

DockingFrames 1.1.0 - Common

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1 Introduction

1.1 The Framework

`DockingFrames` is an open source Java Swing framework. This framework allows to write applications with floating panels: `Components` that can be moved around by the user.

`DockingFrames` consists of two libraries, `Core` and `Common`. `Common` provides advanced functionalities that are built on top of `Core`, it is a wrapper around `Core` and requires `Core` to work.

This guide does not claim to be complete nor that all of its parts are relevant. It is intended as a starting point to explain basic concepts and to find out which classes, interfaces and properties are important for developers. This document only covers `Common`, `Core` has its own guide.

You can utilize `Common` without understanding `Core`, but knowing at least some basics about `Core` will make life much easier.

1.2 Previous versions: 1.0.8

Version 1.0.8 is an important milestone: for the first time the framework contains all the code necessary to handle “real world” applications:

- Due to the new placeholder-mechanism, stored locations are now very stable and any layout can be recreated anytime.
- Due to the new `CLocationModeManager` `Common` is now much flexibler, the new real-fullscreen-maximization feature for free floating panels already makes use of this flexibility.
- Tabs are now put in a menu if there is not enough space to show them; and they can be shown on all sides.
- Applications can prevent a user from closing a `Dockable`, e.g. they could ask the user if he would like to save its data before closing the `Dockable`.
- And there are many more small improvements and bugfixes, have a look at the `transition.pdf` document that comes alongside the framework.

Looking at the questions of our forum ¹ the framework is now feature complete. So the next version is 1.1.0, it will address the issues mentioned in chapter 8 which could not be addressed in 1.0.8.

1.3 The current version: 1.1.0

In version 1.1.0 it is all about refining existing features and making interaction more smooth. With version 1.1.0 the framework has reached a mature state. The most important features of this release are:

- The end of the “secure” packages. From now on unsigned applets and webstart applications are supported by the basic classes, the framework is able to switch between a “restricted mode” and a “free mode” at any time.

¹<http://forum.byte-welt.de/forumdisplay.php?f=69&langid=2>

- Almost all properties are now handled by `UIProperties` (a class from the `Core` project), this allows clients to replace almost all properties.
- New listeners like the `CDockableLocationListener` can keep track of the visibility of dockables, and in this case “visibility” means whether the user can actually see the item or not.
- And the “perspective” API allows clients to analyze and modify a layout without the need to create `CStations` and `CDockables`.

2 Notation

This document uses various notations.

Any element that can be source code (e.g. a class name) and project names are written mono-spaced like this: `java.lang.String`. The package of classes and interfaces is rarely given since almost no name is used twice. The packages can be easily found with the help of the generated API documentation (JavaDoc).



Tips and tricks are listed in boxes.



Important notes and warnings are listed in boxes like this one.



Implementation details, especially lists of class names, are written in boxes like this.



These boxes explain *why* something was designed the way it is. This might either contain some bit of history or an explanation why some awkward design is not as bad as it first looks.



References to examples illustrating something are marked with these boxes. All examples are stored in the “tutorial” project that is downloaded together with the Core and Common library.

3 Basics

While `Common` is a layer atop of `Core`, `Common` itself consists of three more layers: `common`, `facile` and `support` (in their respective packages). The `facile` layer mostly contains stand-alone abstractions of classes/interfaces of `Core`, the `common` layer brings these abstractions together. The `support` layer contains exactly what it's name suggest: small, generic classes and methods that do not fit anywhere but that are really helpful in building up the other layers.

Clients almost exclusively have to make use of the `common` layer. They can use the other layers, but it seldomly makes sense to do so.

3.1 Concepts

In the understanding of `Common` an application consists of one main-window and maybe several supportive frames and dialogs. The main-window is most times a `JFrame` and the application runs as long as this frame is visible. The main-window consists of several panels, each showing some part of the data. E.g. the panels of a web-browser could be the “history”, the “bookmarks” and the open websites.

`Common` adds an additional layer between panels and main-frame, it separates them and allows the user to drag & drop panels. For this to happen the client needs to wrap each panel into a `CDockable`. These `CDockables` are put onto a set of `CStations`, a controller (of type `CControl`) manages the look, position, behavior etc. of all these elements.

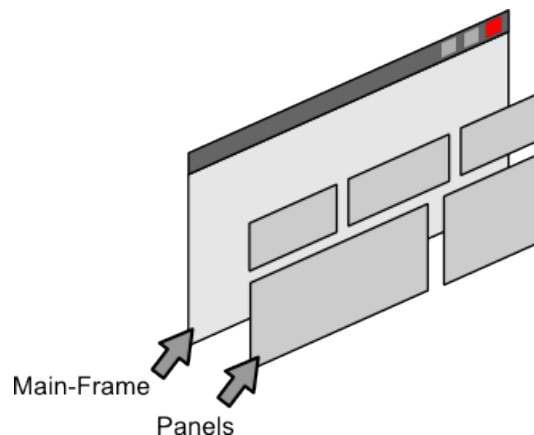


Figure 1: The standard application without `Common`. A main-frame and some panels that are put onto the main-frame.

3.2 Hello World

A first example containing only three colored panels will introduce the very basic vocabulary. In depth discussions of the concepts and implementations follow in the chapters afterwards.

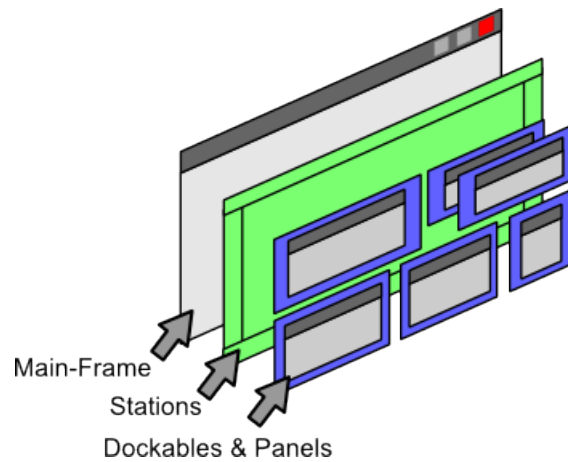


Figure 2: An application with `Common`. The panels are wrapped into `dockables`. The `dockables` are put onto stations which lay on the main-frame. `Dockables` can be moved to different stations.

3.2.1 Setup controller

The first step should be to create a `CControl`. This central controller wires all the objects of the framework together. A `CControl` needs to know the root window of the application, it is used as parent for any dialog that may be opened (e.g. during a drag & drop operation a dialog may be used to paint the dragged element). Most applications will be able to just forward their root window to one of the constructors.

The code to create the controller looks like this:

```

1 public class Example{
2     public static void main( String[] args ){
3         JFrame frame = new JFrame();
4         frame.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
5
6         CControl control = new CControl( frame );
7
8         ...

```



A simple “hello world” application can be found in the tutorial project. Simply start the application using either the jar file “tutorial.jar” or its class “TutorialMain”. The example has the name “Guide/Common/Hello World”.

3.2.2 Setup stations

The second step is to setup the layer between main-frame and `dockables`. There are different `CStations` available, for example the `CMinimizeArea` shows minimized `CDockables`. But most applications will always use the same layout: some station in the center of the frame shows a grid of `CDockables` and on the four edges minimized `CDockables` are listed. The class `CContentArea` is a combination of several `CStations` offers exactly that layout.

There is always a default `CContentArea` available, it can be accessed by calling `getContentArea` of `CControl`. If required additional `CContentAreas` can be created by the method `createContentArea` of `CControl`.

A `CContentArea` is a `JComponent`, so its usage is straight forward. Line 10 is the important new line in this code:

```
1 public class Example{
2     public static void main( String[] args ){
3         JFrame frame = new JFrame();
4
5         frame.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
6
7         CControl control = new CControl( frame );
8
9         frame.setLayout( new GridLayout( 1, 1 ) );
10        frame.add( control.getContentArea() );
11
12        ...
```



`CControl` always creates an additional station for handling free floating `CDockables`.

3.2.3 Setup dockables

The last step is to set up some `CDockables`. `CDockables` are the things that can be dragged and dropped by the user. A `CDockable` has a set of properties, e.g. what text to show as title, whether it can be maximized, what font to use when focused, and so on.

`CDockable` is just an interface and clients should always use one of the two subclasses `DefaultSingleCDockable` or `DefaultMultipleCDockable`. Without going into details: `single-dockables` exist exactly once, while `multi-dockables` can be created and destroyed by the framework anytime.

In the code below new single `dockables` are created in lines 23–25 and 43–48. They need to be registered at the `CControl` in lines 27–29, otherwise they cannot be shown. Optionally the initial location can be set like in line 33 and 36. The initial location is applied in the moment when the `dockable` gets visible, it will not have any influence afterwards. So there is no point in setting the location of the first `dockable`, since there are no other `dockables` it gets all the space anyway and the initial location does not matter afterwards. With other words: the order in which `dockables` are made visible is important.



There is a class `CGrid` which allows to build an initial layout more easily, more about locations can be found in chapter 5

```
1 import java.awt.Color;
2 import java.awt.GridLayout;
3
4 import javax.swing.JFrame;
5 import javax.swing.JPanel;
6
7 import bibliothek.gui.dock.common.CControl;
8 import bibliothek.gui.dock.common.CLocation;
```

```

9  import bibliothek.gui.dock.common.DefaultSingleCDockable;
10 import bibliothek.gui.dock.common.SingleCDockable;
11
12 public class Example{
13     public static void main( String[] args ){
14         JFrame frame = new JFrame();
15
16         frame.setDefaultCloseOperation( JFrame.EXIT_ON_CLOSE );
17
18         CControl control = new CControl( frame );
19
20         frame.setLayout( new GridLayout( 1, 1 ) );
21         frame.add( control.getContentArea() );
22
23         SingleCDockable red = create( "Red", Color.RED );
24         SingleCDockable green = create( "Green", Color.GREEN );
25         SingleCDockable blue = create( "Blue", Color.BLUE );
26
27         control.add( red );
28         control.add( green );
29         control.add( blue );
30
31         red.setVisible( true );
32
33         green.setLocation( CLocation.base().normalSouth( 0.4 ) );
34         green.setVisible( true );
35
36         blue.setLocation( CLocation.base().normalEast( 0.3 ) );
37         blue.setVisible( true );
38
39         frame.setBounds( 20, 20, 400, 400 );
40         frame.setVisible( true );
41     }
42
43     public static SingleCDockable create( String title, Color color ){
44         JPanel background = new JPanel();
45         background.setOpaque( true );
46         background.setBackground( color );
47
48         return new DefaultSingleCDockable( title, title, background );
49     }
50 }

```

4 Foundation

This chapter focuses on the foundation of `Common`: `CControl`, the `stations` and `dockables`.

4.1 Dockables

A `CDockables` is not much more than a set of properties like a “title-icon” and some `Component` which is to be shown to the user. A `CDockable` does not paint any decorations (like a title), handle any `MouseEvent`s or interacts with the user in any other way. Such jobs are handled by various manager-objects, factories and delegates. These objects need to know the `CDockables` they work with and they need to be able to store information about them. To accomplish that each `CDockable` must be registered at a `CControl` and is associated with a unique identifier. Registering a `CDockable` is possible with one of the `addDockable-`methods `CControl` offers.

There are two types of `CDockables`, `single-dockables` and `multi-dockables`. The user usually won’t notice any difference between these two types of dockables:

- `Single-dockables` are the “tool windows”. Their number is limited and the framework can assume that the client always knows all the possible “tool windows”. When starting up, the client can either register all `SingleCDockables` or the client can register some factories of type `SingleCDockableFactory`. Also the client is responsible for storing the contents of `single-dockables`.
- `Multi-dockables` are the “editor windows”. Their numbers are unlimited, and the framework assumes that the client does not know which editor windows exist. The client however knows what types of “editor windows” exist and has to provide factories of type `MultipleCDockableFactory`.

When a `CDockable` is created it is without location and it is invisible. Read chapter 5 to learn about locations and call `CDockable.setVisible` to show the `CDockable`.



The interface `CDockable` has some awkward methods whose implementation is already described in the documentation. `CDockable` is not intended to be implemented by clients, but to be used by them. There is a subclass `AbstractCDockable` which provides the correct implementation for these awkward methods. Even in the framework itself no class (except `AbstractCDockable`) implements `CDockable` directly. The only reason for the existence of `CDockable` is to provide an abstraction from the implementation.



A `CDockable` is not a `Dockable`, but internally references a `Dockable`. This `Dockable` is always of type `CommonDockable`. It can be accessed through the method `intern` of `CDockable`. `DefaultCDockable` offers a method `createCommonDockable` which creates a new `DefaultCommonDockable`. Clients may override this method and provide their own implementation of `DefaultCommonDockable`.

4.1.1 SingleCDockable

A `single-dockable` is created once, added to the controller and made visible. It remains in memory until explicitly removed from the `CControl` or the application terminates. Alternatively a `SingleCDockableFactory` can be used to lazily create a `dockable` once it is required.

The interface `SingleCDockable` represents a `single-dockable`, the class `DefaultSingleCDockable` is a convenient implementation of the interface. The class offers methods similar to those known from a `JFrame`, e.g. it has a content-pane where clients can add some `Components`.

Examples for `single-dockables` could be:

- A browser has one panel “history”, the panel is shown on a `single-dockable`.
- A view that is most of the time invisible. A `single-dockable` is created lazily the first time when the view is shown.

4.1.2 MultipleCDockable

A set of `multi-dockables` is used if the exact number of instances is not known prior to runtime. Before a `multi-dockable` can be used its factory (of type `MultipleCDockableFactory`) must be registered at a `CControl`. The factory offers methods to store and load the layout of a `dockable`. Of course there can be more than one `multi-dockable` per factory. Once the factory is registered, clients can add and remove `multi-dockables` at any time.

The interface describing all `multi-dockables` is `MultipleCDockable`, a convenient implementation is `DefaultMultipleCDockable`. This class offers most of the methods and properties a client should ever need. Implementing a matching `MultipleCDockableFactory` is easy. There is a method to read and to write meta-information from or to a `MultipleCDockable`. Meta-information itself is a `MultipleCDockableLayout` which has methods to write or read its content to a stream (e.g. to file). There are no restrictions to what meta-information really is.

If a `multi-dockable` is made invisible, it should be removed from its `CControl`. Otherwise old objects fill up memory until the application crashes with an `OutOfMemoryException`. Clients either need to remove the `dockable` by themselves or they can call `setRemoveOnClose(true)` to let the element be removed automatically once it becomes invisible



Any **multi-dockable** which is no longer required must be removed from the `CControl`, otherwise an `OutOfMemoryException` may happen.



Automatic removal is triggered when the **dockable** becomes invisible. This happens if the element does no longer have a root-parent. If a client makes the parent of a **multi-dockable** invisible, the **dockable** gets marked invisible as well. However, it does not get removed from its parent. Strange effect happen when the parent is made visible again: most of the decoration of the **dockable** is gone and some parts of the framework will ignore its existence.

An example:

```
1 CControl control = ...
2
3 MultipleCDockableFactory<MyDockable, MyLayoutInformation> = new ...
4 control.addMultipleDockableFactory( "unique_id", factory );
5
6 MyDockable dockable = new ...
7 control.add( dockable );
```

Notice that in line 4 a unique identifier needs to be assigned to the factory.



A more sophisticated example can be found in the tutorial project. The name of the example is “Guide/Common/Editors: MultipleCDockable”.

Examples for **multiple-dockables** are:

- A text-editor can show many documents at the same time. Each document is shown in its own **dockable**.
- A 3D modeling software allows to see the modeled object from different angles. Each camera is a **dockable**.



Why the distinction between **single-** and **multi-dockables**? The algorithms to store and load the layout (place and size of **dockables**) can either use existing objects or create new **dockables**. Using existing objects is preferred because the overhead of creation can be - at least for complex views - high. **Single-** and **multi-dockables** represent this gap.

4.1.3 Visibility

Visibility has two meanings, “logical visibility“ and “true visibility“. If not stated otherwise, this document and all documentation always uses “visibility” as an alias for “logical visibility”.

Logical visibility A `dockable` is (logical) visible if it is either a child of a visible root-station or a registered root-station. With other words, logical visibility means that the `dockable` is somehow accessible to the user, it does not even imply that the user actually can see the `dockable` on the screen. Visibility can change through a set of events:

- Obviously, calling `setVisible` of `CDockable` will change the visibility. If possible, the location of a `CDockable` will be remembered and reused.
- Adding a `CDockable` to a station makes the `CDockable` visible. This may happen for example if using a `CGrid` (see chapter 5).
- The user may close a dockable by clicking onto a special close-button. Clients may call `setCloseable` to allow or deny a user closing the dockable.

There are two listeners to monitor the visibility-state of dockables. Both can either be added to a `CDockable` or to a `CControl`. In the latter case all known dockables are monitored at the same time.

The first listener is the `CDockableStateListener`, it has a method `visibilityChanged` which will be called whenever the visibility changes.

The second listener is the `CVetoClosingListener`. It receives a `CVetoClosingEvent` before and after a set of dockables gets closed. Clients can call the `cancel` method to prevent the closing-operation from finishing its work.



Using the close-button or changing the layout with `CControl.load` will always result in a cancelable `CVetoClosingEvent`. However, some methods force the closing-operation to finish no matter what happens, the method `isCancelable` of `CVetoClosingEvent` will return `false` in such a case. Using the low-level methods of `Core`, one can even close a dockable without triggering a pre-close event. In such a case an unexpected `CVetoClosingEvent` is issued (see `isExpected()`). Naturally such an event cannot be canceled.



The close-action can be replaced by calling `putAction` with the key `ACTION_KEY_CLOSE` of `CDockable`. The action can be replaced at any time. Read more about actions in chapter 6.



If the method `setLocation` of `AbstractCDockable` is called before the dockable is made visible, then the dockable is made visible at the supplied location. Read more about locations in chapter 5.

True visibility A `dockable` is truly visible if the user can actually see the element on the screen. Clients can use the method `isDockableVisible`

of `CDockable` to find out whether a `dockable` is truly visible. Also the `CDockableLocationListener` can help clients to keep track of the true visibility.

It should be noted that logical visibility is required for the framework to acknowledge true visibility. Also the framework will not take things like “is the main-frame minimized” into account.



The `CDockableLocationListener` works asynchronously. Events not originating in the `EventDispatcherThread` may let the listener receive confusing if not plain wrong events.

4.1.4 Mode

If a `CDockable` is visible then it always is in an extended-mode. The extended mode tells something about the behaviour of the `dockable` and where it is placed. The framework offers four default extended modes:

normalized The normal state of a `dockable`. It is placed on the main-frame of the application, but only covers a fraction of the main-frame.

maximized A maximized `dockable` takes all the space it gets and often covers other `dockables`.

minimized A minimized `dockable` is not directly visible. Only a button at one edge of the main-frame indicates the existence of the `dockable`. If the button is pressed then the `dockable` pops up. As soon as it loses focus it disappears again.

externalized The `dockable` is on its own window. Per default the window is an undecorated `JDialog` and child of the main-frame.

Users can change the `extended-mode` either by dragging the `dockable` to a new place or by clicking some buttons that are visible in the title of each `dockable`.

Clients can access and change the `extended-mode` by calling `getExtendedMode` and `setExtendedMode` of `CDockable`. A `dockable` has no `extended-mode` if not visible. Furthermore clients can forbid a `dockable` to go into some `extended-modes`, methods like `setMaximizable` of `DefaultCDockable` allow that. Finally clients can exchange the button that must be pressed by the user by calling `putAction` of `AbstractCDockable`. Keys for `putAction` are declared as `String` constants in `CDockable` with names like `ACTION_KEY_MINIMIZE`.

`Extended-modes` are managed by the class `CLocationModeManager`. You can read more about that class in chapter 5.4.

4.2 Stations

Stations are needed to place and show `CDockables`. A station provides the `Component(s)` (e.g. a `JPanel` or a dialog) that are the parents of the `dockables`. Stations are represented through the interface `CStation`.

`CStations` delegate most of their work to some `DockStation` of `Core`. Like `dockables` a `CStation` requires a unique identifier. This identifier is used to persistently store and load layout information.

In general clients can introduce new stations, but a developer needs a lot of time to properly implement a station:



1. A working `DockStation` for the `Core` project must be written.
2. For each extended-mode that matches the stations ability a `CModeArea` must be written. The `CModeArea` handles the locations (`CLocation`) of the `dockables` on the station.
3. It may even be necessary to write a new extended-mode altogether (which requires an implementation of `CLocationMode`).
4. And then there are countless supportive classes that must be implemented: `CLocation`, `DockableProperty`, several factories, the list goes on...

Conclusion: don't do this unless you have a lot of time to spare.



The `DockStation` that is used by a `CStation` always implements the interface `CommonDockStation`.

4.2.1 All in one: `CContentArea`

The preferred way to create stations is to use a `CContentArea`. A `CContentArea` is not a single `CStation` but a panel containing many stations. Each content-area has a center area where `dockables` are layed out in a grid, and four small areas at the border where `dockables` show up when they are minimized.

There is a default-`CContentArea` present and can be accessed through `getContentArea` of `CControl`. A content-area can later be used like any other `Component`:

```
1 JFrame frame = ...
2 CControl control = ...
3
4 CContentArea area = control.getContentArea();
5 frame.add( area );
```

If more than one content-area is needed then clients can use `createContentArea` of `CControl` to create additional areas. These additional areas can later be removed through `removeContentArea`. The default content-area cannot be removed.



The default content-area is created lazily. There is no obligation to use or create it, clients can as well directly call `createContentArea` or not use them at all.



While `CContentArea` has a public constructor clients should prefer to use the factory method `createContentArea`. In future releases the constructor might be changed.

To place `dockables` onto a content-area a `CGrid` can be of help. With the method `deploy` the content of a whole `CGrid` can be put onto the center area. More about `CGrid` and other mechanisms to position elements are listed up in chapter 5.

4.2.2 Center area: `CGridArea`

A `CGridArea` is kind of a lightweight version of `CContentArea`. A grid-area contains normalized and maximized `dockables`. Other than a content-area it cannot show minimized `dockables`.

`CGridAreas` should be created through the factory method `createGridArea` of `CControl`. If it is no longer required it can be removed through the method `removeStation`.

Like `CContentArea` `CGridArea` has a method `deploy` to add a whole set of `dockables` quickly to the station.

Usage of a grid-area could look like this:

```
1 JFrame frame = ...
2 CControl control = ...
3
4 CGridArea center = control.createGridArea( "center" );
5 frame.add( center.getComponent() );
```

Notice that in line 5 the method `getComponent` has to be called. This method returns the `Component` on which the station lies.

Some more things that might be interesting:



- A grid-area implements `SingleCDockable`, hence it can be a child of another area. Remember that the area must be manually added to the `CControl` as `dockable`.
- The method `setMaximizingArea` influences of what happens when a child of the area gets maximized. If `true` was given to the method then the child gets maximized within the boundaries of the grid-area. Otherwise the child might cover the area or even be transferred to another area.

4.2.3 Minimized: CMinimizeArea

Most things that were said for CGridArea hold true for CMinimizeArea as well. A minimize-area should be created through createMinimizeArea of CControl.

4.2.4 Grouping Dockables: CWorkingArea

The CWorkingArea is a subclass of CGridArea. The difference between them is, that the property working-area is false for a grid-area, but true for a CWorkingArea.

Having this property set to true places some constraints on the station:

- Children of this station cannot be moved to another station if that other station shows dockables in normalized mode. For a user this means that children can only be minimized, maximized or externalized, but not dragged away.
- The user cannot drop dockables onto the station unless they are already children of the station.
- If the station has no children then it appears as grey, empty space which does not go away.
- Children of a working-area are not stored for temporary layout. For the user this means that applying a layout does neither affect the station, nor dockables that can be put onto the station.

CWorkingAreas can be used to display a set documents. For example in an IDE (like Eclipse or Netbeans) each source file would get its own CDockable which then is put onto the working-area.



The children of a CWorkingArea are often good candidates for being MultipleCDockables.

5 Locations

Location means position and size of a `dockable`. A location can be relative to some parent of a `dockable` or it can be fix.

5.1 For a single dockable: CLocation

The location of a single `dockable` is represented by a `CLocation`. The method `getBaseLocation` of `CDockable` gets the current location and the method `setLocation` changes the current location.

Most subclasses of `CLocation` offer one or more methods to obtain new locations. An example: `CGridAreaLocation` offers the method `north`. While `CGridAreaLocation` represents just some `CGridArea`, the location obtained through `north` represents the upper half of the grid-area. Clients can chain together method calls to create locations:

```
1 CGridAreaLocation root = ...
2 CDockable dockable = ...
3
4 CLocation location = root.north( 0.5 ).west( 0.5 ).stack( 2 );
5 dockable.setLocation( location );
```

The chain of calls in line 4 creates a location pointing to the upper left quarter of some grid-area. Assuming there is a stack of `dockables` in that quarter, the location points to the third entry of that stack. In line 5 the location of `dockable` is set, the framework will try to set `dockable` at the exact location but cannot make any guarantees (e.g. if there is no stack in the upper left quarter, then framework cannot magically invent one).

To create a root-location clients can call one of the static factory methods of `CLocation` or directly instantiate the location. Calling the factory methods of `CLocation` is preferred.

Setting the location of a `dockable a` to the location of another `dockable b` will move away `b` from its position. As an example:

```
1 CDockable a = ...
2 CDockable b = ...
3
4 CLocation location = b.getBaseLocation();
5 a.setLocation( location );
```

If `b` should remain at its place then the method `aside` of `CLocation` can create a location that is near to `b`, but not exactly `b`'s position:

```
5 a.setLocation( location.aside() );
```



`CLocation` is an abstraction from `DockableProperty`. While each `DockableProperty` has its own API and concepts, `CLocations` unify usage by providing the chain-concept. The chain-concept allows some typesafety and should reduce the amount of wrongly put together locations.



`CLocations` describe only the current location of a `dockable`, they are not useful for any long-term storage. `CControl` already stores the location of each `dockable` and it uses some very complex constructs to ensure that the locations remain useful even if `dockables` are missing or moved around. Clients should not store locations themselves.

5.2 For a group of dockables: `CGrid`

Sometimes it is necessary to set the position of several `dockables` at once. For example when the application starts up a default layout could be created. If `dockables` are minimized or externalized the position can simply be set with `CLocations`. If `dockables` are shown normalized on a grid-area, a working-area, or the center of a `CContentArea` then things get more complex. Using `CLocation` would require a precise order in which to add the `dockables`, and some awkward coordinates to make sure they are shifted at the right place when more `dockables` become visible.

`CGrid` is a class that collects `dockables` and their boundaries. All this information can then be put onto a grid-like areas in one command. Furthermore a `CGrid` can also automatically register `dockables` at a `CControl`. An example:

```
1 CControl control = ...
2
3 SingleCDockable single = new ...
4 MultipleCDockable multi = new ...
5
6 CGrid grid = new CGrid( control );
7
8 grid.add( 0, 0, 1, 1, single );
9 grid.add( 0, 1, 1, 2, multi );
10
11 CContentArea content = control.getContentArea();
12 content.deploy( grid );
```

The `CGrid` created in line 6 will call the `add`-methods of `control` (line 1) with any `dockable` that is given to it. In lines 8,9 two `dockables` are put onto the grid. The numbers are the boundaries of the `dockables`. In line 12 the contents of the grid are put onto `content`. The `dockables` `single` and `multi` will be arranged such that `multi` has twice the size of `single`.

Boundaries are relative to each other, there is no minimal or maximal value for a coordinate or size. `CGrid` is able to handle gaps and overlaps, but such defections might yield awkward layouts.



Make sure not to add a `dockable` twice to a `CControl`. If using a `CGrid` the `add` method of `CControl` must not be called. Also note that there is a second constructor for `CGrid` that does not have any argument. If that second constructor is used, then the `CGrid` will not add `dockables` to any `CControl`.



Dockables can also be grouped in a stack by `CGrid`. Any two dockables with the same boundaries are grouped. The `add` method uses a vararg-argument, more than just one dockable can be placed with the same boundaries this way.



Internally `CGrid` uses a `SplitDockGrid`. `SplitDockGrid` contains an algorithm that creates a `SplitDockTree`. This tree has dockables as leafs and relations between dockables are modeled as nodes. A `SplitDockTree` can be used by a `SplitDockStation` to build up its layout.

5.3 For all dockables: persistent storage

The “layout” is the set of all locations, even including invisible dockables. `CControl` supports the storage and replacement of layouts automatically. Clients only need to provide some factories for their custom dockables. A layout does not have direct references to any dockable, it is completely independent of gui-components.

There are four important methods in `CControl` used to interact with layouts:

- `save` - stores the current layout. The method requires a `String` argument that is used as key for the layout. If a key is already used then the old layout gets replaced with the new one.
- `load` - is the counterpart to `save`. It loads a layout that was stored earlier.
- `delete` - deletes a layout.
- `layouts` - returns all the keys that are in use for layouts.



The class `CLayoutChoiceMenuPiece` can build some `JMenuItems` that allow the user to save, load and delete layouts at any time. More about `MenuPieces` can be found in chapter 7.8.



Layouts are divided into two subsets: “entry” and “full” layouts. An entry-layout does not store the location of any `dockable` that is associated with a working-area. A full-layout stores all locations. The method `save` always uses entry-layouts and a full-layout is only used when the applications properties are stored persistently in a file.

Working-areas are intended to show some documents that are only temporarily available. Assuming that each `dockable` on a working-area represents one such document it makes perfectly sense not to replace them just because the user chooses another layout. Changing them would mean to close some documents and load other documents, and that is certainly not the behaviour the user would expect.



The client is responsible to store the contents of any `single-dockable`.

5.3.1 Persistent Storage

`Common` uses a class called `ApplicationResourceManager` to store its properties. Among other things all layout information is stored in this resource-manager. Normally any information in the resource-manager gets lost once the application shuts down. But clients can tell the resource-manager to write its contents into a file. Either they call `getResources` of `CControl` and then one of the many methods that start with “write” or they use directly `CControl`. An example:

```
1 File file = new File( "layout.data" );
2
3 // write properties
4 control.write( file );
5
6 // read properties
7 control.read( file );
```

5.3.2 Dealing with lazy creation and missing dockables

While `MultipleCDockables` are created only when they are needed, `Common` assumes that `SingleCDockables` are always present. However this assumption would require to create components that might never be shown. In order to solve the problem `SingleCDockableFactory` was introduced. If a missing `single-dockable` is required the factories method `createBackup` is called. Assuming the factory returns not `null` then the new `dockable` is properly added to `CControl` and made visible.

`SingleCDockableFactory`s need to be registered at the `CControl` using the method `addSingleDockableFactory`. They can also be removed using the method `removeSingleDockableFactory`.



If a `dockable` is removed from a `CControl` then normally all its associated location information is deleted. If however a factory with the same id as the `dockables` id is registered, then the location information remains. If another `dockable` with the same id is later registered, then this new `dockable` inherits all settings from the old one.



`CControls` behavior for missing `dockables` can be fine tuned with a `MissingCDockableStrategy`.

5.3.3 Perspectives

Layout information is stored in various formats: the `Dockables` and `DockStations` is one format, an xml-file could be another format. There is a special intermediate format, every format can be converted into this intermediate format, and the intermediate format can be converted to any other format.

Perspectives are yet another format of the layout. Perspectives are lightweight and can be easily modified by clients. They are an ideal tool to set up the layout of an application during startup. In order to access perspectives a `CControl` must be around, like in this example:

```
1 CControl control = ...
2
3 // accessing a set of perspectives
4 CControlPerspectives perspectives = control.getPerspectives();
5
6 // creating a new perspective, this method actually copies some
7 // properties from "control"
8 CPerspective perspective = perspectives.createPerspective();
9
10 ... // setting up the layout
11
12 // applying the new perspective
13 perspectives.setPerspective( perspective, true );
```

A `CPerspective` offers methods to access various `CStationPerspectives` and add `CDockablePerspectives` to them.

In the example project, in “Guide/Common”, there are several examples showing how to use perspectives:



Perspectives (Introduction) Is a very simple hello-world style application with several `Dockables` that are placed through the perspective API.

Perspectives (Multiple Dockables) Shows how to access and set up `MultipleCDockables` and `CWorkingAreas`.

Perspectives (History) Shows how the location history can be modified with the perspective API.

5.4 The frameworks viewpoint

Locations are handled by the `CLocationModeManager`. Clients may never have any contact with this class, but it is of such importance for the inner workings of `DockingFrames` that it deserves a chapter in this document.

The `CLocationModeManager` contains a list of `CLocationModes` where each `CLocationMode` provides the code for handling one extended-mode (like `ExtendedMode.MAXIMIZED`). The manager also contains a map which stores the location of each `dockable` for each mode. When the user clicks on a button like “minimize”, the location for the affected `dockable` is read from the map and given to the `apply` method of the appropriate `CLocationMode`.

Each of the existing `CLocationModes` contains a set of `StationModeAreas` where each `StationModeArea` represents a `DockStation`. If `apply` is called, the call is forwarded to the best matching `StationModeArea`. The area then converts the properties to a format understandable by its `DockStation` and drops the `dockable`.

Sounds easy enough, but some stations can represent more than one extended-mode. For example the `SplitDockStation` (or `CGridArea`, `CWorkingArea`) can show “normalized” and “maximized” children. And if the user drops a “normalized” `dockable` onto a station which shows a “maximized” `dockable`, then the “maximized” `dockable` needs to be reset first. So a `SplitDockStation` needs two `StationModeAreas` which are assigned to different `CLocationModes`, and these areas must know of a pending change before it happens. There is a set of tools to handle these jobs:

- Any change of location or mode runs in a transaction. During a transaction most listeners of the framework are not informed about changes. This prevents code from the framework or the client to interrupt the work. Stalled events are fired once the transaction is over and only if they are still valid. The `runTransaction` methods of the manager do all of this.
- `LocationModeListeners` can be added to any mode. Before an `apply` method is executed the listeners are called. Other modes may act before or cancel any action.
- And the `ChangeSet` can be used to store any `dockable` whose properties need an update.

The `CLocationModeManager` and its supportive classes do more: they decide which buttons to show on `dockables`, e.g. whether a “minimize” button is necessary. They decide what to do if the user double-clicks on a title. They decide which element to maximize (the whole stack or just a single `dockable`). And they offer a lot of methods to query and change the current position of `dockables`.



The whole mechanism around `CLocationModeManager` consists of roughly 50 classes and interfaces, some of them quite small, others quite large. It was introduced in version 1.0.8 as replacement of the outdated `StateManager`. Compared to the old mechanism the new one is much more complex and requires considerable more code. But it is also more flexibel, e.g. adding new implementations of `DockStation` or handling additional extended-modes was not possible with the old mechanism.

6 Actions

Actions are small graphical components associated with a `dockable`. They can show up at different locations, e.g. as buttons in the title. An action is an

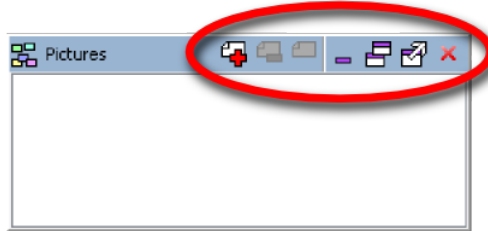


Figure 3: A set of actions on a `dockable`. The actions are the icons within the red oval.

instance of `CAction`. `Common` provides several subclasses of `CAction`. `CActions` can be added to any `DefaultCDockable` through the method `addAction`. An example:

```
1 DefaultCDockable dockable = ...
2 CAction action = new ...
3
4 dockable.addAction( action )
```

To separate a group actions from another group a separator is needed. The method `addSeparator` of `DefaultCDockable` adds such a separator. Separators are specialized `CActions`.

An action is not a `Component`, it can appear at the same time at different locations with different views. For example an action can be seen as button in a title and at the same time as menu-item in a popup-menu.

6.1 CButton

`CButtons` are actions that can be triggered many times by the user and will always behave the same way. `CButton` itself is much like `JButtons` and offer many methods that can also be found in `JButtons`. E.g. clients can add an `ActionListener` to the `CButton` in order to be informed when the user clicks onto the button.

6.2 CCheckBox

This action has a state, it is either selected or not selected (`true` or `false`). Whenever the user triggers the action the state changes. `CCheckBox` is abstract and clients must create a subclass, the method `changed` will be called when the state changes. An example:

```
1 public class SomeAction extends CCheckBox{
2     public SomeAction(){
3         setText( "Something" );
4     }
5
6     protected void action(){
7         boolean selected = isSelected();
8         ...
9     }
```

```
9     }  
10 }
```

6.3 CRadioButton

In most aspects the `CRadioButton` behaves like a `CCheckBox`. `CRadioButton`s are grouped together, the user can select only one of the buttons in a group. A group is realized with the help of the class `CRadioGroup`:

```
1 CRadioButton buttonA = ...  
2 CRadioButton buttonB = ...  
3  
4 CRadioGroup group = new CRadioGroup();  
5  
6 group.add( buttonA );  
7 group.add( buttonB );
```

6.4 CMenu

A `CMenu` is a list of `CActions`. The user can open the `CMenu` and it will show a popup-menu with its actions. Clients can add and remove actions from a `CMenu` through methods like `add`, `insert`, or `remove`.

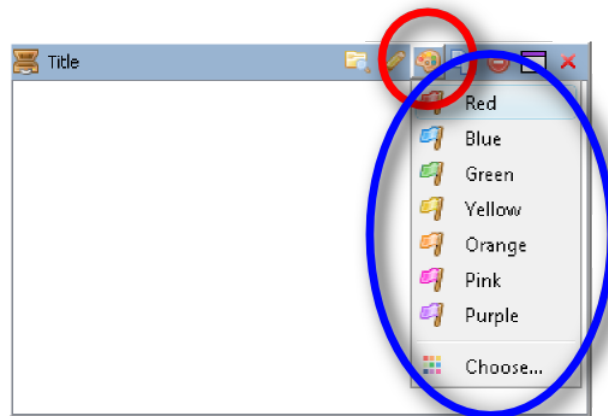


Figure 4: An open `CMenu`. The action itself is at the top within the red circle. Its menu consists of `CButtons` and a separator, the menu is within the blue oval.

6.5 CDropDownButton

A `CDropDownButton` consists of two buttons. One of them opens a menu, the other one triggers the last selected item of that menu again.

The behavior of `CDropDownButton` can be influenced through its items. This requires that the items are subclasses of `CDropDownItem`. `CButton`, `CCheckBox` and `CRadioButton` fulfill this requirement. There are three properties to set:

- `dropDownSelectable` - whether the action can be selected at all. If not, then clicking onto the item might trigger it, but the drop-down-buttons icon and text will remain unchanged.

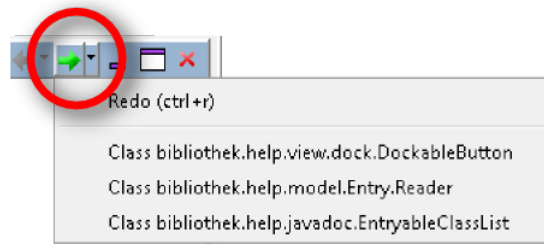


Figure 5: A `CDropDownButton` within a red circle.

- `dropDownTriggerableNotSelected` - if not set, then this item cannot be triggered if not selected. As a consequence the item must be clicked twice until it reacts.
- `dropDownTriggerableSelected` - if not set, then this item cannot be triggered if selected. It still can be triggered by opening the menu and then clicking onto the item.

If a `CDropDownButton` cannot trigger its selected item, then it just opens its menu.

6.6 CPanelPopup

Basically a button that opens a popup with an arbitrary component as content. The popup appears at the same location the menu of a `CMenu` would appear. In a menu a `CPanelPopup` appears as menu-item and opens the popup in the middle of the `CDockable` to which it is attached. The class provides methods for clients to modify its behavior, e.g. to replace the popup by another implementation.

6.7 CBlank

This action is not visible and does nothing. It can be used as placeholder where a `null` reference would cause problems, e.g. because `null` is sometimes replaced by some default value.

6.8 System Actions

`Common` adds a number of actions to any `CDockable`, e.g.: the close-button. These actions are deeply hidden within the system and cannot be accessed. There is however a mechanism to replace them with custom actions. Each `CDockable` has a method `getAction` which is called before a system action is put in place. If this method does return anything else than `null` then the system action gets replaced. `AbstractCDockable` offers the method `putAction` to set these replacements. An example:

```

1 SingleCDockable dockable = ...
2 CAction replacement = ...
3
4 dockable.putAction( CDockable.ACTION_KEY_MAXIMIZE, replacement );

```

In this example whenever the maximize-action of `dockable` should be visible, `replacement` is shown. This feature should of course be treated with respect, changing the behavior of an action can confuse the user a lot.



The class `CCloseAction` is an action that closes any `dockable` on which it is shown. The subclasses of `CExtendedModeAction` change the extended-mode of their `dockables`.

6.9 Custom Actions

Clients are free to write their custom actions. They need to implement a new `DockAction` and a subclass of `CAction`. The subclass can give its super-class an instance of the custom `DockAction` or call `init` to set the action. Please refer to the guide for `Core` to find out how to implement a `DockAction`.

7 Other Effects

`Common` allows to customize some behavior and components. Understanding these features is not necessary to work with `Common`, but impressive effects can be built with them. This chapter will, without any specific order, introduce some of these features.

7.1 Color

Every `dockable` has a `ColorMap`. This map contains colors that are used in the graphical user interface. Normally the map is empty and some default colors are used. If a client puts some colors into the `ColorMap`, then the user interface is immediately updated using the new colors. `ColorMap` itself contains a set of keys that can be used, as an example:

```
1 CDockable dockable = ...
2 ColorMap map = dockable.getColors();
3 map.setColor( ColorMap.COLOR_KEY_TAB_BACKGROUND, Color.RED );
```



Some keys are specializations of other keys. For example `COLOR_KEY_TAB_BACKGROUND` changes the background of tabs, while `COLOR_KEY_TAB_BACKGROUND_FOCUSED` changes the background of focused tabs only. A specialized key overrides the value provided by a general key.



Colors require the support of a `DockTheme` that applies them. Only themes of `Common` do that, the original themes of `Core` will render the `ColorMap` useless. In `Common` clients should interact with themes only through the `ThemeMap`, this map will make sure that only themes are used that support colors.

Also note that some `Components`, like the `JTabbedPane`, and some `LookAndFeels` do not support custom colors.

7.2 Font

Exactly like the color, fonts of `dockables` can be exchanged. Each `dockable` has a `FontMap` which contains `FontModifiers`. `FontModifiers` can change some property of a font, an example:

```
1 CDockable dockable;
2 FontMap fonts = dockable.getFonts();
3
4 GenericFontModifier italic = new GenericFontModifier();
5 italic.setItalic( GenericFontModifier.Modify.ON );
6 fonts.setFont( FontMap.FONT_KEY_TAB, italic );
```

The `FontModifier italic` will change the italic flag of the original font to `true` (line 5).



Some **Components**, like the `JTabbedPane`, and some **LookAndFeels** do not support custom fonts. In this case the settings are just ignored.

7.3 Size

Every **dockable** has a width and a height. Some **dockables** are flexibel in their size, others would be better of with a constant size. There is a feature to lock the size and a feature to set a specific size.

7.3.1 Lock the size

Every `AbstractCDockable` has the method `setResizeLocked`. If the size is locked then the framework will try not to change the size of the **dockable**. There are also methods to lock only the width or the height (`setResizeLockedHorizontally` and `setResizeLockedVertically`).



Locking the size does not prevent the user from manually resizing the **dockable**. And sometimes a station needs to violate the locking as well, e.g.: when a grid-area has only one child the size cannot be chosen freely.

7.3.2 Request a size

It is also possible for client code to request a specific size for one or many `CDockables`. Clients need to call `setResizeRequest` and maybe `handleResizeRequest` like in the example below:

```
1 CControl control = ...
2
3 DefaultCDockable a = ...
4 DefaultCDockable b = ...
5
6 a.setResizeRequest( new Dimension( 200, 300 ), false );
7 b.setResizeRequest( new RequestDimension( 500, true ), false );
8
9 control.handleResizeRequests();
```

In this example two resize requests are handled at the same time. In line 6 the resize request of `a` is set to 200,300, the argument `false` tells `a` not yet to process the request. In line 7 the resize request of `b` is set, `b` should have the width 500 but should not care about its height. Finally in line 9 all the requests are processed together. If the second parameter in line 7 would be `true` instead of `false`, then line 9 would not be necessary.



Not processing a request directly, but collect them, allows requests to interact with each other. Assume there are three **dockables** in a line and the task is to resize the two elements at the begining and the end of the line. If one resize request is handled before the other, then the second request might destroy the work of the first one.



Every object can add a `ResizeRequestListener` to `CControl`, this listener will be called when resize requests need to be processed. Most of the `CStations` add such a listener. The only station on which requests can have complex interactions is the `CGridArea` (and the `CContentArea`). With the `PropertyKey RESIZE_LOCK_CONFLICT_RESOLVER`, defined in `CControl`, clients can set the algorithm that is used to solve contradictions in a `CGridArea`.

7.4 Grouping

If the user clicks on one of the extended-mode actions (like “maximize”) of a `CDockable`, then the `CGroupBehavior` will be asked to define the actual sequence of events to happen. Some `CGroupBehaviors` might decide to move around entire stacks of `CDockables`, others might decide to move just one `CDockable`.

Clients may change the behavior by calling `CControl.setGroupBehavior` like in this example:

```
1 CControl control = ...
2 CGroupBehavior behaviour = ...
3
4 control.setGroupBehavior( behavior );
```

In line 2 a custom behavior is declared, in line 4 the behavior is set.



The old `CMaximizingBehavior` has been replaced by the `CGroupBehavior`. Two default behaviors are available and defined as constants in the `CGroupBehavior` itself.

7.5 Preferences

Common allows users to set some properties like the keys that need to be pressed in order to maximize a `dockable` (`ctrl+m`). Normally this mechanism is deactivated and clients first need to activate it:

```
1 CControl control = ...
2 PreferenceModel preferences = new CPreferenceModel( control );
3
4 control.setPreferenceModel( preferences );
```

This piece of code activates the preference mechanism. In line 2 the set of preferences that can be changed by the user is set up, a `CPreferenceModel` is often the best choice. Then in line 4 the model is connected to `control`. Calling `setPreferenceModel` will activate persistent storage for `model` and also immediately load values into the model.

The model can later be presented to the user:

```
1 CControl control = ...
2 PreferenceModel model = control.getPreferenceModel();
3 Component owner = control.intern().getController().findRootWindow();
4
5 if( model instanceof PreferenceTreeModel ){
6     PreferenceTreeModel tree = (PreferenceTreeModel)model;
7     PreferenceTreeDialog.openDialog( tree, owner );
8 }
```



```

9  else{
10     PreferenceDialog.openDialog( model , owner );
11 }

```

In line 3 the root window of the application is searched, it is used as parent window for any dialog that needs to be opened. In line 7 or line 10 a dialog is opened that shows the preferences. There are two different dialogs, one with a tree at the left side to make select a subset of preferences, one without tree.

There are different preference models. `CPreferenceModel` contains all possible preferences for Common, it consists of four other models:



- `CKeyStrokePreferenceModel`: The different key combinations that, when pressed, initiate some action.
- `CLayoutPreferenceModel`: General settings for the themes.
- `BubbleThemePreferenceModel`: Settings affecting the eclipse-theme.
- `EclipseThemePreferenceModel`: Settings affecting the bubble-theme.

Internally each item of the model is a `Preference`, clients can put together their own model.



The class `CPreferenceMenuItem` can act as a menu-item for opening the preference-dialog, read more about menus in chapter 7.8.

7.6 Themes

A theme sets look and behavior of `DockingFrames`. Themes are managed by the `ThemeMap`, this map contains `Strings` as keys and `ThemeFactory`s as values. `ThemeMap` is however more than just a map, it also tells which theme is currently selected. Clients can call `select` to change the selection.

In the current version 5 themes are always installed per default, the keys of these 5 themes are stored as constants directly in `ThemeMap`.

Working with the `ThemeMap` could look like this:

```

1  CControl control = ...
2  ThemeMap themes = control.getThemes();
3
4  themes.select( ThemeMap.KEY_FLAT_THEME );
5
6  themes.add( "custom", new CustomFactory() );

```

In line 2 the map is accessed. In line 4 one of the preinstalled themes is selected, this theme is applied to `control`. In line 6 a factory for a custom theme is installed.



A theme has much freedom in how to present the `dockables`. But `Common` allows clients to set color and font of various elements associated with a `CDockable`. The standard themes of `Core` would not respect these settings, hence `Common` needs some modified themes. The `ThemeMap` is an attempt to hide this ugly fact from developers and to make sure they don't use the wrong theme.

7.7 LookAndFeel

`LookAndFeel` tells a `Swing` application how to paint things and how to behave. The relation between `LookAndFeel` and `Swing` is like the relation between theme and `DockingFrames`. The `LookAndFeel` can be changed while the application runs, but the method `updateUI` must be called for each and every existing `JComponent` by the client itself.

Of course, clients are free to implement such a function. `DockingFrames` will detect a change of the `LookAndFeel` and update itself where necessary, but it will not update the `JComponents`.

But `Common` includes better support for `LookAndFeel` changes. The class `LookAndFeelList` provides a list of all available `LookAndFeels` and allows to change the current selection. Per default the list does not exist but clients can easily create one:

```
1 LookAndFeelList list = LookAndFeelList.getDefaultList();
2
3 CControl control = ...
4
5 ComponentCollector collector =
6     new DockableCollector( control.intern() );
7 list.addComponentCollector( collector );
8
9 XElement xsettings = ...
10 list.readXML( xsettings );
```

In line 1 a `LookAndFeelList` is accessed, calling `getDefaultList` will create it. In order to automatically update `JComponents` they need to be connected to the list. This is done with the help of `ComponentCollectors`. If for example a `CControl` like `control` (line 3) is given, then the class `DockableCollector` (lines 5-7) is able to collect *all* components related to it. This includes all `dockables` but also the root-window of the application. The `LookAndFeelList` can store its state persistantly and later read the state, for example in line 9 some earlier setting is accessed and in line 10 the settings are applied.



If using a `CLookAndFeelMenuPiece` then everything in the example snippets gets done automatically. Read chapter 7.8.2 to learn more about this menu.

7.8 Menus

Most `Swing` applications use menus (like in figure 6). `DockingFrames` contains a few actions that fit nicely into a menu, for example store and load a layout.

For a given option the number of required menu-items may change during runtime, e.g. every stored layout requires one item. But developers may not

want to add one `JMenu` for each option of `DF`. To resolve this problem `Common` introduces a very small framework that allows the management of dynamically growing or shrinking menus.

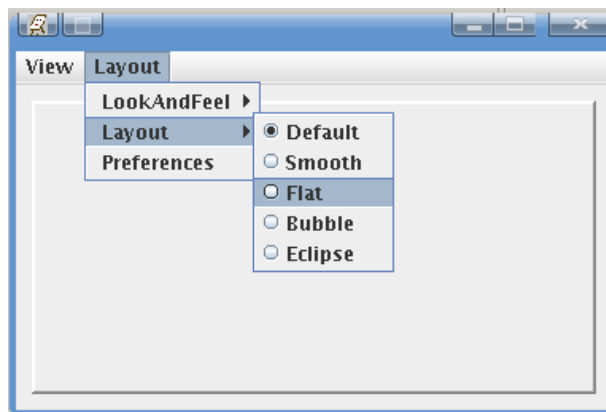


Figure 6: Some menus.

The most important class of the menu-framework is the `MenuPiece`. Basically a `MenuPiece` is a list of `Components` which informs observers if it changes its size. There are around 15 subclasses of `MenuPiece`, they allow to compose many pieces to one big piece or have more specific duties like providing the stored layouts.

An incomplete list of composing `MenuPieces` contains:

`RootMenuPiece` : Represents a whole `JMenu`.

`SubMenuPiece` : A wrapper around a `RootMenuPiece` allowing it to act like a submenu.

`NodeMenuPiece` : Just a list of `MenuPieces` that act like one big piece.

`SeparatingMenuPiece` : A wrapper around another `MenuPiece` introducing separators at the top and/or bottom.

Other `MenuPieces` that might be interesting are:



`BaseMenuPiece` : A good base class for custom `MenuPieces`, allows to add or remove `Components` directly.

`FreeMenuPiece` : A piece that does not add children by itself but has public methods which can be invoked by clients to modify the piece directly.

In the remainder of this section the more complex `MenuPieces` are introduced.

7.8.1 Themes

`Common` has several themes built in, a theme tells how to paint certain components or how to react on certain events. The theme mechanism is described in more detail in chapter 7.6.

Clients can use a `CThemeMenuPiece` to quickly create a menu that changes the theme. The menu tracks any changes in the `ThemeMap` of the associated `CControl`.



If a `CThemeMenuPiece` is no longer required, then clients should call its method `destroy`.

7.8.2 LookAndFeel

`Common` already supports `LookAndFeel`s, more about this feature can be read in chapter 7.7. The `CLookAndFeelMenuPiece` adds a menu that lists all the available `LookAndFeel`s and allows to exchange them.



If a `CLookAndFeelMenuPiece` is no longer required, then clients should call its method `destroy`.



Each `CLookAndFeelMenuPiece` will store the selection persistent, assuming that clients call `write` of `CControl` or of `ApplicationResourceManager`. If this behavior is not wished, then the `LookAndFeelMenuPiece` provides similar behavior but without the persistent storage.

7.8.3 Layout

The layout is the location of all `dockables` as described in chapter 5.3. The `CLayoutChoiceMenuPiece` offers users several actions to work with layouts:

Save : Saves the current layout. If the current layout has not yet a name then a dialog pops up so the user can enter a name.

Save As : Saves the current layout but always asks the user to enter a new name for the layout.

Load : Loads a previously saved layout, the current layout gets not stored.

Delete : Deletes a previously saved layout.

7.8.4 List of Dockables

All closeable `SingleCDockables` known to a `CControl` can be listed in a `SingleCDockableListMenuPiece`. With this menu the user can make the `dockables` visible or invisible. The menu will update its content automatically as `dockables` are added or removed from the `CControl`.

7.8.5 Preferences

Common supports preferences as described in chapter 7.5. The class `CPreferenceMenuPiece` adds a single item that opens a dialog with the preferences of a `CControl`.

Per default the preference system is disabled. Clients can activate the preference system in two ways:



- Call `setPreferenceModel` of `CControl` with the preferences that should be editable.
- Call `setup` of `CPreferenceMenuPiece` to obtain a new menu and set the default model (`CPreferenceModel`) in the same step.

8 Suggestions, Questions and Remarks

Users and developers made a lot of good suggestions, this chapter is an incomplete list of them.

Some word of warning: this is an open source project, as such its developer(s) are not so much interested in selling the framework to as many people as possible, but on having fun writing something cool. Hence some things that people would like to have will never be implemented because the developers don't have fun doing this stuff.

8.1 Version 1.0.7

8.1.1 Of people using the library

- **Question:** When showing tabs, would it be possible to show a drop-down menu when there is not enough space for all the tabs?
Answer 1.0.7: This will be implemented and has high priority.
Answer 1.0.8: The `TabLayoutManager` is responsible for deciding which actions to place in the overflow-menu and which not. Clients may use `TabPane.LAYOUT_MANAGER` to set their own implementation.
- **Question:** Tabs: would it be possible to show them on the left, right, bottom, top rotate etc...?
Answer 1.0.7: Whilst it would be easy to just put them at another place, there needs more to be done. This feature requires to upgrade most of the painting code. In theory the `StackDockComponent` would already provide developers with the ability to use their very own tabs (at their own place), but not to reuse the existing tabs. More settings would be a nice improvement of the framework and will most certainly be implemented.
Answer 1.0.8: Use `StackDockStation.TAB_PLACEMENT` to set the side on which to show tabs.
- **Question:** AWT, it needs better support (e.g. things should be painted over AWT panels as well).
Answer: AWT and Swing don't work together. This framework is based on Swing, any attempt to support AWT will result in a lot of ugly hacks. Also given the fact that AWT isn't hardly used anymore (except for applications playing video or rendering 3D scenes) this feature has little to none chances of getting implemented.
- **Question:** Could the framework be made available for [insert your favorite tool here]? E.g. in a Maven repository or for the Netbeans GUI Builder.
Answer 1.0.7: Making the framework available in/for any special tool immediately yields two new problems. First, as soon as one tool is supported people will ask for another tool, this will never end... Second, a library does not get better because it does support many other tools, it does get better because it has lesser bugs, more settings or features.
Answer 1.0.8: Andrei Pozolotin set up a Maven repository, for other tools the answer remains the same.

- **Question:** Assume an externalized `CDockable`, if it gets maximized, could it be maximized like a `JFrame`? It would will the entire screen instead of falling back to the nearest `CContentArea`.

Answer 1.0.7: This is a good idea. It is not yet clear how to implement this, but it is among those things that will be done.

Answer 1.0.8: That is now the default behavior. With `ScreenDockStation.FULL_SCREEN_STRATEGY` clients can influence what exactly “full screen” means.

8.1.2 Of the developers

Since the framework has its own forum many questions have been asked, and most of them were answered as well. From these questions some observations can be made:

- Problems arise both in `Core` and in `Common`. The problems are however of different nature. In `Core` most problems concern small things, e.g. how to place the tabs. Most of these problems can be solved with small patches. The problems related to `Common` are a lot more serious. Often the answer is “`Common` is not able to do that”. And even worse, there is often no small patch. In short: *Common has serious design flaws*. Especially `Common` lacks the ability to customize components.

Hence most future work must be spent on `Common`.

- The features now available seem to be sufficient for most applications. The requests for things that are entirely missing has dropped to almost zero. There is no need for new features, there is need to improve existing features.

Putting the pieces together the areas that will make the framework better are most likely:

- The `StateManager`, this class is responsible for managing the “extended mode”. The class has continually grown and has become a major hindrance for customization. Currently there is absolutely no abstraction in this class, it needs to be redesigned from scratch. This class is almost as important as `DockController` or `CControl`, its redesign will affect a lot of other classes. The effect will be, that a) any station can have any function, or many functions at the same time (e.g. minimizing could be mapped to a custom component). And b) clients would be able to introduce their very own extended modes.
- `CControl` and other classes use a lot of anonymous classes. They need to be named and made public, and clients need to be able to exchange them by their own implementations. New factories, also factories with customizable properties, could help.
- Clients need more control over `CDockables`, or better their representation as `Dockable`. One possibility would be a second series of `CDockables` that extend directly `DefaultDockable`.
- There should also be more observers, clients should be able to register and react (or cancel) to almost all actions of the framework.

8.2 Version 1.0.8

8.2.1 Of people using the library

- **Question:** Will there be support for Maven?
Answer: Andrei Pozolotin created a maven repository. You can find information about it on <http://code.google.com/p/docking-frames/>.
- **Question:** The guides and documentation are not helpful: they are incomplete, do not start with the basics and do not build upon each other.
Answer: It is completely understandable that starting with this framework is not that easy. The guides are intended to provide background information about tasks that often need to be done. There clearly is a gap between background information and practice. To close the gap a set of example applications will be included in the next version (some of them are already packed together with this version). These examples will be executable.
- **Question:** The code snippets in the guides are too small.
Answer: In future releases there will be an example in the example-project for most snippets.
- **Question:** How do I create a layout (a “perspective”).
Answer: If the placeholder mechanism would contain some public API, then this could be easily solved. Unfortunately such an API does not yet exist, but is on the todo-list.

8.2.2 Of the developers

Some of the issues of 1.0.7 have been addressed. Mostly the `StateManager` got replaced by the `CLocationModeManager`. Customization still is an issue.

- There is an annotation `Todo`, Interfaces, classes or methods that need to be changed are marked with this annotation.
- People often would like to set a new border or to slightly modify the current `DockTheme`. Currently such a task requires people to write several new classes. This is far from intuitive and not easy to accomplish, especially if someone does not know where to start. In order to solve the issue several changes will happen:
 1. There will be class `ThemeManager` (or a similar name), this manager will provide a set of `PropertyKeys`. Using these keys clients will have the ability to override the settings of a theme without the need to subclass or even access the theme.
 2. The `ThemeManager` will make use of `UIProperties` to distribute its content. This way clients can override settings for individual `Dockables`.
- It is hard to start with the framework. And it is nearly impossible to use some of the advanced stuff. In order to help people finding their way, the next version will include a set of examples. There may be between 20 to 30 examples, each example will be an executable application showing and explaining how to accomplish some task.

- The framework would support unsigned applets and webstart applications. But clients need to use special “secure” classes. This is an obstacle: it forces the use of factories at locations where factories do not improve the framework. Also subclassing is broken because there are two classes essentially doing the same, but not being the same. For these reasons the “secure” package will be removed in the next version. Instead classes will get the ability to switch between “secure” and “normal” behavior even after they were created.

9 Version 1.1.0

9.1 Of the people using the framework

This time there is no question that is asked by many people. Almost all questions are about little things. So the list below contains only some example questions.

- **Question:** When will the framework be bugfree?
Answer: Never. But the number of bugs is slowly decreasing. Your questions and bug reports can help speeding up that process. Always include the stacktrace (yes, really, you might not have guessed but they so much help finding bugs...) and/or a description how to reproduce the bug.
- **Question:** What about transparent background?
Answer: Does not have a high priority, as transparency can already be simulated.
- **Question:** How does the CGrid work, how do I add or remove Dockables from a CControl.
Answer: There is still much confusion about the CGrid. CGrid can be used one time to setup the initial layout, afterwards the method setVisible of CDockable has to be used to make new Dockables visible. You need to add (addDockable) any Dockable to the CControl unless you added it through the CGrid.

9.2 Of the developers

With version 1.1.0 the framework moves from “beta” to “release”. There were many small enhancements, notably the complete elimination of the “secure” packages and the introduction of perspectives.

- Customization is now much easier due to existence of the ThemeManager and the various subclasses of UIProperties. What remains missing are some examples how to use the new features, this will be addressed in version 1.1.1.
- A lot small “todo”s have been collected in version 1.1.0, and version 1.1.1 is mostly dedicated on solving this open issues.
- While perspectives are already a powerfull tool they lack features like exporting/importing from a file and an easy way to modify them.

1. Ideally clients should be able to define a default perspective, modify the perspective (e.g. adding additional `Dockables`) and the framework would extrapolate the current layout by comparing the original default perspective with the modified one. If and how this feature could be supported is yet open to debate.
2. An editor to inspect and modify the perspectives of an application might also be a handy tool. At the moment this is more science fiction than reality.

A Properties

Core allows clients to set a number of properties, Common adds a few more. All properties can be set or read by `putProperty` and `getProperty` of `CControl`. An example:

```
1 CControl control = ...
2
3 PropertyKey<KeyStroke> key = control.KEY_CLOSE;
4 KeyStroke value = KeyStroke.getKeyStroke( " shift _X" );
5
6 control.putProperty( key, value );
```

A.1 Client specific properties

The following properties are intended to be used by the client only, the keys are stored as constants in `CControl`:

KEY_MAXIMIZE_CHANGE

Type `KeyStroke`

Default `ctrl + m`

Usage If pressed then the focused `dockables` changes between maximized and normal state.

KEY_GOTO_MAXIMIZED

Type `KeyStroke`

Default `null`

Usage If pressed then the focused `dockable` becomes maximized.

KEY_GOTO_NORMALIZED

Type `KeyStroke`

Default `ctrl + n`

Usage If pressed then the focused `dockable` becomes normalized.

KEY_GOTO_MINIMIZED

Type `KeyStroke`

Default `null`

Usage If pressed then the focused `dockable` becomes minimized.

KEY_GOTO_EXTERNALIZED

Type `KeyStroke`

Default `ctrl + e`

Usage If pressed then the focused `dockable` becomes externalized.

KEY_CLOSE

Type `KeyStroke`

Default `ctrl + F4`

Usage If pressed then the focused `dockable` is made invisible.

A.2 Advanced properties

Some additional properties are reserved for more detailed customization.

CControl.CCONTROL

Type CControl

Default The CControl itself

Usage This unmodifiable property allows access to the CControl even if only a DockController is available.

CControl.RESIZE_LOCK_CONFLICT_RESOLVER

Type ConflictResolver<RequestDimension>

Default an instance of DefaultConflictResolver

Usage Tells how to distribute space when two or more dockables have conflicting size requests. See also chapter 7.3.

LocationModeManager.DOUBLE_CLICK_STRATEGY

Type DoubleClickLocationStrategy

Default DoubleClickLocationStrategy.DEFAULT

Usage This strategy tells to what extended-mode a Dockable changes if the user double clicks on it.

LocationModeManager.MODE_ENABLEMENT

Type ExtendedModeEnablementFactory

Default DefaultExtendedModeEnablement.FACTORY

Usage This strategy tells what extended-modes are available for each Dockable.

CControl.CCONTROL

Type CControl

Default The CControl in whose realm the query was asked

Usage Used internally for items which have access to a DockController but not to its CControl. This property cannot be modified.