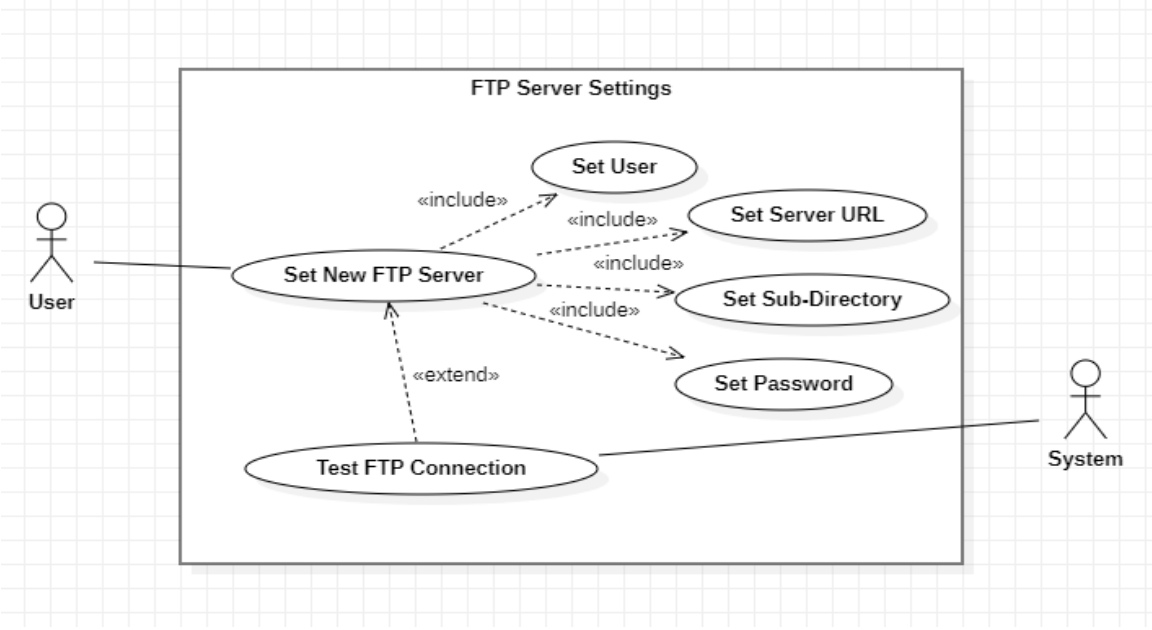
Primary actor: User

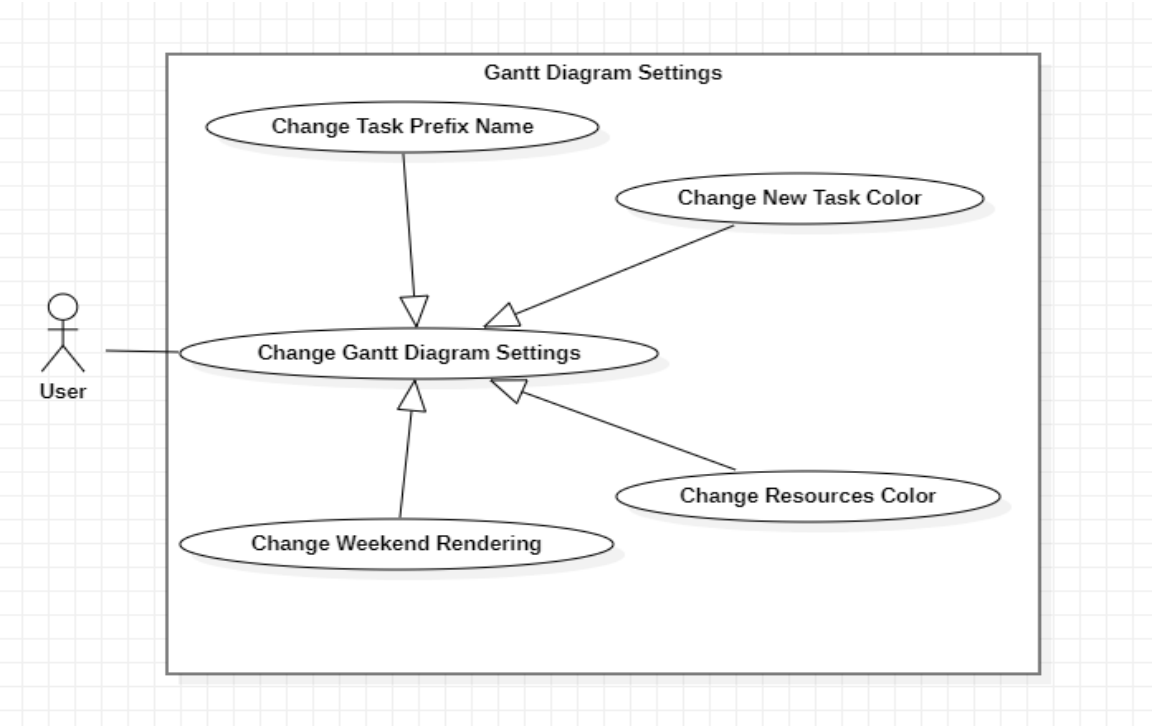
Secondary actor: System

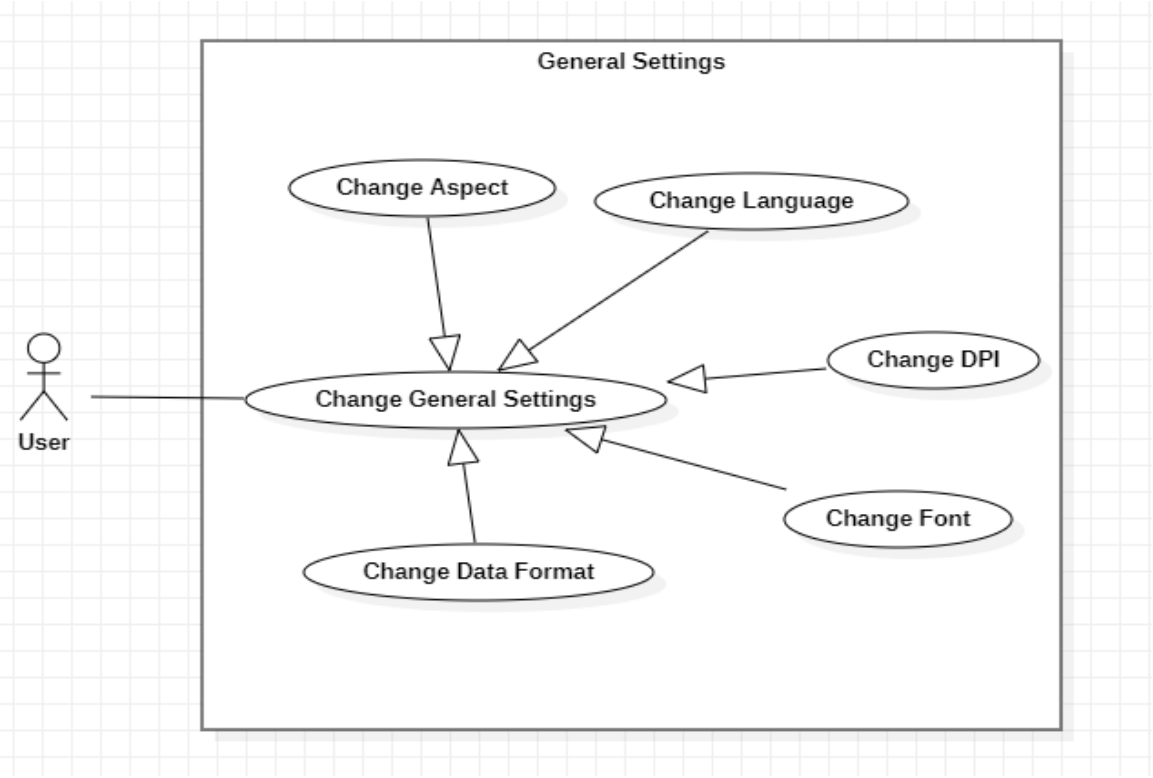
Manage Settings

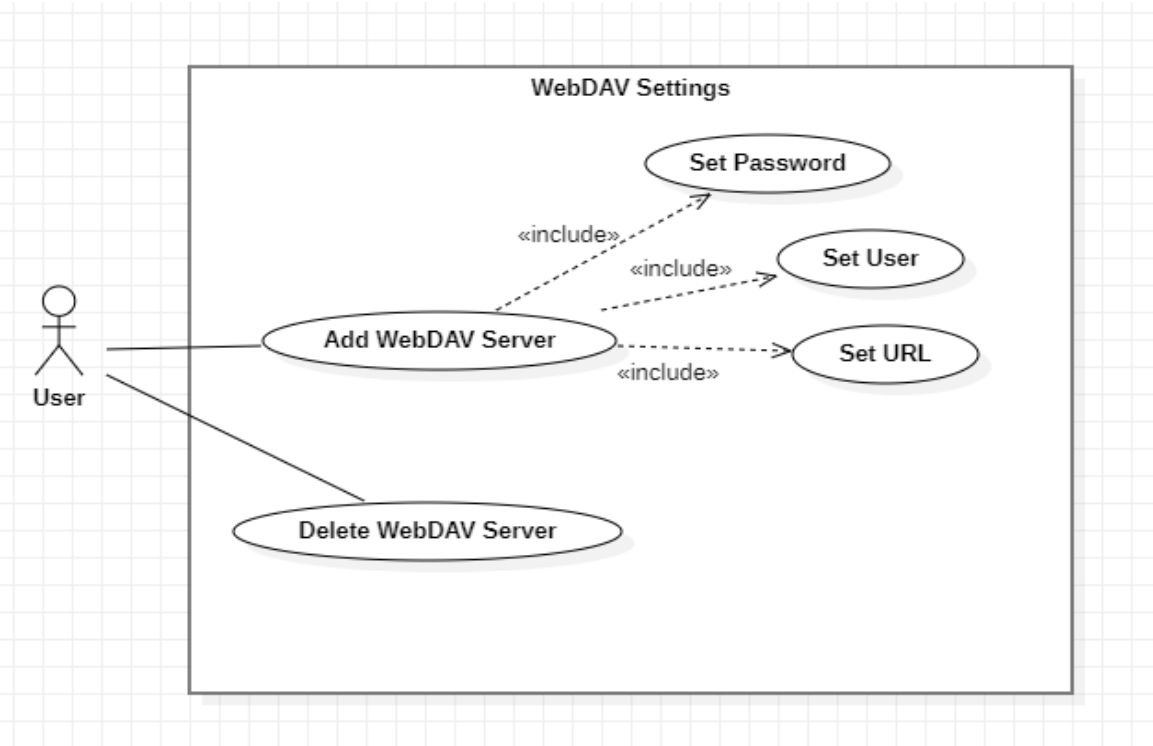
Author: Pedro Fernandes






Gantt Diagram Settings
Change Task Prefix Name
Change New Task Color
User
Change Gantt Diagram Settings
Change Resources Color
Change Weekend Rendering


General Settings
Change Aspect
Change Language
Change DPI
User
Change General Settings
Change Font
Change Data Format



User stories

1. **CSV Exporter Settings**

   As a user, I want to configure CSV settings so I can specify the data of the project I want to export.

2. **FTP Server Settings**

   As a user, I want to configure FTP servers I can connect to so I can access projects in remote locations.

3. **Gantt Diagram Settings**

   As a user, I want to change the way diagrams look by default so I can more easily manage a consistent design.

4. **General Settings**

   As a user, I want to change the look and feel of the application so I can more easily adjust to it.

5. **WebDAV Settings**

   As a user, I want to configure WebDAV servers I can connect to so I can work on projects together with my colleagues.

Description

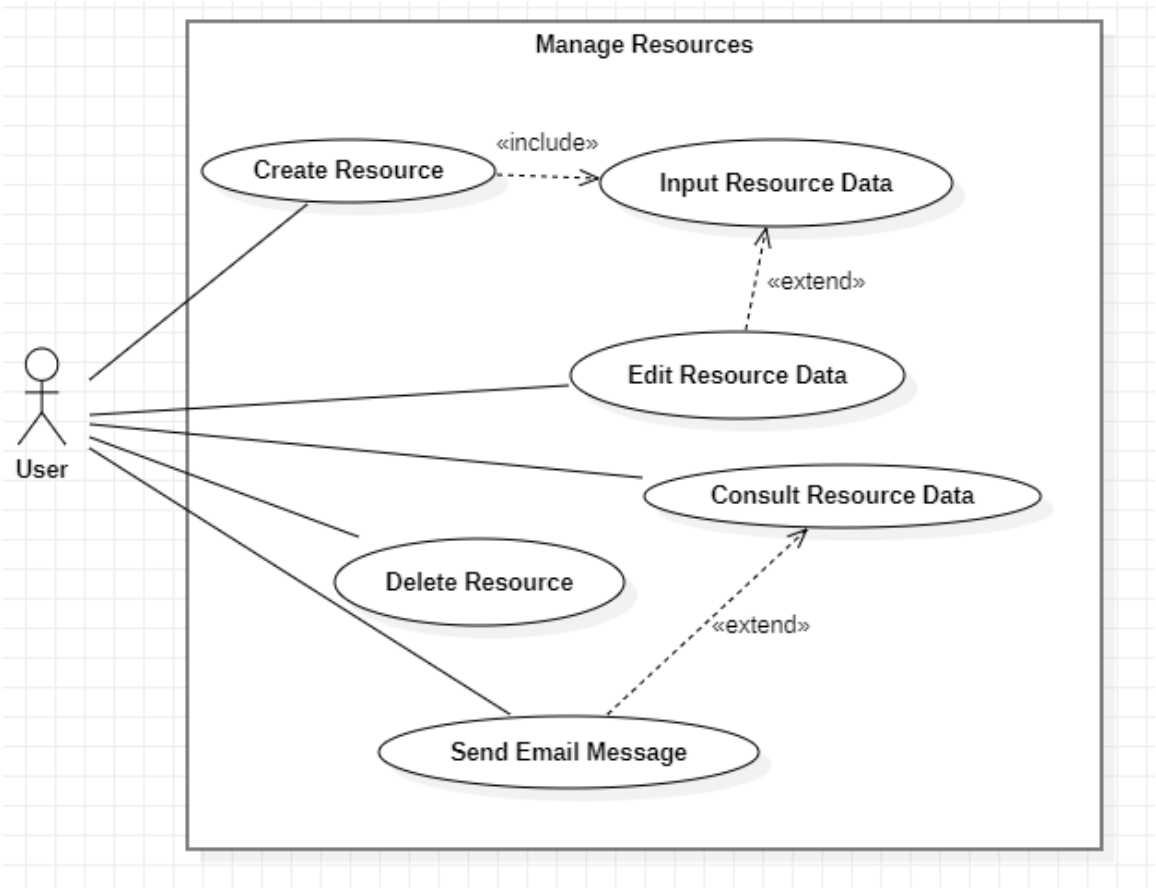
The User changes settings to better fit their preference and/or necessities. The User can change General Settings that affect the visual part of the application, change the way that the application exports CSV or add FTP and WebDAV servers. When adding FTP server, the system may perform connection tests.

Primary actor: User

Secondary actor: System

Manage Resources

Author: Pedro Lopes



User Stories

1. **Create/Delete Resource**

   As a user, I want to be able to add and remove resources so I can control the number of existing resources.

2. **Input Resource Data**

   As a user, I want to be able to input data for resources so that they contain exactly the information I want.

3. **Edit Resource Data**

   As a user, I want to be able to edit resource data, so I don’t need to always create new resources.

4. **Consult Resource Data**

As a user, I want to be able to consult resource data, so I can always know that information.

5. **Send Email Message**

As a user I want to be able to send emails to certain resources so I can communicate and discuss ideas with them.

Description

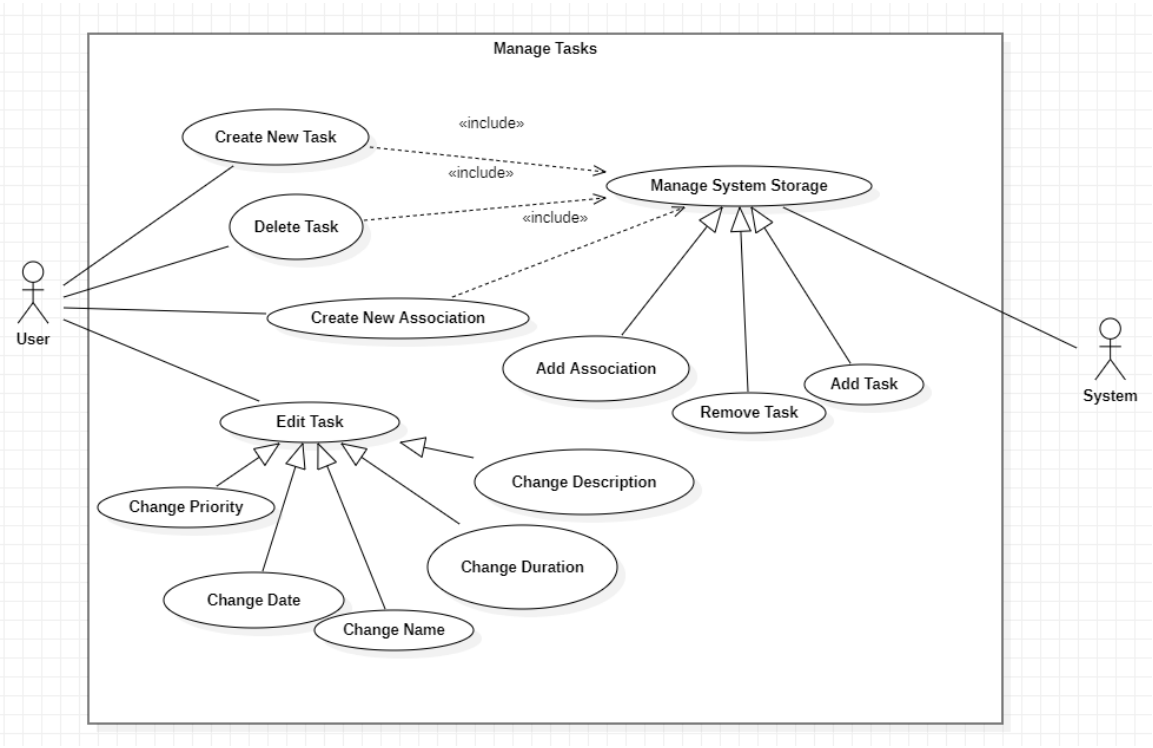
The User manages the system resources. The User can create new Resources, edit their data and delete them. It's also possible to send an email to a Resource based on the email address that was inserted in that Resource's data.

Primary actor: User

Secondary actor: None

Manage Tasks

Author: Rafael Martins



User Stories

1. Create New Task

As a User, I want to be able to create new tasks so that I can create the basis of my gantt chart.

2. Delete Task

As a User, I want to be able to delete the tasks that no longer are needed so that I can keep my gantt chart more simple and easier to understand.

3. Create New Association

As a User, I want to be able to create associations between tasks so that I can order them correctly and show which tasks depend on other tasks.

4. Manage System Storage

As the System, I want to be able to manage the internal data structures of the application so that I'm only using the storage and processing power required to handle the current use of the application.

Description

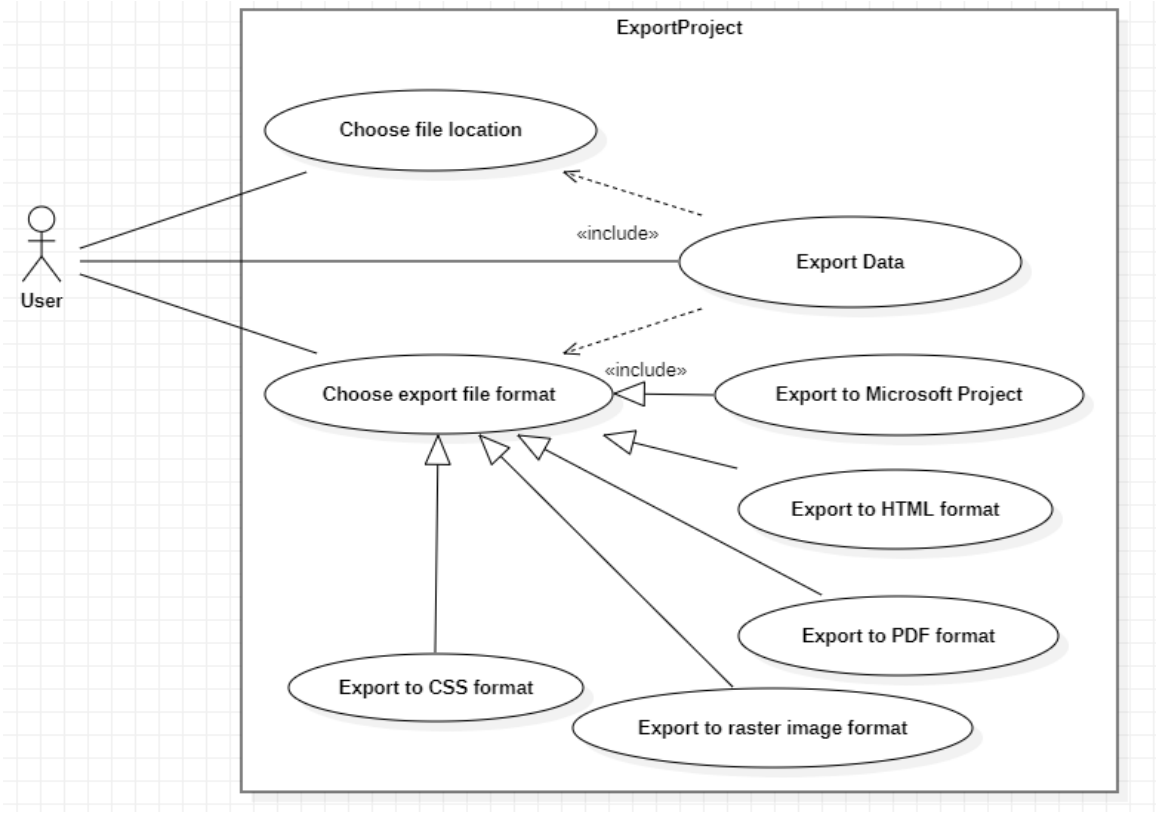
The User manages the tasks. The User has to first create at least one task to be able to edit it, and at least two tasks to be able to create an association. When a task is created/deleted, or an association is created, the system has to change its data structure accordingly.

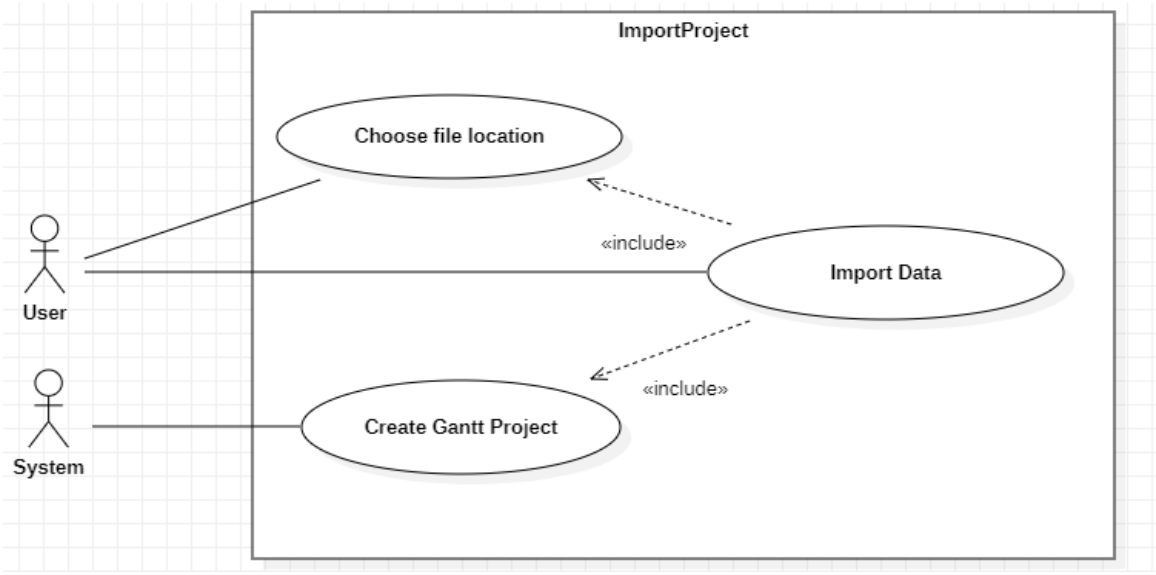
Primary actor: User

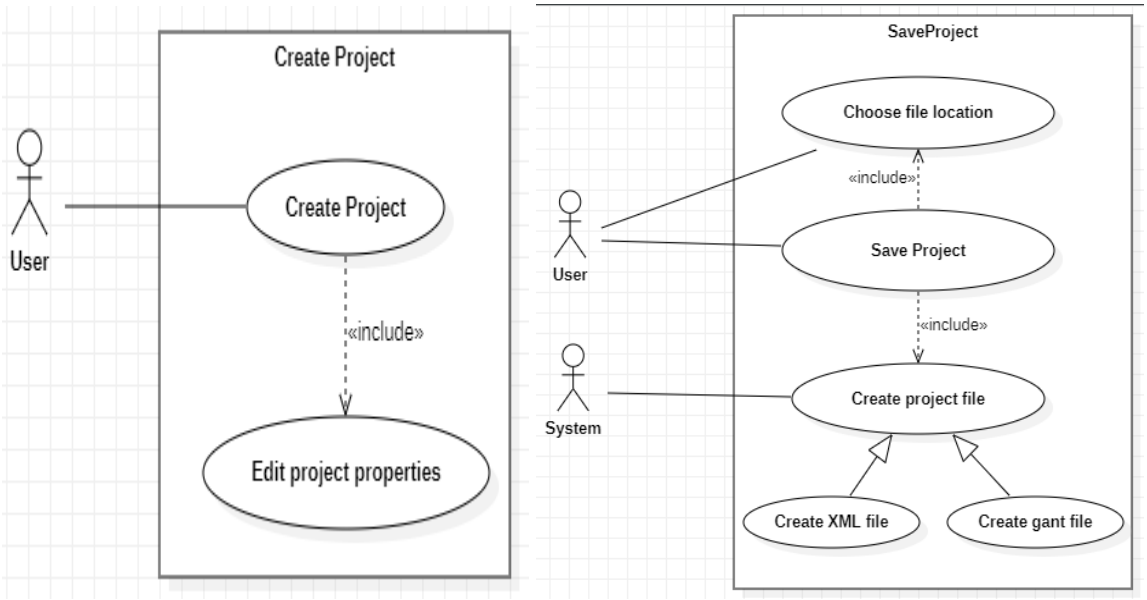
Secondary actor: System

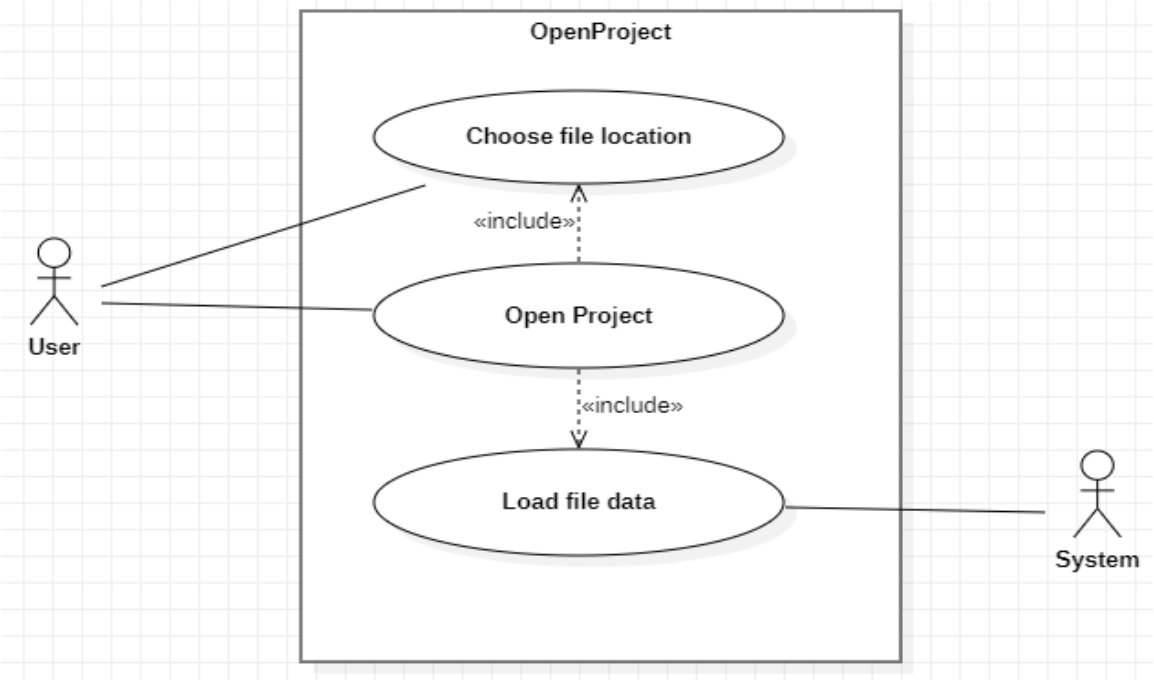
File Manager

Author: Rafael Pereira









User Stories

1. Create Project

As a user, I want to be able to edit project properties while creating a new one, so that I can easily define the main structure of the project before I even start working on it.

2. Export Project

As a user, I want to be able to export the project and choose the export properties, so I can decide the file format of the exported project and where it will be exported.

3. Import Project

As a user, I want to be able to import the data from a file other than gantt or xml files into the project, so I can easily use other files that may have useful information to create my project.

4. Open Project

As a user, I want to be able to open a saved Project, so that I don't have to import and consequently create a new project every time I want to work on my current project.

5. Save Project

As a user, I want to be able to save my current project, so that I can store my project on the machine I am working on, in a format that can be easily opened by the application.

Description

The user can create a new project, load an existing gantt project from the machine or save the current project. Besides that he can also export the project to other file formats and last but not least, the user can import a file with the data needed to generate a gantt project.

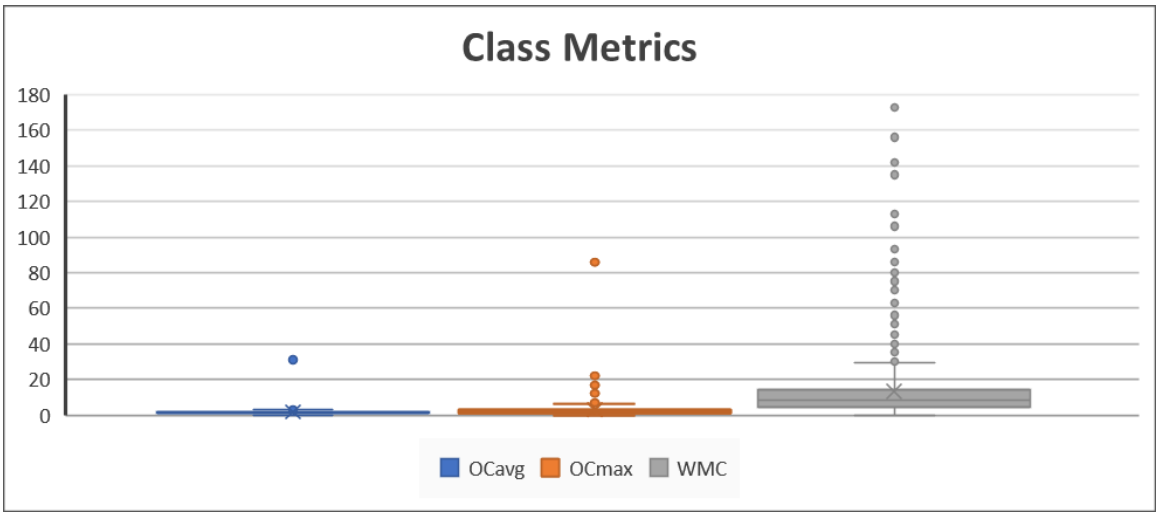
Primary actor: User

Secondary actor: System

Metrics Sets

Complexity Metrics

Author: Guilherme Fernandes



Explanation

Cyclomatic complexity of a code section is the quantitative measure of the number of linearly independent paths (the number of situations that lead to different paths in the code, p.e. one if has two independent paths) in it.

Average operation complexity (OCavg) is the Average Cyclomatic Complexity of all non-abstract methods in each class.

Maximum operation complexity (OCmax) is the Maximum Cyclomatic Complexity of the non-abstract methods in each class. Inherited methods are not counted.

Weighted method complexity (WMC) is the total cyclomatic complexity of the methods in each class.

Average values of metrics for the *ganttproject*

- OCavg ≈ 1,55
- OCmax ≈ 2,96
- WMC ≈ 13,21

Potential Trouble Spots

The maximum value of OCavg and OCmax is, 31 and 86 respectively, which corresponds to the GanttXMLOptionsParser class and could decrease if, for example, the startElement method handles fewer subproblems. A possible solution would be to divide this method into smaller methods, each dealing with a specific subproblem.

The highest value of WMC is 173, which corresponds to the TaskManagerImpl class. This high value is due to the fact that this class is relatively large and contains some extensive methods, such as newTaskBuilder, createLength, compareDocumentOrder, ...

A solution would be to divide this class into several classes, for example, in order to simplify the createLength method, a class could be created that would be responsible for processing the string and calculating its numeric value, which would make the method more readable, and less complex

Relatability to identified Code Smells

Usually, high complexity is directly related to the long method and large class code smells, because as seen previously, when one of these code smells is present in the class, we always have a higher complexity.

MOOD Metrics

Author: Pedro Lopes

Explanation

MHF (Method Hiding Factor): Percentage of methods that are hidden from the remaining classes. A high value indicates that there might not a lot of functionality, while a low value indicates that the implementation might not have enough abstraction.

AHF (Attribute Hiding Factor): Percentage of attributes that are hidden from the remaining classes. Ideally all attributes would be hidden (AHF = 100%).

MIF (Method Inheritance Factor): Percentage of methods that are inherited from other classes.

AIF (Attribute Inheritance Factor): Percentage of attributes that are inherited from other classes. High values (of MIF and AIF) indicates that there might be too much inheritance or that the inherited elements have a big scope, while low values might indicate that there isn't enough inheritance or too much use of override.

PF (Polymorphism Factor): Percentage of overridden inherited methods, according to Fernando Brito and Abreu, values above 10% are too high and reduce benefits.

CF (Coupling Factor): Percentage of classes that are coupled with another class, high values are a sign of high complexity and therefore higher difficulty of understanding the code.

Average values of metrics for the *ganttproject*

MHF (Method Hiding Factor): 45,24%

AHF (Attribute Hiding Factor): 88,19%

MIF (Method Inheritance Factor): 51,58%

AIF (Attribute Inheritance Factor): 75,96%

PF (Polymorphism Factor): 29,70%

CF (Coupling Factor): 2,08%

Potential Trouble Spots

AIF has a high value, which means, too many classes with access to variables from classes higher in the hierarchy, which increases the complexity of the project.

PF also has a high value (according to Fernando Brito and Abreu), the benefits of inheriting methods (reuse and simplicity) are negated by the use of override.

Relatability to identified Code Smells

Haven't found any relation between the metrics and the code smells identified in phase 1.

Martin Package Metrics

Author: Rafael Martins

Explanation

Ce (Efferent Coupling): Used to measure interrelationships between classes, gives the number of classes in other packages that classes from a specific package depend upon (outgoing dependencies), allows us to measure the vulnerability of a package to changes in packages it depends on. High values indicate that the package is unstable because there could be changes in the packages it depends on.

Ca (Afferent Coupling): Similar to Ce, this measures the number of classes from other packages that depend on classes from a specific package (incoming dependencies), also allows us to measure the sensitivity of the packages to changes in the package they depend on. High values indicate stability of the package, for it cannot have any substantial changes.

I (Instability): Measures the relative susceptibility of a package to changes, it is defined according to the formula: Ce / (Ce + Ca). Values close to 1 mean that the package has more outgoing dependencies and, therefore, is more susceptible to changes. Values close to 0 mean that the package has more incoming dependencies and, therefore, is less susceptible to changes. Preferred values for I are 0 – 0,3 and 0,7 – 1 (packages should either be very stable or very unstable).

A (abstractness): Measures the degree of abstraction of a package, it is defined by the following formula: Ta / (Ta + Tc), where Ta is the number of abstract classes and Tc is the number of concrete classes. Preferred values are close to the extremes (0 and 1), packages that are stable (metric I close to 0) should also be abstract, while unstable packages (metric I close to 1) should be concrete.

D (Normalized Distance from Main Sequence): Used to measure the balance between stability and abstractness, it is calculated using the following formula: D = |A + I -1|. The value of this metric should be as low as possible, so that the components are located close to the main sequence.

Average values of metrics for the *ganttproject*

Ce(Efferent Coupling): 239,98

Ca(Afferent Coupling): 239,98

I(Instability): 0,50

A(Abstractness): 0,24

D(Normalized Distance from Main Sequence): 0,30

Potential Trouble Spots

The spots we want to look out for are packages with a lot of dependencies and a relatively high value for D, these packages don't have a good balance of abstraction and instability and therefore will require a lot of work if changes are needed:

- Net.sourceforge.ganttproject.util.collect (Ca = 199 D = 1)
- biz.ganttproject.core.chart.canvas (Ca = 766 D = 0,79)
- net.sourceforge.ganttproject.language (Ca = 940 D = 0,68)
- biz.ganttproject.core.time (Ca = 1181 D = 0,58)
- net.sourceforge.ganttproject.task (Ca = 4434 D = 0,53)
- biz.ganttproject.core.option (Ca = 1491 D = 0,53)

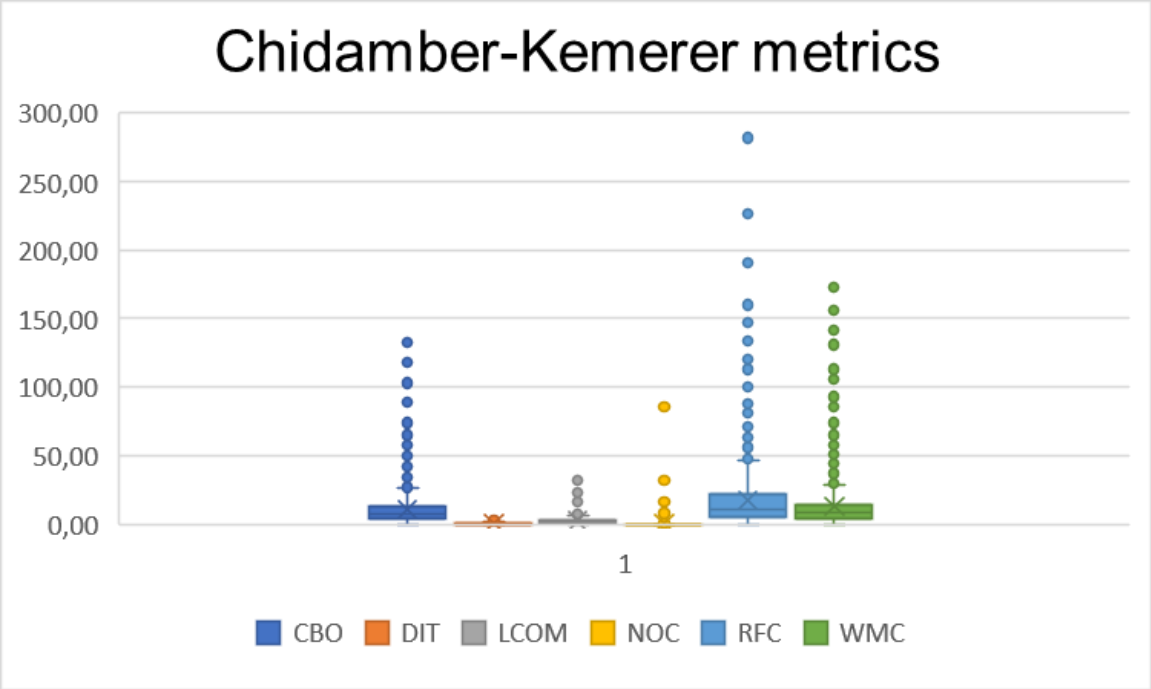
There are other packages whose D value is high (1 or close), but these contain a relatively small number of dependencies, so the potential trouble these could generate is not as high as for the ones mentioned above.

Relatability to identified Code Smells

Large classes normally have a lot of dependencies, because of this, these classes end up being very unstable for a lot of changes could be necessary, and they are not very abstract.

Chimdaber & Kemerer Metrics

Author: Rafael Pereira



Explanation

CBO (Coupling Between Object Classes): Used to measure coupling between Classes, two classes are coupled when methods declared in one class use methods or instance variables defined by the other. The use relationship can go either way, i.e. both use or be used cases are taken into account, but only once. In addition a high CBO indicates excessive coupling between objects, which is detrimental to modular design and prevents reusability, since to change the behavior of the object implies having to change the coupled objects.

DIT (Depth of Inheritance Tree): This metric calculates the maximum inheritance path from class to root class, the deeper a class is in the hierarchy, the more methods and variables it is likely to inherit, making it more complex. In other words, the higher the DIT value, the deeper the tree is, which indicates greater design complexity and consequently can increase the appearance of bugs and decrease quality.

LCOM (Lack of Cohesion of Methods): LCOM is used to measure cohesiveness in a class. It works by taking a pair of methods in a class and adding 1 to Q if those methods share at least one variable access, or adding 1 to P if they don't, so that the final value of LCOM is:

$$LCOM = P - Q \text{ if } P > Q$$

$$LCOM = 0 \text{ Otherwise}$$

If LCOM is 0 it indicates that the class is cohesive, if it's not it usually means that the class can be split into two or more classes. A high LCOM value indicates disparateness in a class, meaning that it might be attempting to achieve many different objectives, resulting in less predictable behavior. Such classes are usually more prone to errors and are harder to test.

NOC (Number of Children): Used to calculate the immediate child classes derived from a base class i.e., unlike DIT which measures depth, this measures the breadth of a class hierarchy. A high NOC can indicate several things:

- High reuse of base class
- Improper abstraction of the parent class
- Misuse of sub-classing

RFC (Response for a Class): This metric calculates the number of methods in the response set of a given class, which is a set of methods that can potentially be executed in response to a message received by an object of that class. A higher value here usually indicates more bugs, since classes tend to be more complex and harder to understand.

WMC (Weighted Methods Per Class): To put it simply this metric counts the methods of a class, a high value here should bring the focus of our attention to the given class which may have a greater impact on derived classes and consequently the whole system, it also tends to have more bugs.

Average values of metrics for the *ganttproject*

- CBO = 10,94
- DIT = 0,57
- LCOM = 2,46
- NOC = 0,56
- RFC = 15,42
- WMC = 13,21

Potential Trouble Spots

The **net.sourceforge.ganttproject.language.GanttLanguage** has the maximum CBO value (133) in the project, which can be a problem later on because due to its large coupling number changing this class or one of its couple classes can cause problems in all the others, thus decreasing modularity.

The class **net.sourceforge.ganttproject.export.ConsoleUIFacade** holds the maximum LCOM value (34) and even though we know it is still incomplete it is important to give it attention since LCOM represents lack of cohesion between methods, which may suggest that we could break this class into several classes with more cohesion.

Given the high number of direct NOC children (86), and a fair value of WMC (65), it indicates to us that **net.sourceforge.ganttproject.action.GPAction** should be reviewed as it is a relatively complex class that can affect many other classes and is therefore a potential trouble spot.

The **net.sourceforge.ganttproject.GanttProject** is another trouble spot, it has the highest RFC value in the project (282) and also the second highest WMC value (156), making it a very complex class with an excessive size, factors that make it difficult to understand and promote a build-up of bugs. It should be broken down into several simpler classes.

Last but not least, we also have the **net.sourceforge.ganttproject.task.taskManagerImpl** which holds the maximum WMC value in the project (173), given its excessive number of methods this class has, it becomes much more difficult to understand than necessary and consequently promotes an accumulation of bugs and errors.

Relatability to identified Code Smells

CBO – a high value of CBO is usually related to a Inappropriate Intimacy code smell since this metric measures the coupling that is happening between classes.

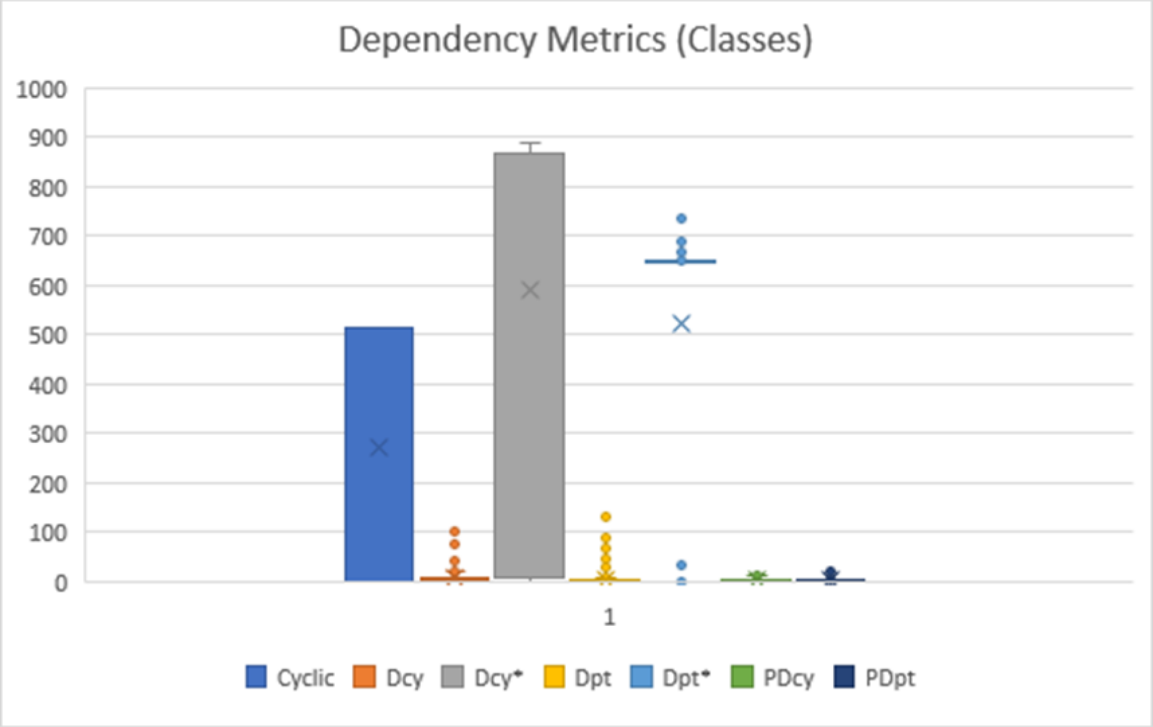
LCOM – usually a project should strive to have a low value of LCOM since this likely means that the class is very cohesive, however sometimes cohesive classes might be related to God Classes (Large Class code smell) which are meant to be avoided.

DIT and NOC – both metrics can be related to the Shotgun Surgery code smell since they both measure, in two different ways, the amount of inheritance that is happening in the project.

WMC – a high value for WMC can be related to the Large Class code smell since this metric is used to measure how many methods each class has. If the metric value is high then it likely means that the class is too big (i.e has too many methods) and could potentially split into two or more classes.

Dependency Metrics

Author: Pedro Fernandes



Explanation

Cyclic (Number of cyclic dependencies)

Indicates the number of classes/interfaces/packages that depend on other classes/interfaces/packages, which in turn also depend on the first ones, resulting in cyclic dependencies. Such dependencies may lead to code that is harder to understand and worse to test

Dcy (Number of dependencies)

Calculates the number of classes/interfaces each class/interface directly depends on. A higher number of direct dependencies may result in code which is harder to maintain.

Dcy* (Number of transitive dependencies)

Calculates the number of classes/interfaces each class/interface directly or indirectly depends on.

Dpt (Number of dependents)

Calculates the number of classes/interfaces which directly depend on each class/interface. A lower number of dependents may result in code which is not as useful as was initially intended.

Dpt* (Number of transitive dependents)

Calculates the number of classes/interfaces which directly or indirectly depend on each class/interface.

PDcy (Number of package dependencies)

Calculates the number of packages each class/interface/package directly (or indirectly for classes/interfaces) depend on.

PDpt (Number of dependent packages)

Calculates the number of packages which directly (or indirectly for classes/interfaces) depend on each class/interface/package.

PDpt* (Number of transitive dependent packages)

Calculates the number of packages which directly or indirectly depend on each package.

Average values of metrics for the *ganttproject*

- Cyclic ≈ 270,91
- Dcy ≈ 7,12
- Dcy* ≈ 591,08
- Dpt ≈ 4,25
- Dpt* ≈ 523,89
- PDcy ≈ 3,25
- PDpt ≈ 2,23

Potential Trouble Spots

net.sourceforge.ganttproject.AbstractChartImplementation (Cyclic = 515)

> This class is just one of the many classes in this project that have the highest cyclic number of dependencies, which indicates that code is almost all related, at least through something.

net.sourceforge.ganttproject.task.TaskManagerImpl (Dcy = 78)

This class has a very high dependency count.

org.ganttproject.impex.htmlpdf.itext.ITextEngine (Dcy* = 890)

This class has the highest transitive dependency count, making it very sensitive to most changes

net.sourceforge.ganttproject.util.MathUtil (Dpt/Dpt*/PDpt = 0)

This class is not being used anywhere in the project.

net.sourceforge.ganttproject.chart.ChartModelBase (PDcy = 13)

This class depends on various packages.

Relatability to identified Code Smells

net.sourceforge.ganttproject.calendar.CalendarEditorPanel (Large Class)

The dependency metrics for this class are very high, with-it having lots of dependencies (Dcy = 17), it seems that trying to combine too many dependencies within a single class, results in a very large class.