

# **AVC, Application View Controller**

## ***User Manual***

version 0.11.0

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**AVC outline**

*Current version is AVC 0.11.0, beta status, released 23-Feb-2016.*

*Tested on:*

*Kubuntu 14.04 LTS Trusty Tahr, FP 23-Feb-2016*

*python 2 version: 2.7.6 (default, Jun 22 2015, 17:58:13) [GCC 4.8.2]*

*python 3 version: 3.4.3 (default, Oct 14 2015, 20:28:29) [GCC 4.8.4]*

*jython version: 2.7.0*

*widget toolkits: GTK+ v2.24.23, GTK3 v3.10.8, Qt4 v4.10.4, Swing v1.7.0\_80-b15*

*Tkinter v8.6, tkinter v8.6, wxWidgets v3.0.1.1 .*

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The AVC web site is hosted at <http://avc.inrim.it>

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**Author note**

The author will be happy to hear about any usage of AVC. Please, feel free to send questions, corrections and suggestions to the author. The poor English of this manual requires special indulgence.

**Document info**

author:	Fabrizio Pollastri
created:	2007-07-10-11.25.23 PM
modified:	2016-02-23-11.38.46
version:	225

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# 1. Introduction

## 1.1. What is

AVC, the Application View Controller is a multiplatform, fully automatic, live connection among graphical interface widgets and application variables for the python [1] language.

AVC supports in a uniform way the most popular widget toolkits: GTK2+ and GTK3+ [2], Qt4 and Qt5 [3], Tk [4], wxWidgets [5]. The Swing [6] widget toolkit for the java [7] environment is also supported via the jython [8] compiler.

AVC is a normal python package that can be imported by any python or jython application.

Graphical User Interfaces (GUIs) are the easy way to input data to an application software and to view the data produced by the application. The management of data exchanges between the GUI and the application is a central problem in GUI programming, it absorbs a relevant part of the programming effort. AVC makes the programming of this data exchanges very easy.

AVC is a fully transparent and automatic connection between the values displayed and entered by GUI widgets and the variables of an application using the GUI. The connection is bidirectional. If the application sets a new value into a connected variable, AVC copies the new value into all the widgets connected to the variable. If a new value is entered by a widget, AVC copies the new value into all other widgets connected the variable, into the variable and optionally notifies the change to the application. The connections are autogenerated by looking for matching names between widget names and variable names.

The application is completely unaware of the presence of the connected variables, it reads and writes them as normal variables. Only if the application requires to be immediately notified when a connected variable changes value, a notify handler must be added to the application.

## 1.2. Features

- Fully transparent widget-variable connections
- Automatic connection by matching widgets and variables names
- Multiple matching namespaces
- Dynamic connections
- No design pattern, no application redesign, no widget toolkit dependent code, separation between application logic and GUI.
- Multiple widget toolkits support: GTK2+, GTK3+, Qt4, Qt5, Tk, wxWidgets, Swing.
- Full compatibility and support for Glade Error: Reference source not found, Qt Designer [15], Visual Tcl [16] and wxGlade [17] interface design tools.
- Normal widgets: button, check button, combo box, entry, label, progress bar, radio button, slider, spin button, status bar, text view/edit, toggle button.
- Advanced widgets: calendar, color selection, list view, tree view.
- Normal variable types: boolean, integer, float, string, list, tuple.
- Advanced variable types: calendar tuple, color tuple, 2D table (list of lists), hierarchical tree (dictionary with paths of values inside tree as keys)
- Multiple widgets to one variable connection
- Dual update timing of variable value views: immediate or periodic.
- Testing printout logging activity with selectable verbosity
- Python package written in pure python
- Free software (GNU GPL license version 3 [18])

## 1.3. Quick start

Essential instructions to get started with AVC. These instructions are valid for all supported toolkits. The AVC package is supposed already installed. For a simple example, see further along the section “Spinbutton/Spinbox/SpinCtrl/Spinner Example” of the widget toolkit of interest.

Import the python binding of the widget toolkit of choice, then Import the AVC package.

```
from avc import *
```

Derive the application class from the AVC class. Let suppose that the application class name is "theApp".

```
class theApp(AVC):
```

In the class `__init__` method create the GUI previously designed with your preferred interface designer or create it statement by statement, naming the widgets with the rule described below.

Define all variables to be connected in the application by assigning them to the desired initial values. Each variable must have a name equal to the matching name of the widgets that are to be connected to the variable. A widget matching name is the widget name itself, if it does not contain a double underscore `'__'`, otherwise is the name part before the double underscore.

In the application, after the creation of the GUI and after the instantiation of all the variables to be connected, call the instance method `'avc_init'`. Let suppose that the application instance name is `"the_app"`.

```
the_app.avc_init()
```

All is done for AVC. When the application enters the toolkit event loop, AVC takes full control over data exchange between the connected variables and widgets.

## 1.4. Installation

**AVC** can be installed by both python and jython.

To run **AVC** with python, **Python 2.2 or later** must already be installed. The latest release is recommended. Python is available from <http://www.python.org/>.

To run **AVC** with jython, **Jython 2.5.1 or later** must already be installed. The latest release is recommended. Python is available from <http://www.jython.org/>.

The first step is to download the AVC tarball from <http://avc.inrim.it/dist/>.

Open a shell. Unpack the tarball in a temporary directory (**not** directly in Python's/Jython's site-packages). Commands:

```
tar xzf avc-X.Y.Z.tar.gz
```

X, Y and Z are the major and minor version numbers of the tarball.

Go to the directory created by expanding the tarball:

```
cd avc-X.Y.Z
```

Get root privileges:

```
su
```



(enter root password)

To install for python type:

```
python setup.py install
```

To install for jython type:

```
jython setup.py install
```

If the python/jython executable isn't on your path, you'll have to specify the complete path, such as /usr/local/bin/python or usr/local/bin/jython.

## 2. Common reference

This is the part of the user manual common to all supported widget toolkits: GTK+, Qt4, Tk, wxWidgets and Swing.

### 2.1. Supported widgets

The following table shows the correspondences between the AVC abstract widget types and the names of the real widgets in the supported toolkits.

**Table 1: Map of supported widget**

AVC abstract widget type	real widgets by supported toolkits				
	GTK2+ GTK3+	Qt4 Qt5	Tk	wxWidgets	Swing
<b>Button</b>	Button	QPushButton <sup>(1)</sup>	Button	Button BitmapButton	JButton
<b>Calendar</b>	Calendar	QCalendar	-	CalendarCtrl	-
<b>Check Button</b>	CheckButton	QCheckBox	Checkbutton	CheckBox	JCheckBox
<b>Color Selection</b>	ColorSelection	QColorDialog	-	ColorPicker	JColorChooser
<b>Combo Box</b>	ComboBox ComboBoxText	QComboBox <sup>(2)</sup>	-	Choice ComboBox	JComboBox
<b>Entry</b>	Entry	QLineEdit	Entry	TextCtrl	JTextField
<b>Label</b>	Label	QLabel	Label	StaticText	JLabel
<b>List View</b>	TreeView	QTreeWidget	-	ListCtrl <sup>(3)</sup>	JTable
<b>Progress Bar</b>	ProgressBar	QProgressBar	-	Gauge	JProgressBar
<b>Radio Button</b>	RadioButton	QRadioButton	Radiobutton	RadioBox	JRadioButton
<b>Slider</b>	HScale VScale Scale	QSlider <sup>(4)</sup>	Scale	Slider	JSlider
<b>Spin Button</b>	SpinButton	QSpinBox <sup>(5)</sup> QdoubleSpinBox	Spinbox	SpinCtrl	JSpinner
<b>Status Bar</b>	StatusBar <sup>(6)</sup>	-	-	StatusBar <sup>(6)</sup>	-
<b>Text View</b>	TextView	QTextEdit	Text	TextCtrl	JTextArea
<b>Toggle Button</b>	ToggleButton	QPushButton <sup>(7)</sup>	Togglebutton	ToggleButton	JToggleButton
<b>Tree View</b>	TreeView	QTreeWidget	-	TreeCtrl <sup>(8)</sup>	JTree <sup>(8)</sup>

#### Notes

(1) QPushButton with "toggleButton" property set to "False" (the default).

(2) QComboBox with "editable" property set to "False" (the default).

(3) ListCtrl with property "style" set to "report".

(4) QSlider manages integer values only.

(5) QSpinBox manages integer values only.

(6) StatusBar is used as a simple output label.

(7) QPushButton with "toggleButton" property set to "True". Set it with QPushButton method `setToggleButton(True)`.

(8) TreeCtrl and JTree do not support columns and header.

## 2.2. Widgets-variables names matching

AVC connects widgets and variables using a names matching procedure with the following rules.

The matching name for a variable is the variable name itself.

The matching name for a widget is the widget name itself, if the name does not contain a double underscore ('\_\_'), otherwise the matching name is the part of the widget name before the double underscore. This allow to differentiate widget names for widgets that are to be connected to the same variable.

Each widget having a matching name equal to a variable matching name is connected to that variable.

A widget can be connected to one variable. A variable can be connected to one or more widgets.

widget name	matching name
button_ok	button_ok
toggle__button	toggle
check_button_1	check_button_1
radio_button__2	radio_button

**Table 2: Examples of matching names**

## 2.3. Matching namespaces

The name matching process of AVC works on two sides. One is the application program where AVC search for matching names of variables. The other is the GUI where AVC search for matching names of widgets. The matching process can be performed any number of times and at any moment during application run time by a simple call to the proper AVC method ("avc\_init" or "avc\_connect"). For each call, the name search in the application is bounded to the attributes of the python object calling the AVC method. While the name search in the widgets is bounded to a widgets subtree, if the subtree root widget is specified in the call. If no root widget is specified, the whole GUI widget tree is searched. In other words, the search namespace of the application variables is the scope (the directly accessible namespace or the set of local symbols) of the object calling the AVC method. See the "countdown" example.

## 2.4. Connected objects

Each python object calling one of the connecting methods of AVC ("avc\_init" or "avc\_connect") is a "connected" object. All connected objects must be instances of classes derived from the AVC class. Let suppose that the class name is "myConnectedClass", the class definition statement will be

```
class myConnectedClass(AVC):
```

The AVC class is derived from the builtin object class that is the base of all new style classes introduced with python 2.2. So, also the derived class becomes a new style class.

## 2.5. Static and dynamic connections

Any widget-variable connection created by AVC is dynamic, in the sense that it can be created or deleted at any moment during the application run time. The simplest usage of AVC as outlined in 1.3 uses the connections in a "static" mode: the connections are setup only one

time at the application init (call to `avc_init`) and they stay alive and unchanged until application termination. In a more flexible usage, AVC creates some connections at application init time, then during run time new GUIs or parts of GUI come up as connected objects and when the application destroy some part of this GUIs, the corresponding connections are automatically deleted. When the application deletes a widget that belongs to a connection, AVC automatically removes it from the connection and if the connection has no more widgets, the connection is also removed (see "countdown" example). An example of dynamic connection is a dialog window that comes up at some execution time. The application can connect any widget in the dialog that is referenced by some application variable by the following call: `the_app.avc_connect(new_dialog_window)`.

## 2.6. Uniform separation between application logic and GUI

AVC allows to structure the application with a program logic separated from GUI statements for all supported toolkits. For example, program logic can be put in one class and GUI management in another class (see "counter" example).

## 2.7. AVC initialization

AVC start its job just after it is initialized. AVC initialization can take place in the application after the creation of the GUI and after the instantiation of all variables to be connected. AVC initialization is done by calling the instance method `avc_init`. Let suppose that the application instance name is "the\_app", the AVC init statement will be

```
the_app.avc_init()
```

When the value of a connected variable is changed, the values displayed by the widgets connected to it are updated by AVC in one of two allowed modes: immediate or periodic. Mode selection is done at AVC initialization specifying the "view\_period" argument. If the argument is omitted, like in `the_app.avc_init()`, it is assigned a default value of 0.1 seconds, selecting a periodic views update with that period. If the argument is assigned a value, like in `the_app.avc_init(view_period=0.2)`, views will be updated every "view\_period" seconds. If the argument is assigned to zero or to "None" value, like in `the_app.avc_init(view_period=0)`, views will be updated immediately after each change of the variable value.

## 2.8. Connecting widgets with variables

Two AVC methods can be called to perform widgets-variables connections: "avc\_init" and "avc\_connect". As detailed in 2.7, any application using AVC must call the "avc\_init" method at init time. This call is normally performed by the application object that implements the "main" function of the application. `avc_init` initializes all the internal logic of AVC and makes any required connection of the "main" object between its attributes and the whole widget tree of the GUI. In many cases this is enough, so no more AVC calls are required. If other application objects needs to perform connections, they must call the "avc\_connect" method. This method makes any required connection of the calling object between its attributes and the widget tree whose root widget is given as argument. Let suppose that the object name is "object1", the call statement will be

```
object1.avc_connect(tree_root_widget)
```

If the argument is omitted, the widget tree defaults to the whole GUI widget tree. The following rules apply to `avc_connect` operations: widget trees can overlap, a connected widget can not be reconnected in another way. See "countdown" example.

## 2.9. Normal abstract widget collection

All supported widgets are divided into two groups: normal and advanced. Normal widgets embed simple data that can be connected to a basic python type, i.e. the button widget can be connected to a boolean variable. Advanced widgets embed complex data that needs to be connected to a more complex python type.

The normal real widgets of the supported toolkits are mapped to the following set of abstract widgets. The detailed python data corresponding at each abstract widget is given.

### Button

The memoryless press button, its connected variable must be a boolean. In normal state (button not pressed) the variable is "False", in pressed state (mouse pointer over button and mouse button 1 pressed) the variable is "True".

Names for button widget in supported toolkits: GTK+ "Button" and Qt4 "QPushButton" with toggle attribute off, Tk "Button", wxWidgets "Button", Swing "JButton".

### Check button

The behavior of the check button widget is the same of the toggle button widget. See [toggle button](#).

Names for check button widget in supported toolkits: GTK + "CheckButton", Qt4 "QCheckBox", Tk "Checkbutton", wxWidgets "CheckBox", Swing "JCheckBox".

### Combo box

The combo box, an item selector. The connected variable must be of type integer, its value is the index of the selected item. When no item is selected index is -1.

Names for combo box widget in supported toolkits: GTK2+ "ComboBox", GTK3+ "ComboBoxText", Qt4 "QComboBox", not available in Tk, wxWidgets "Choice" "ComboBox", Swing "JComboBox".

### Entry

The text entry, its connected variable can be integer, float or string. Text input must conform to the type of the connected variable. If the connected variable is of type string, its value is copied to the entry widget "as is", if type is integer or float, the value is converted to string before copy.

Names for text entry widget in supported toolkits: GTK+ "Entry", Qt4 "QLineEdit", Tk "Entry", wxWidgets "TextCtrl", Swing "JTextField".

### Label

The text label, its connected variable can be boolean, integer, float, string, list, tuple or object. If the label is created with a default text, AVC tests it against the connected variable to be a valid python formatting string. If the test is successful, the default text is saved by AVC and used to format the label text updates when the connected variable value changes. If the connected variable is a generic python object, the formatting string is applied to the dictionary of the object. If the test is not successful, the label text updates are rendered by the standard python string representation applying the `str` function to the connected variable. For further details, see the "label example".

Names for text entry widget in supported toolkits: GTK+ "Label", Qt4 "QLabel", Tk "Label",

wxWidgets "StaticText", Swing "JLabel".

### Progress bar

The progress bar, its connected variable must be a float. If the value assigned to the variable is negative, the progress bar is pulsed (display effect: a short colored segment shuttling along the progress bar). If the value assigned to the variable is in the range 0.0 - 1.0, the progress bar is extended for the proportional amount (0.0 → 0%, 1.0 → 100%).

Names for progress bar widget in supported toolkits: GTK+ "ProgressBar", Qt4 "QProgressBar", Tk not supported, wxWidgets "Gauge", Swing "JProgressBar".

### Radio button

The radio buttons come always in groups of two or more radio buttons. Each radio button behaves like a [check button](#), but only one radio button at a time can be checked in each group. A variable of type integer can be connected to each group of radio buttons, its value is the index of the checked radio button in the group.

Names for text entry widget in supported toolkits: GTK+ "RadioButton", Qt4 "QRadioButton", Tk "Radiobutton", wxWidgets "RadioBox", Swing "JRadioButton".

### Slider

The slider, its connected variable can be integer or float. The GTK+ "HScale" and "VScale" support both types. On the contrary, Qt4 supports only integers with "QSlider" widget. Also Swing with "JSlider" support only integers. Remember that in python floats are always doubles.

Names for text entry widget in supported toolkits: GTK2+ "Hscale" and "Vscale", GTK3+ "Scale", Qt4 "QSlider", Tk "Slider", wxWidgets "Slider", Swing "JSlider".

### Spin button

The spin button, its connected variable can be integer or float. The GTK+ "SpinButton" support both types. On the contrary, Qt4 differentiate integer or float support with two widgets: "SpinBox" and "DoubleSpinBox". Remember that in python floats are always doubles.

Names for spin button widget in supported toolkits: GTK+ "SpinButton", Qt4 "QSpinBox" for integer and "QDoubleSpinBox" for float, Tk "Spinbox", wxWidgets "SpinCtrl", Swing "JSpinner".

### Status bar

The status bar, its connected variable is a string.

Names for text view/edit widget in supported toolkits: GTK+ "StatusBar", Qt4 and Tk not supported, wxWidgets "StatusBar".

### Text view/edit

The text view/edit, its connected variable is a string.

Names for text view/edit widget in supported toolkits: GTK+ "TextView", Qt4 "QTextEdit", Tk "Text", wxWidgets "TextCtrl", Swing "JTextArea".

### Toggle button

The toggle button, a button with memory, its connected variable must be a boolean. Each time the button is pressed, it changes its state: from on to off or viceversa. In off state the variable is "False", in on state the variable is "True".

Names for toggle button widget in supported toolkits: GTK+ "ToggleButton", Qt4 "PushButton" with toggle attribute on, Tk "Togglebutton", wxWidgets "ToggleButton", Swing "JToggleButton".

## 2.10. Advanced abstract widget collection

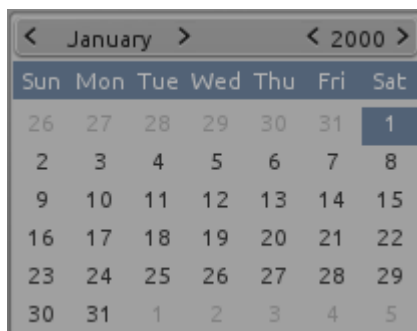
The advanced real widgets of the supported toolkits are mapped to the following set of abstract widgets. The detailed python data corresponding at each abstract widget is given. The widget graphics show below depends on the toolkit used. The example images as taken from GTK widgets.

### Calendar

The calendar, this widget the current date with a calendar graphic. The date can be changed by interacting with the widget graphic.

A calendar widget displaying some date

The connected python variable



[2000,1,1]

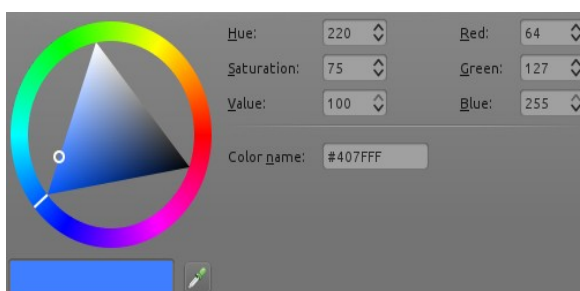
In the example above, the calendar widget displays the date of January 1, 2000. The connected variable is a list with the format [year, month, day]. Month and day numbers starts from 1.

### Color selection

The color selection, this widget a graphic showing the current selected color. The color can be changed by interacting with the widget graphic.

A color selection widget displaying a color

The connected python variable



[0.249989,0.499992,1.000000,1.000000]

In the example above, the widget displays the current color in four different modes. Graphically, the color triangle on the left. By Hue, saturation and value components. By red, green and blue components. The value of each components of this last representation is given in decimal and hexadecimal numbers. The connected variable is a list with the format [red, green, blue, alpha]. The value of each components span the range 0.0 - 1.0. The corresponding decimal range in widget representation is 0 - 255. The corresponding hexadecimal range in widget representation is 00 - ff. The alpha component, the color transparency, is assumed to be 1.0 that means a color completely opaque.

## List view

The list view, this widget can display data as a 2D table of one or more columns, the columns can have an optional header. All items in one column may have the same type. Different columns can have different types. At present, only textual data can be displayed: no icons, no check boxes, etc. Let explain the connected python variable with an example.

A list view widget displaying some data

col1 int	col2 str
3	three
1	one
2	two

The connected python variable

```
{'head':['col1 int','col2 str'], \
'body':[[1,'one'],[2,'two'],[3,'three']]}
```

In the above example, the list view displays a data table with two columns and three rows plus an header. The connected python variable is contained into a dictionary with two keys: “head” and “body”. The value of the key “head” controls the header of the list view. Its value type must be a list of strings, each string appears into the head of a column. To remove the header in the widget, remove the “head” key/value pair from the dictionary. The value of the key “body” controls the data displayed in the table. Its must be a list of row data, where each row is a list of column values.

Names for list view widget in supported toolkits: GTK+ “TreeView”, Qt4 “QTreeWidget”, Tk not supported, wxWidgets “ListCtrl”, Swing “JTable”.

Note: wxWidgets “ListCtrl” works with property “style” set to “report”.

## Tree view

The tree view, this widget can display a hierarchical data tree, it can have an optional header. At present, only textual data can be displayed: no icons, no check boxes, etc. Let explain the connected python variable with an example.

A tree view widget displaying some data

col1 int	col2 str
▼ 1	one
11	one one
12	one two
▼ 2	two
21	two one
22	two two

The connected python variable

```
{'head':['col1 int','col2 str'], \
'body':{'1':[1,'one'],'2':[2,'two'], \
'1.1':[11,'one one'],'1.2':[12,'one two'], \
'2.1':[21,'two one'],'2.2':[22,'two two']]}
```

In the above example, the tree view displays two root rows, rows 1 and 2. Each root row has two children rows, rows 11 and 12 for root row 1, rows 21 and 22 for root row 2. The whole tree has 6 rows and two columns with an header. The connected python variable is contained into a dictionary with two keys: “head” and “body”. The value of the key “head” controls the header of the tree view. Its value type must be a list of strings, each string appears into the head of a column. To remove the header in the widget, remove the “head” key/value pair from



the dictionary. The value of the key “body” controls the data displayed in the tree. Its must be a dictionary of row data. The row value is a list of column values. The key of each row is the path of the row in the tree, referred only to the visual current position of the row respect to the other rows. A row path is represented as a string with one or more integers separated by dots. Root rows paths have only one integer, starting from 1 for the topmost row and increasing by one at each root row going toward bottom. First level children have two integers. The first is the parent path, the second is the child top-down order, starting from 1 for the topmost child and increasing by one at each child of the same parent going toward bottom. Path of deeper rows in a tree is built applying recursively the above rules.

Names for tree view widget in supported toolkits: GTK+ “TreeView”, Qt4 “QTreeWidget”, Tk not supported, wxWidgets “TreeCtrl”, Swing “JTree”.

Note: wxWidgets “TreeCtrl” and Swing “JTree” do not support columns and headers.

## 2.11. Connection update trigger events

On the application side there is only one event triggering the update of the connected widgets, the assignment of a new value to the connected variable. On the contrary, from the GUI side, several events can trigger the update of a new value in the connected variable and in the other connected widgets. The following table specifies for each widget which GUI events trigger the update.

**Table 3: GUI events triggering connection update**

AVC abstract widget type	real widgets events by supported toolkits				
	GTK2+ GTK3+	Qt4 Qt5	Tk	wxWidgets	Swing
<b>Button</b>	MLB press MLB release	MLB press MLB release	MLB press MLB release	MLB press MLB release	MLB press MLB release
<b>Calendar</b>	MLB press	MLB release	-	MLB press MLB release	-
<b>Color Selection</b>	MLB press Label edit end	MLB release on OK button	-	MLB release on OK button	MLB release Label edit end
<b>Check Button</b>	MLB release	MLB release	MLB press	MLB release	MLB release
<b>Combo Box</b>	MLB release Arrows+Enter	MLB release Arrows+Enter	NA	MLB release Arrows+Enter	MLB release Arrows
<b>Entry</b>	Enter	Enter	Enter	Key press	Key release
<b>Label</b>	-	-	-	-	-
<b>List View</b>	Row deleted Row changed	Layout changed Data changed Header data changed	NA	Label edit end	Label edit end
<b>Progress Bar</b>	NE	NE	NA	NE	NE
<b>Radio Button</b>	MLB release Arrow press	MLB release Arrow press	MLB press	MLB release Arrow press	MLB release
<b>Slider</b>	Drag	Drag	Drag	Drag end	Drag
<b>Spin Button</b>	MLB press MRB press Enter	MLB press Key press	MLB release Enter	MLB press MRB press Enter	MLB press Enter
<b>Status Bar</b>	NE	NE	NA	NE	NE
<b>Text View</b>	Key press	Key press	Enter	Key press	Key press
<b>Toggle Button</b>	MLB release	MLB release	MLB press	MLB release	MLB release

<b>Tree View</b>	Row deleted Row changed	Layout changed Data changed Header data changed	NA	Label edit end	Label edit end
------------------	----------------------------	--	----	----------------	----------------

**Notes**

Arrows: up and down arrow keys.

Drag: mouse left button pressed while moving.

Enter: the enter key.

Key: any printable key.

Label edit end: enter key pressed after label editing.

MLB: mouse left button.

MRB: mouse right button.

NA: widget not available.

NE : display only widget, no input event.

## 2.12. Caveat

Below, there is a list of things to pay attention to have a good experience with AVC. They are in part limitations chosen by design to keep AVC as simple as possible, in part limitations imposed by the python language. They may become development targets in the future.

### 2.12.1. General caveat

The attributes exploration goes deep one level, it is not recursive on objects. This means that only attributes of the current class are considered for matching. If an attribute of the current object class is an object containing other attributes, these are not considered for matching.

Several core operation of AVC must be executed atomically, to avoid the burden of mutually exclusive execution provisions, AVC cannot be used together with multiple thread of control.

When the connected variable is a mutable sequence (list or dictionary), the assignment to the variable with subscripts do not trigger the value update into the connected widgets. So, assign the connected variable as a whole without any subscript.

For efficient programming, use small (in memory footprint sense) connected variables: avoid long lists or big dictionaries.

At present, no persistence of connected variables is implemented. At application termination, nothing is saved about the status of the connected variables.

The update of tree view widgets rewrites completely the displayed tree, so the expanded/collapsed status of each tree node is lost.

### 2.12.2. Widget toolkit specific caveat

AVC for Swing do not implement widget removal: it seems that Swing do not have a widget destroy signal to listen.

GTK2+ glade interface designer rename automatically different widget with the same name by appending a number.

## 2.13. Testing and debugging

AVC can produce a printout of its activity that can be useful for testing and debug purposes. The verbosity level of the printout can be selected from 0 (minimum) to 4 (maximum). Let suppose that the program to test is “myprogram.py”, then to produce the printout with the maximum verbosity the following command is required.

```
myprogram.py --avc-verbosity 4
```

The content of the each verbosity level is the following.

- **level 0:** nothing printed, the default.
- **level 1:** header with AVC version, widget toolkit type and version, program name, verbosity level, connection update mode; connection list with name, variable type, initial value, removed connections.
- **level 2:** as level 1 plus the widgets and the change handlers list of each connection, the removed widgets.
- **level 3:** as level 2 plus the details of widgets in connections lists.
- **level 4:** as level 3 plus full widget tree for each scansion.
- **level 5:** as level 4 plus full printout of internal structures (cogets, connections, widgets).

### 2.13.1. Testing printout for example gtk3\_counter.py

The following example shows the output produced by running the example “gtk3\_counter.py” with verbosity at level 4. Similar outputs are given for the other widget toolkits.

```
./gtk3_counter.py --avc-verbosity 4
AVC 0.10.0 - Activity Report
widget toolkit binding: GTK3 v3.10.8
program: ./gtk3_counter.py
verbosity: 4
connection update mode: periodic, period=0.1 sec
widget tree scansion from top level [<Window object at 0x7f5289538870 (GtkWindow at 0x1b1a360)>]
  skip unsupported widget Window,"root_window"
  skip unsupported widget Box,"GtkBox"
  creating coget "counter" in <avc.avccore.Coget object at 0x7f52837b0e10>
  creating connection "counter" in <__main__.ExampleMain object at 0x7f528c64c610>
    type: <type 'int'>
    initial value: 0
  add widget Label,"counter" to connection "counter"
    valid format string: "<b>%d</b>"
  creating coget "high_speed" in <avc.avccore.Coget object at 0x7f52837b0e50>
  creating connection "high_speed" in <__main__.ExampleMain object at 0x7f528c64c610>
    type: <type 'bool'>
    initial value: False
    connected handler "high_speed_changed"
  add widget CheckButton,"high_speed" to connection "high_speed"
  skip unmatched widget Label,"GtkLabel"
removing widget Label from connection "counter" of <__main__.ExampleMain object at 0x7f528c64c610>
```

```
removing connection "counter" from <__main__.ExampleMain object at 0x7f528c64c610>  
deleting coget "counter" <avc.avccore.Coget object at 0x7f52837b0e10>  
removing widget CheckButton from connection "high_speed" of <__main__.ExampleMain  
object at 0x7f528c64c610>  
removing connection "high_speed" from <__main__.ExampleMain object at 0x7f528c64c610>  
deleting coget "high_speed" <avc.avccore.Coget object at 0x7f52837b0e50>
```

In the “widget tree scansion” all the widgets of the GUI are analyzed. In fact, the root widgets of the searched tree are the top level windows. Each widget can be skipped (ignored) or added to a connection. A widget is skipped because it is of type not supported AVC or it has a name not matching any variable of the application or it is already connected. When a name match is found and the related connection do not exists, the message “ creating connection ...” appears with the name of the connection and the object in which resides the connected variable. The type and the initial value of the variable is also displayed. A widget is added to a connection because it name matches some application variable. For each added widget, its class type and its name are printed.

Things to be noticed. The connection “counter” has a label widget that was preloaded with a valid formatting string ("**<b>%d</b>**"). The connection “high\_speed” has a check button widget and it has the change handler “high\_speed\_changed”.

When the main window is closed, all the contained widgets are deleted, so for each deleted widget that is also connected a remove message appears. When a connection has no more widgets, it is also removed and a remove message appears.

## 3. GTK2+ reference

This is the part of the user manual specific to the GTK2+ widgets toolkit.

### 3.1. Module dependencies

AVC GTK2+ depends on PyGTK [9] the python wrapper for GTK2+ libraries. AVC GTK2+ imports the following modules from PyGTK.

```
import gtk
import gobject
```

### 3.2. Widget naming

Both Glade, the interface designer, and GTK2+ allow duplicated naming of widgets.

### 3.3. Status bar widget

AVC uses the GTK2+ status bar widget as a simple output label. Only context #1 with one or none message on status bar stack is used.

### 3.4. Interface designer

AVC is fully compatible with Glade, the design tool for GTK2+. Glade produces an interface description that is saved as a specific xml format (.glade).GTK2+ and GTK3+ reference

This is the part of the user manual specific to the GTK+ widgets toolkit.

## 4. GTK3+ reference

This is the part of the user manual specific to the GTK3+ widgets toolkit.

### 4.1. Module dependencies

AVC GTK3+ depends on PyGObject [10] the python wrapper for GTK3+ libraries. AVC GTK3+ imports the following modules from PyGTK.

```
import gi.repository.GObject as GObject
import gi.repository.Gtk as Gtk
```

### 4.2. Widget naming

Both Glade, the interface designer, and GTK3+ allow duplicated naming of widgets.

### 4.3. Interface designer

AVC is fully compatible with Glade, the design tool for GTK3+. Glade produces an interface description that is saved as a specific xml format (.ui).

## 5. Qt4 and Qt5 reference

This is the part of the user manual specific to Qt4 [3] widgets toolkit.

### 5.1. Module dependencies

AVC Qt4 depends on PyQt v4 [11] the python bindings for Qt v4 application framework. AVC Qt4 imports the following modules from PyQt.

```
import PyQt4.Qt as qt
```

### 5.2. Widget naming

Qt4 Designer and Qt4 **do not** allow duplicated naming of widgets. So use the 'double underscore' mechanism to differentiate widgets names.

### 5.3. Application GUI class

The application objects that need to interact with Qt4 GUI, must be instantiated from an application class that is derived from the `QApplication` class. Let suppose that the application GUI class name is "theAppGUI", the application class statement will be

```
class theAppGUI(QApplication):
```

### 5.4. Interface designer

AVC is fully compatible with Qt4 Designer, the design tool for Qt4. Qt4 Designer produces an interface description that is saved as a specific xml format (.ui).

## 6. Tk reference

This is the part of the user manual specific to Tk [4] widgets toolkit.

### 6.1. Module dependencies

AVC Tk depends on Tkinter [12] the python bindings for Tk application framework. Tkinter is part of the standard python library. AVC Tk imports the following module from python standard library.

```
import Tkinter
```

### 6.2. Widget naming

The Tk toolkit has a specific naming scheme for its widgets. Widget name is generally the concatenation of its parent's name followed by a period (unless the parent is the root window `.`) and a string containing no periods, e. g. `".baseframe.button1"`. For this reason, the complete name of each widget is unique. AVC takes as widget name not the complete Tk name but only the part after the rightmost dot. For example a widget with the complete Tk name `".baseframe.button1"` has the AVC name `"button1"`.

### 6.3. Interface designer

AVC supports the 'Visual Tcl' interface design tool for Tk. Visual Tcl produces an interface description that is saved as tcl script.



## 7. wxWidgets reference

This is the part of the user manual specific to wxWidgets [5] widgets toolkit.

### 7.1. Module dependencies

AVC wxWidgets depends on wxPython [13] the python bindings for wxWidgets application framework. AVC wxWidgets imports the following module from python standard library.

```
import wx
```

### 7.2. Widget naming

Both wxGlade, the interface designer, and wxWidgets allow duplicated naming of widgets.

### 7.3. Application GUI class

The application objects that need to interact with wxWidgets GUI, must be instantiated (in the simplest form) from an application class that is derived from the PySimpleApp class. Let suppose that the application GUI class name is "theAppGUI", the application class statement will be

```
class theAppGUI(PySimpleApp):
```

### 7.4. Interface designer

AVC supports the 'wxGlade' interface design tool for wxWidgets and all other design tools producing an interface description that is saved in the native xml format ('xrc') of wxWidgets.

## 8. Swing reference

This is the part of the user manual specific to Swing [6] widgets toolkit.

### 8.1. Module dependencies

AVC Swing depends on jython Swing modules [8], the jython bindings for java Swing application framework. AVC Swing imports the following module from jython standard library.

```
from java import awt
from javax import swing
```

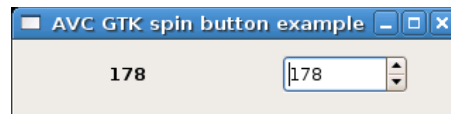
### 8.2. Widget naming

Swing allows duplicated naming of widgets.

## 9. GTK2+ examples

### 9.1. Spin button example

This simple example shows how **AVC** can manage data exchange from widget to widget without any specific code in the application. The program creates a window with two widgets: a spin button and a label. When the value in the spin button is changed by clicking on up or down arrows or by entering it with the keyboard, the new value is displayed into the label.



#### 9.1.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

import gtk                      # gimp tool kit bindings
import gtk.glade                # glade bindings

from avc import *               # AVC

GLADE_XML = 'gtk_spinbutton.glade' # GUI glade descriptor

class Example(AVC):
    """
    A spin button whose value is replicated into a label
    """

    def __init__(self):
        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # the variable holding the spin button value
        self.spin_value = 0

    def on_destroy(self, window):
        "Terminate program at window destroy"
        gtk.main_quit()

#### MAIN

example = Example()              # instantiate the application
```

```

example.avc_init()          # connect widgets with variables
gtk.main()                 # run GTK event loop until quit

#### END

```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_spinbutton.glade'.

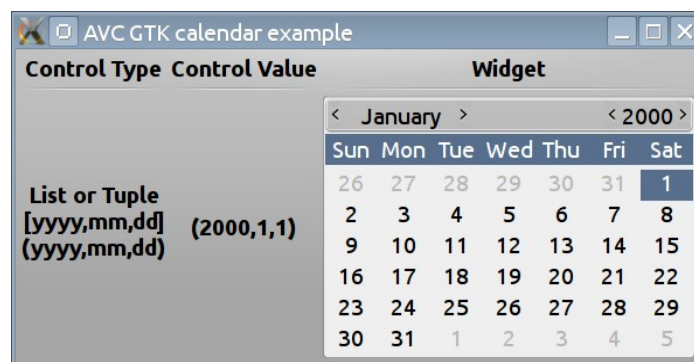
The key points of the example regarding **AVC** are the following.

- During Glade editing, the same name '**spin\_value**' was given to the spin button and to the label.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **AVC** class (`class Example(AVC):`).
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (`self.spin_value = 0`).
- The `avc_init` method is called after the instantiation of the application class, to realize the connections of the two widgets through the '**spin\_value**' variable and to initialize the widgets values with the initial value of the variable (`example.avc_init()`).

Example files in directory 'examples' of distribution: program 'gtk\_spinbutton.py' , Glade descriptor 'gtk\_spinbutton.glade'.

## 9.2. Calendar example

This example shows the graphic rendering of the calendar widget displaying the default date of January 1, 2000.



The connected variable can be a list or a tuple with the format yyyy, mm, dd: four digit year, two digit month, two digit day. Month and day numbers start from 1.

### 9.2.1. Python source

```

#!/usr/bin/python
# .copyright   : (c) 2013 Fabrizio Pollastri.
# .license    : GNU General Public License v3

import gtk          # gimp tool kit bindings
import gtk.glade    # glade bindings

```

```
from avc import *                                # AVC
GLADE_XML = 'gtk_calendar.glade'                 # GUI glade descriptor

class Example(AVC):
    """
    Calendar widget connected to label widget (GTK)
    """
    def __init__(self):
        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # all types of connected variables
        self.calendar_value = (2000,1,1)

    def on_destroy(self,window):
        "Terminate program at window destroy"
        gtk.main_quit()

#### MAIN

example = Example()                             # instantiate the application
example.avc_init()                              # connect widgets with variables
gtk.main()                                      # run GTK event loop until quit

#### END
```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_calendar.glade'.

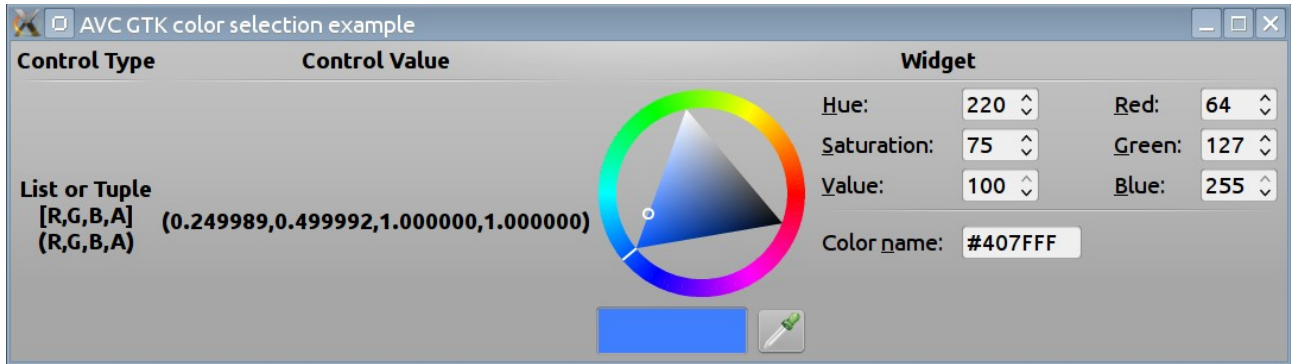
Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- When the GTK event loop is entered the calendar date is set to the initial value of the connected variable: January 1, 2000.

Example files in directory 'examples' of distribution: program 'gtk\_calendar.py' , Glade descriptor 'gtk\_calendar.glade'.

## 9.3. Color selection example

This example shows the graphic rendering of the color selection widget displaying the default color of 0.25 red, 0.5 green, 1.0 blue, 1.0 alpha.



The connected variable can be a list or a tuple with the format red, green, blue, alpha, where each color component spans the value range 0.0 - 1.0 . Alpha is the color opacity: 1.0 is the maximum opacity.

### 9.3.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2013 Fabrizio Pollastri.
# .license : GNU General Public License v3

import gtk                                # gimp tool kit bindings
import gtk.glade                          # glade bindings

from avc import *                        # AVC

GLADE_XML = 'gtk_colorselection.glade'    # GUI glade descriptor

class Example(AVC):
    """
    Color selection widget connected to label widget (GTK)
    """
    def __init__(self):
        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # all types of connected variables
        self.color_value = (0.25,0.50,1.,1.)

    def on_destroy(self,window):
        "Terminate program at window destroy"
        gtk.main_quit()

#### MAIN

example = Example()                      # instantiate the application
example.avc_init()                       # connect widgets with variables
gtk.main()                               # run GTK event loop until quit
```

```
#### END
```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_colorselection.glade'.

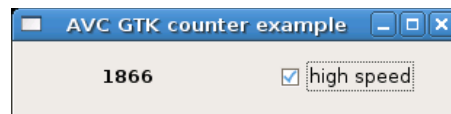
Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- When the GTK event loop is entered the color is set to the initial value of the connected variable: 0.25,0.5,1.0,1.0 .

Example files in directory 'examples' of distribution: program 'gtk\_colorselection.py' , Glade descriptor 'gtk\_colorselection.glade'.

## 9.4. Counter example

This example shows how **AVC** can manage data input from a check button widget to the application and from the application to a label widget without any specific code in the application. The program creates a window with two widgets: a check button and a label. The label displays the value of an integer counter. The check button controls the increment speed of the counter. Initially, it is unchecked meaning that the increment speed of the counter is 2 units per second. When the user checks the check button the increment speed grows to 10 units per seconds and returns to the initial value (2) when the check button is unchecked again.



### 9.4.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

import gobject                                #--
import gtk                                    #- gimp tool kit bindings
import gtk.glade                             # glade bindings

from avc import *                             # AVC

GLADE_XML = 'gtk_counter.glade'              # GUI glade descriptor
LOW_SPEED = 500                               #-
HIGH_SPEED = 100                             #- low and high speed period (ms)

class ExampleGUI:
    "Counter GUI creation"

    def __init__(self):
        # create GUI
        glade = gtk.glade.XML(GLADE_XML)
```

```

    # autoconnect GUI signal handlers
    glade.signal_autoconnect(self)

def timer(self,period,function):
    "Start a GTK timer calling back 'function' every 'period' seconds."
    self.timer1 = GObject.timeout_add(period,function)

def on_destroy(self,window):
    "Terminate program at window destroy"
    gtk.main_quit()

class ExampleMain(AVC):
    """
    A counter displayed in a Label widget whose count speed can be
    accelerated by checking a check box.
    """

    def __init__(self,gui):

        # save GUI
        self.gui = gui

        # the counter variable and its speed status
        self.counter = 0
        self.high_speed = False

        # start incrementer timer
        self.gui.timer(LOW_SPEED,self.incrementer)

    def incrementer(self):
        """
        Counter incrementer: increment period = LOW_SPEED, if high speed is False,
        increment period = HIGH_SPEED otherwise. Return False to destroy previous
        timer.
        """
        self.counter += 1
        if self.high_speed:
            period = HIGH_SPEED
        else:
            period = LOW_SPEED
        self.gui.timer(period,self.incrementer)
        return False

    def high_speed_changed(self,value):
        "Notify change of counting speed to terminal"
        if value:
            print 'counting speed changed to high'
        else:
            print 'counting speed changed to low'

#### MAIN

example_gui = ExampleGUI()
example = ExampleMain(example_gui)
example.avc_init()
gtk.main()
# create the application GUI
# instantiate the application
# connect widgets with variables
# run GTK event loop until quit

```



```
#### END
```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_counter.glade'. The key points of the example regarding **AVC** are the following.

- During Glade editing, the name '**counter**' was given to the label and the name '**high\_speed**' was given to the check button.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **AVC** class (`class Example(AVC):`).
- A integer variable with an initial value of 0 and name '**counter**' is declared in the application to hold the counter value (`self.counter = 0`).
- A boolean variable with an initial value of False and name '**high\_speed**' is declared in the application to hold the speed status of the counter increment speed (`self.high_speed = False`).
- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections between the '**counter**' variable and the label widget and between the '**high\_speed**' variable and the check button, the label widget is initialized with the initial value of the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'gtk\_counter.py' , Glade descriptor 'gtk\_counter.glade'.

## 9.5. Label example

This example shows the formatting capabilities of the label widget. For each supported type of the connected variable, a formatting string is defined and a sample value of the connected variable is displayed into two label widgets: one with formatting and the other with the standard python string representation.

AVC GTK label example			
Control type	Format string	Label with format	Label without format
boolean	<b>%d</b>	1	True
float	<b>%f</b>	1.000000	1.0
integer	<b>%d</b>	1	1
list	<b>%d,%d,%d</b>	1,2,3	[1, 2, 3]
string	<b>%s</b>	abc	abc
tuple	<b>%d,%d,%d</b>	1,2,3	(1, 2, 3)
object with attributes x=1, y=2	<b>%(x)d,%(y)d</b>	1,2	<__main__.Obj instance at 0xb732a1ec>

### 9.5.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license   : GNU General Public License v3

import gtk                # gimp tool kit bindings
import gtk.glade          # glade bindings
```

```

from avc import *                # AVC

GLADE_XML = 'gtk_label.glade'    # GUI glade descriptor

class Example(AVC):
    """
    Showcase of formatting capabilities for the label widget
    """

    def __init__(self):

        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # all types of connected variables
        self.bool_value = True
        self.float_value = 1.0
        self.int_value = 1
        self.list_value = [1,2,3]
        self.str_value = 'abc'
        self.tuple_value = (1,2,3)
        class Obj:
            "A generic object with 2 attributes x,y"
            def __init__(self):
                self.x = 1
                self.y = 2
        self.obj_value = Obj()

    def on_destroy(self,window):
        "Terminate program at window destroy"
        gtk.main_quit()

#### MAIN

example = Example()              # instantiate the application
example.avc_init()              # connect widgets with variables
gtk.main()                      # run GTK event loop until quit

#### END

```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_label.glade'. Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- For each control type (for each row) the two label widgets, one in the column "Label with format" and one in the column "Label without format", are connected to the variable of the corresponding type. For example, in row "boolean", both label widgets are called "bool\_value", so they connect to the variable `self.bool_value`.
- When the GTK event loop is entered both columns are set to display the initial values of the connected variables. For example, in row "integer", both labels are set to display the integer value 1.
- The differences of representation between the column "Label with format" and the column "Label without format" reflect the different printout results coming from the formatting capabilities of the label widget and from `str`, the generic textual rendering

function of python.

Example files in directory 'examples' of distribution: program 'gtk\_label.py' , Glade descriptor 'gtk\_label.glade'.

## 9.6. Showcase example

This example shows a table of almost all widget/variable type combinations supported by **AVC**. The program creates a window with three columns: the first shows the type of the connected variable, the second shows all the widgets that can be connected to that type of variable, the third shows the current value of each variable. Each row of the window represent a widgets/variable combination as follows.

- Row 1: memoryless button with boolean variable, pressed = True, unpressed = False.
- Row 2: buttons with memory, toggle and check buttons, pressed = True, unpressed = False.
- Row 3: mutually exclusive choices widgets, radio buttons numbered from 0 to 2 and a combo box with 3 items, index variable = number of checked radio button and selected item of combo box.
- Row 4: integer input/output widgets, spin button, entry and slider.
- Row 5: float input/output widgets, spin button, entry and slider.
- Row 6: string input/output widget, entry.
- Row 7: string input/output widget, text view/edit.
- Row 8: status messages, status bar.

The text label widget is used in all output modes for the column of the connected variable values. The program increment the value of each connected variable looping top-bottom at three rows per seconds. The user can also change the values in the connected variables interacting with the widgets.

Control Type	Widgets	Control Value
boolean	button	False
	toggle button <input checked="" type="checkbox"/> check button	True
index (integer)	radio buttons    combo box	2
	<input type="radio"/> choice 0 <input type="radio"/> choice 1 <input checked="" type="radio"/> choice 2    choice 2	
integer	spin button    entry    slider	5
	5    5    5	
float	2.5    2.5    2.5	2.50
	2.5    2.5    2.5	
string	entry	AAAAA
string	text view/edit	line of text, line of text, line of text
	line of text, line of text, line of t line of text, line of text, line of t line of text, line of text, line of t line of text, line of text, line of t line of text, line of text, line of t	line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text
string	status bar	status message
	status message	

### 9.6.1. Python source

```
#!/usr/bin/python
```

```
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

import gobject          #-
import gtk              #- gimp tool kit bindings
import gtk.glade        # glade bindings

from avc import *      # AVC

GLADE_XML = 'gtk_showcase.glade'      # GUI glade descriptor
INCREMENTER_PERIOD = 333              # ms

class Example(AVC):
    "A table of all supported widget/control type combinations"

    def __init__(self):

        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # the control variables
        self.boolean1 = False
        self.boolean2 = False
        self.radio = 0
        self.integer = 0
        self.float = 0.0
        self.string = ''
        self.textview = ''
        self.status = ''

        # start variables incrementer
        increment = self.incrementer()
        gobject.timeout_add(INCREMENTER_PERIOD, increment.next)

    def incrementer(self):
        """
        Booleans are toggled, radio button index is rotated from first to last,
        integer is incremented by 1, float by 0.5, string is appended a char
        until maxlen when string is cleared, text view/edit is appended a line
        of text until maxlen when it is cleared. Status bar message is toggled.
        Return True to keep timer alive.
        """
        while True:

            self.boolean1 = not self.boolean1
            yield True

            self.boolean2 = not self.boolean2
            yield True

            if self.radio >= 2:
                self.radio = 0
            else:
                self.radio += 1
            yield True
```

```

        self.integer += 1
        yield True

        self.float += 0.5
        yield True

        if len(self.string) >= 10:
            self.string = ''
        else:
            self.string += 'A'
        yield True

        if len(self.textview) >= 200:
            self.textview = ''
        else:
            self.textview += 'line of text, line of text, line of text\n'
        yield True

        if not self.status:
            self.status = 'status message'
        else:
            self.status = ''
        yield True

    def on_destroy(self, window):
        "Terminate program at window destroy"
        gtk.main_quit()

#### MAIN

example = Example()
example.avc_init()
gtk.main()

#### END

```

# instantiate the application  
# connect widgets with variables  
# run GTK event loop until quit

The GUI layout was previously edited with Glade and saved to the file 'gtk\_showcase.glade'. The key points of the example regarding **AVC** are the following.

- During Glade editing, the following names were given to the widgets.

Row	widget	name
1	button	<b>boolean1_button</b>
	output value label	<b>boolean1_var</b>
2	togglebutton	<b>boolean2_togglebutton</b>
	checkboxbutton	<b>boolean2_checkboxbutton</b>
	output value label	<b>boolean2_var</b>
3	radiobutton0	<b>radio_radiobutton0</b>
	radiobutton1	<b>radio_radiobutton1</b>
	radiobutton2	<b>radio_radiobutton2</b>
	combobox	<b>radio_combobox</b>
	output value label	<b>radio_var</b>
4	spinbutton	<b>integer_spinbutton</b>
	entry	<b>integer_entry</b>
	slider	<b>integer_slider</b>
	output value label	<b>integer_var</b>
5	spinbutton	<b>float_spinbutton</b>
	entry	<b>float_entry</b>

	slider	<b>float_slider</b>
	output value label	<b>float_var</b>
6	entry	<b>string_entry</b>
	output value label	<b>string_var</b>
7	textview	<b>textview_textview</b>
	output value label	<b>textview_var</b>
8	statusbar	<b>status_statusbar</b>
	output value label	<b>status_var</b>

- The **AVC** package is imported at program begin (from `avc import *`).
- The application class is derived from the **AVC** class (`class Example(AVC):`).
- The following variables are declared in the application.

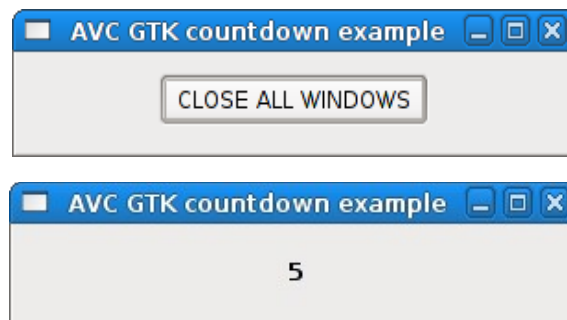
```
self.boolean1 = False
self.boolean2 = False
self.radio = 0
self.integer = 0
self.float = 0.0
self.string = ''
self.textview = ''
self.status = ''
```

- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections of all widewts/variable combinations and to initialize the widgets values with the initial value of the connected variable .

Example files in directory 'examples' of distribution: program 'gtk\_showcase.py' , Glade descriptor 'gtk\_showcase.glade'.

## 9.7. Countdown example

This example continuously creates at random intervals windows displaying a counter. Each counter starts from 10 and is independently decremented. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.



### 9.7.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license : GNU General Public License v3

import gobject
import gtk

#--
#- gimp tool kit bindings
```

```
import gtk.glade                                # glade bindings
from avc import *                               # AVC

from random import randint                       # random integer generator

GLADE_XML_MAIN = 'gtk_countdown_main.glade' # main window glade descriptor
GLADE_XML_CD = 'gtk_countdown.glade' # count down window glade descriptor
TOPLEVEL_NAME = 'countdown' # name of the top level widget
COUNTDOWN_PERIOD = 500 # count down at 2 unit per second
MAX_CREATION_PERIOD = 4000 # create a new count down at 1/2 this

class Countdown(AVC):
    """
    A countdown counter displayed in a Label widget. Count starts at given
    value. When count reaches zero the counter and its GUI are destroyed.
    """

    def __init__(self, count_start=10):

        # create GUI
        self.glade = gtk.glade.XML(GLADE_XML_CD)

        # autoconnect GUI signal handlers
        self.glade.signal_autoconnect(self)

        # init the counter variable
        self.counter = count_start

        # connect counter variable with label widget
        self.avc.connect(self.glade.get_widget(TOPLEVEL_NAME))

        # start count down
        gobject.timeout_add(COUNTDOWN_PERIOD, self.decrementer)

    def decrementer(self):
        "Counter decrementer. Return False to destroy previous timer."

        self.counter -= 1

        if self.counter:
            # if counter not zero: reschedule count timer
            gobject.timeout_add(COUNTDOWN_PERIOD, self.decrementer)
        else:
            # counter reached zero: destroy this countdown and its GUI
            self.glade.get_widget(TOPLEVEL_NAME).destroy()

        return False

class Example(AVC):
    """
    Continuously create at random intervals windows with a countdown from 10 to 0.
    When a countdown reaches zero, its window is destroyed. Also create a main
    window with a "close all" button.
    """

    def __init__(self):

        # create main window
```

```

self.glade = gtk.glade.XML(GLADE_XML_MAIN)

# create the first countdown
self.new_countdown()

# close all button connected variable
self.close_all = False

# autoconnect GUI signal handlers
self.glade.signal_autoconnect(self)

def new_countdown(self, count_start=10):
    "Create a new countdown"

    # create a new countdown
    Countdown(count_start)

    # autocall after a random delay
    gobject.timeout_add(randint(1, MAX_CREATION_PERIOD), self.new_countdown)

    return False                # destroy previous timer

def on_destroy(self, window):
    "Terminate program at window destroy"
    gtk.main_quit()

def close_all_changed(self, value):
    "Terminate program at 'close all' button pressing"
    gtk.main_quit()

#### MAIN

example = Example()                # instantiate the application
example.avc_init()                # connect widgets with variables
gtk.main()                        # run GTK event loop until quit

#### END

```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_countdown\_main.glade' for the main window and to the file 'gtk\_countdown.glade' for the counter windows.

The key points of the example regarding **AVC** are the following.

- During Glade editing of the main window, the name '**close\_all**' was given to the button widget; during Glade editing of the counter window, the name '**counter**' was given to the label widget.
- The **AVC** package is imported at program begin (`from avc import *`).
- Both the application class and the counter class are derived from the **AVC** class (`class Example(AVC):` | `class Countdown(AVC):`).
- A boolean variable with an initial value of False and name '**close\_all**' is declared in the application (`self.close_all = False`).
- The method '**close\_all\_changed**' is defined in the application to handle the press event of the 'close all windows' button.
- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to init AVC logic and to realize the connection of the 'close all windows' button to the '**close\_all**' variable.



- A integer variable with an initial default value of 10 and name '**counter**' is declared in the Countdown class (`self.counter = count_start`)
- The `avc_connect` method is called at the instantiation of the Countdown class (`self.avc_connect(self.glade.get_widget(TOPLEVEL_NAME))`) with argument the window widget of the counter. This call realizes the connection of the label widget to the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'gtk\_countdown.py' , Glade descriptors 'gtk\_countdown\_main.glade' anc 'gtk\_countdown.glade'.

## 9.8. List tree view example

The first row of this example shows the display capabilities of a widget in list view mode: display of 2D tabular data. The second row shows the display capabilities of a widget in tree mode: display of a hierarchical data tree. For each row, it is showed the connected python data equivalent to data displayed by each widget. The rows of the list view are rolled down by one position every 2 seconds.

AVC GTK list tree view example		
Data Structure	Control Value	Widget
list	{ 'body': [[1, 'one'], [2, 'two'], [3, 'three']], 'head': ['col1 int', 'col2 str']] }	col1 int   col2 str
		1   one
		2   two
		3   three
tree	{ 'body': { '1.1': [11, 'one one'], '1.2': [12, 'one two'], '1': [1, 'one'], '2': [2, 'two'], '2.2': [22, 'two two'], '2.1': [21, 'two one']], 'head': ['col1 int', 'col2 str']] }	col1 int   col2 str
		▼ 1   one
		11   one one
		12   one two
		▼ 2   two
		21   two one
		22   two two

### 9.8.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri.
# .license : GNU General Public License v3

import gobject                                #-
import gtk                                    #- gimp tool kit bindings
import gtk.glade                              # glade bindings

from avc import *                             # AVC

import copy                                   # object cloning support

GLADE_XML = 'gtk_listtreeview.glade'         # GUI glade descriptor

UPDATE_PERIOD = 2000                         # ms

class Example(AVC):
```

```

"""
Showcase of display capabilities for the tree view widget
"""

def __init__(self):

    # create GUI
    self.glade = gtk.glade.XML(GLADE_XML)

    # autoconnect GUI signal handlers
    self.glade.signal_autoconnect(self)

    # make tree view rows reorderable
    self.glade.get_widget('list__treeview').set_reorderable(True)
    self.glade.get_widget('tree__treeview').set_reorderable(True)

    # connected variables
    self.list = {'head':['col1 int','col2 str'], \
        'body':[[1,'one'],[2,'two'],[3,'three']]}
    self.list_work = copy.deepcopy(self.list)
    self.tree = {'head':['col1 int','col2 str'],'body':{ \
        # root rows
        '1':[1,'one'], \
        '2':[2,'two'], \
        # children of root row '1'
        '1.1':[11,'one one'], \
        '1.2':[12,'one two'], \
        # children of root row '2'
        '2.1':[21,'two one'], \
        '2.2':[22,'two two']}}

    # start variables update
    update = self.update()
    gobject.timeout_add(UPDATE_PERIOD,update.next)

def update(self):
    """
    Tabular data rows data are rolled down.
    """
    rows_num = len(self.list['body'])
    while True:
        # save last row of data
        last_row = self.list_work['body'][-1]
        # shift down one position each data row
        for i in range(1,rows_num):
            self.list_work['body'][-i] = \
                self.list_work['body'][-1-i]
        # copy last row into first position
        self.list_work['body'][0] = last_row
        # copy working copy into connected variable
        self.list = self.list_work
        yield True

def on_destroy(self,window):
    "Terminate program at window destroy"
    gtk.main_quit()

#### MAIN

```

```
example = Example()                # instantiate the application
example.avc_init()                 # connect widgets with variables
gtk.main()                         # run GTK event loop until quit

#### END
```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_listtreeview.glade'.

Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- For the data structure of type list, a control variable named '**self.list**' is defined in the application and connected to label widget is put in the column "Control value" and to the list view widget put in the column "Widget". The control variable is set to the following initial value:

```
self.list = {'head':['col1 int','col2 str'], \
             'body':[[1,'one'],[2,'two'],[3,'three']]}
```

- For the data structure of type tree, a control variable named '**self.tree**' is defined in the application and connected to label widget is put in the column "Control value" and to the tree view widget put in the column "Widget". The control variable is set to the following initial value:

```
self.tree = {'head':['col1 int','col2 str'],'body':{ \
    # root rows
    '1':[1,'one'], \
    '2':[2,'two'], \
    # children of root row '1'
    '1.1':[11,'one one'], \
    '1.2':[12,'one two'], \
    # children of root row '2'
    '2.1':[21,'two one'], \
    '2.2':[22,'two two']}}
```

- When the GTK event loop is entered both list and tree view are set to display the initial values of the connected variables as explained in "List view" at page 16 and in "Tree view" at page 16.

Example files in directory 'examples' of distribution: program 'gtk\_listtreeview.py' , Glade descriptor 'gtk\_listtreeview.glade'.

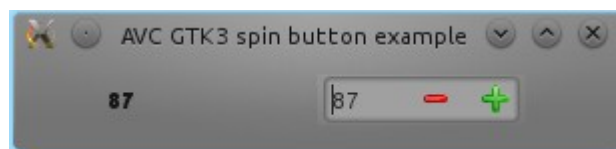
## 10. GTK3+ examples

The GTK3+ examples follow the same schema of the GTK2+ examples. The following table gives a complete list of the files of these examples with a brief description.

Program source	User interface descriptor	description
gtk3_calendar.py	gtk3_calendar.ui	A label displaying the selected date in the calendar
gtk3_colorchooser.py	gtk3_colorchooser.ui	A label displaying the selected color in the colorchooser
gtk3_countdown.py	gtk3_countdown_main.ui gtk3_countdown.ui	Continuously creates at random intervals windows displaying a decrementing counter. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.
gtk3_counter.py	gtk3_counter.ui	A label displaying an incrementing counter and a check button controlling the incrementing speed
gtk3_label.py	gtk3_label.ui	Display all the formatting capabilities of the label widget
gtk3_listtreeview.py	gtk3_listtreeview.ui	Display capabilities of list tree widget with its controlling value
gtk3_showcase.py	gtk3_showcase.ui	Show a table of almost all widget/variable type combinations supported for GTK3+
gtk3_spinbutton.py	gtk3_spinbutton.ui	A spinbutton whose value is replicated into a label
gtk3_spinbutton_progui.py		As above, but the user interface is generated programmatically

### 10.1. Spin button example

This simple example shows how **AVC** can manage data exchange from widget to widget without any specific code in the application. The program creates a window with two widgets: a spin button and a label. When the value in the spin button is changed by clicking on up or down arrows or by entering it with the keyboard, the new value is displayed into the label.



#### 10.1.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2015 Fabrizio Pollastri.
# .license   : GNU General Public License (see below)

import gi.repository.Gtk as Gtk      # gimp tool kit bindings
```

```

from avc import *                                # AVC

UI_XML = 'gtk3_spinbutton.ui'                    # GUI descriptor
ROOT_WINDOW = 'root_window'                     # root window name

class Example(AVC):
    """
    A spin button whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        self.builder = Gtk.Builder()
        self.builder.add_from_file(UI_XML)
        self.builder.connect_signals(self)
        self.root_window = self.builder.get_object(ROOT_WINDOW)
        self.root_window.show_all()

        # the variable holding the spin button value
        self.spin_value = 0

    def on_destroy(self, window):
        "Terminate program at window destroy"
        Gtk.main_quit()

#### MAIN

example = Example()                             # instantiate the application
example.avc_init()                              # connect widgets with variables
Gtk.main()                                      # run GTK event loop until quit

#### END

```

The GUI layout was previously edited with Glade and saved to the file 'gtk\_spinbutton.glade'.

The key points of the example regarding **AVC** are the following.

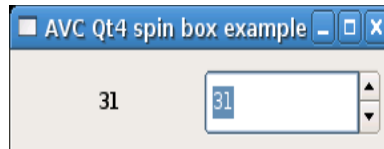
- During Glade editing, the same name '**spin\_value**' was given to the spin button and to the label.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **AVC** class (`class Example(AVC):`).
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (`self.spin_value = 0`).
- The `avc_init` method is called after the instantiation of the application class, to realize the connections of the two widgets through the '**spin\_value**' variable and to initialize the widgets values with the initial value of the variable (`example.avc_init()`).

Example files in directory 'examples' of distribution: program 'gtk3\_spinbutton.py' , User interface descriptor 'gtk3\_spinbutton.ui'.

# 11. Qt4 examples

## 11.1. Spin box example

For a functional description of the graphic interface see the GTK+ “Spin button example” at page 27.



### 11.1.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *              # ui files realizer
import sys                           # system support

from avc import *                    # AVC

UI_FILE = 'qt4_spinbox.ui'           # qt ui descriptor

class Example(QApplication,AVC):
    "A spin box whose value is replicated into a text label"

    def __init__(self):
        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # the variable holding the spin box value
        self.spin_value = 0

#### MAIN

example = Example()                  # instantiate the application
example.avc_init()                   # connect widgets with variables
example.exec_()                      # run Qt event loop until quit

#### END
```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_spinbox.ui'. The key points of the example regarding **AVC** are the following.

- During Qt4 Designer editing, the name '**spin\_value\_spinbox**' was given to the spin box and the name '**spin\_value\_label**' was given to the label.
- The **AVC** package is imported at program begin (from avc import \*).
- The application class is derived from the **QApplication** class of Qt4 and from the **AVC** class of AVC (class Example(QApplication,AVC):).
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (self.spin\_value = 0).
- The avc\_init method is called after the instantiation of the application class (example.avc\_init()) to realize the connections of the two widgets through the '**spin\_value**' variable and to initialize the widgets values with the initial value of the variable .

Example files in directory 'examples' of distribution: program 'qt4\_spinbox.py', UI descriptor 'qt4\_spinbox.ui'.

## 11.2. Calendar example

This example shows the graphic rendering of the calendar widget displaying the default date of January 1, 2000.



The connected variable can be a list or a tuple with the format yyyy, mm, dd: four digit year, two digit month, two digit day. Month and day numbers start from 1.

### 11.2.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2013 Fabrizio Pollastri
# .license : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *             # ui files realizer
import sys                           # system support

from avc import *                   # AVC

UI_FILE = 'qt4_calendar.ui'         # qt ui descriptor
```

```
class Example(QApplication,AVC):
    """
    Calendar widget connected to label widget (Qt4)
    """

    def __init__(self):

        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # all types of connected variables
        self.calendar_value = (2000,1,1)

#### MAIN

example = Example()                # instantiate the application
example.avc_init()                 # connect widgets with variables
example.exec_()                    # run Qt event loop until quit

#### END
```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_calendar.ui'.

Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

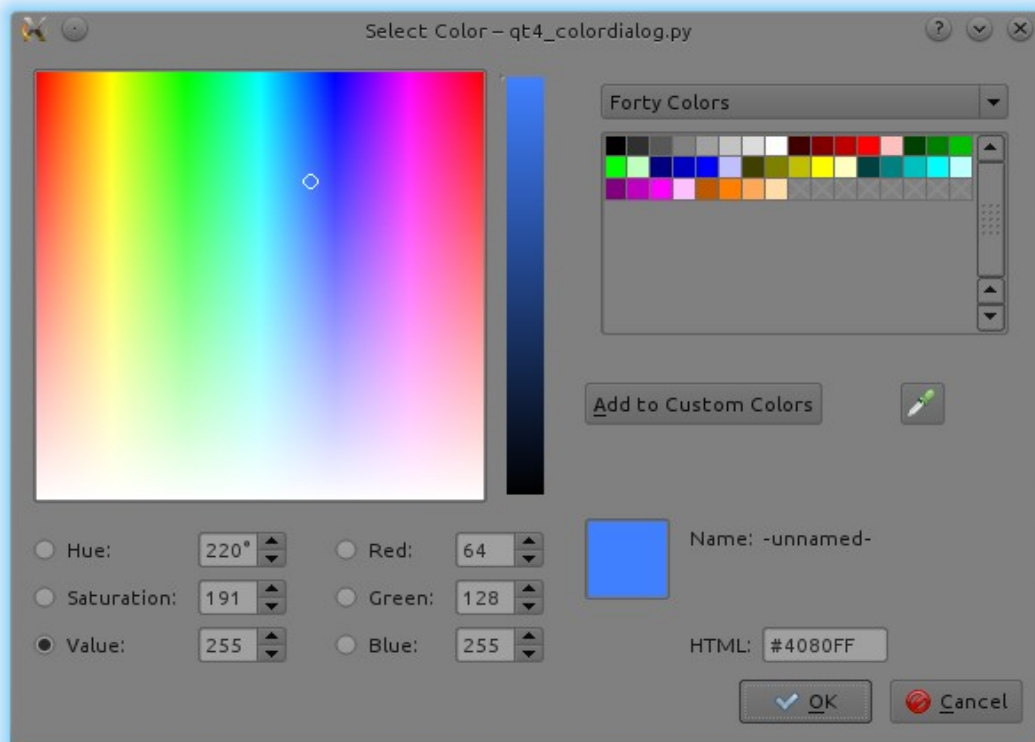
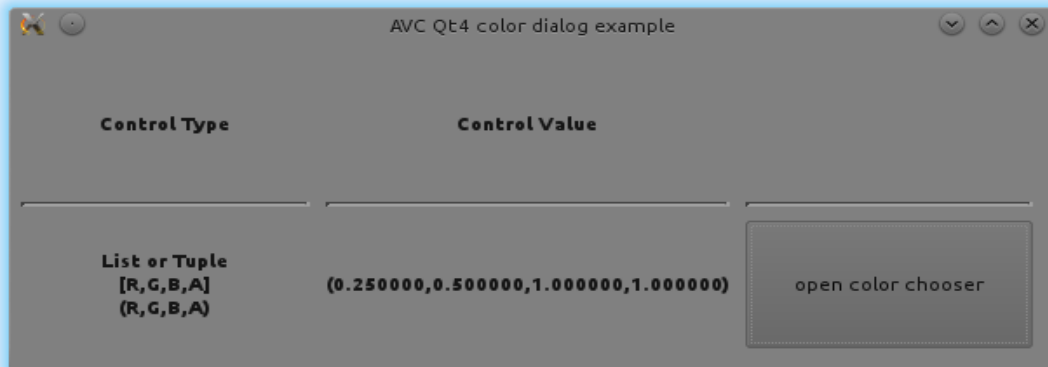
- When the QT event loop is entered the calendar date is set to the initial value of the connected variable: January 1, 2000.

Example files in directory 'examples' of distribution: program 'qt4\_calendar.py', UI descriptor 'qt4\_calendar.ui'.

## 11.3. Color dialog example

This example shows the graphic rendering of the color selection widget displaying the default color of 0.25 red, 0.5 green, 1.0 blue, 1.0 alpha. Color selection has two windows. The base window displaying the connected variable with the default color values (first image). The color dialog window displaying graphically the current color and allowing user interaction to choose a new color (second image).





The connected variable can be a list or a tuple with the format red, green, blue, alpha, where each color component spans the value range 0.0 - 1.0 . Alpha is the color opacity: 1.0 is the maximum opacity.

### 11.3.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2013 Fabrizio Pollastri
```

```

# .license      : GNU General Public License v3

from PyQt4.QtCore import *          # Qt core
from PyQt4.QtGui import *          # Qt GUI interface
from PyQt4.uic import *             # ui files realizer
import sys                          # system support

from avc import *                  # AVC

UI_FILE = 'qt4_colordialog.ui' # qt ui descriptor

class Example(QApplication,AVC):
    """
    ColorDialog connected to label widget (Qt4)
    """

    def __init__(self):

        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # all types of connected variables
        self.open_color_chooser = False
        self.color_value = (0.25,0.5,1.0,1.0)

    def open_color_chooser_changed(self,value):
        """
        Create color chooser dialog connecting a color variable to it
        """
        if value:
            # create color chooser dialog with name matching 'color_value'
            self.color_chooser = QColorDialog()
            self.color_chooser.setObjectName('color_value__color_chooser')
            self.color_chooser.show()
            # connect color variable with color chooser
            self.avc_connect(self.color_chooser)

##### MAIN

example = Example()                # instantiate the application
example.avc_init()                # connect widgets with variables
example.exec_()                    # run Qt event loop until quit

##### END

```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_colordialog.ui'.

Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

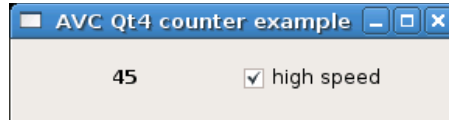
- When the QT event loop is entered the color is set to the initial value of the connected variable: 0.25,0.5,1.0,1.0 .

Example files in directory 'examples' of distribution: program 'qt4\_colordialog.py', UI descriptor

'qt4\_colordialog.ui'.

## 11.4. Counter example

For a functional description of the graphical interface see the GTK+ “Counter example” at page 31.



### 11.4.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *             # ui files realizer
import sys                          # system support

from avc import *                   # AVC

UI_FILE = 'qt4_counter.ui'          # qt ui descriptor
LOW_SPEED = 0.5                     #-
HIGH_SPEED = 0.1                    #- low and high speed count period (sec)

class ExampleGUI(QApplication):
    "Counter GUI creation"

    def __init__(self):
        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

    def timer_start(self,period,function):
        "Start a Qt timer calling back 'function' every 'period' seconds."
        self.timer1 = QTimer()
        QObject.connect(self.timer1,SIGNAL("timeout()"),function)
        self.timer1.start(int(period * 1000.0))

    def timer_set_period(self,period):
        "Set a new period to timer"
        self.timer1.stop()
        self.timer1.start(int(period * 1000.0))

class ExampleMain(AVC):
    """
```

```

A counter displayed in a Label widget whose count speed can be
accelerated by checking a check box.
"""

def __init__(self,gui):

    # save GUI
    self.gui = gui

    # the counter variable and its speed status
    self.counter = 0
    self.high_speed = False

    # start incrementer timer
    self.gui.timer_start(LOW_SPEED,self.incrementer)

def incrementer(self):
    """
    Counter incrementer: increment period = LOW_SPEED, if high speed
    is False, increment period = HIGH_SPEED otherwise.
    """
    self.counter += 1
    if self.high_speed:
        period = HIGH_SPEED
    else:
        period = LOW_SPEED
    self.gui.timer_set_period(period)

def high_speed_changed(self,value):
    "Notify change of counting speed to terminal"
    if value:
        print 'counting speed changed to high'
    else:
        print 'counting speed changed to low'

#### MAIN

example_gui = ExampleGUI()                # create the application GUI
example = ExampleMain(example_gui)        # instantiate the application
example.avc_init()                        # connect widgets with variables
example_gui.exec_()                       # run Qt event loop until quit

#### END

```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_counter.ui'. The key points of the example regarding **AVC** are the following.

- During Qt4 Designer editing, the name '**counter**' was given to the label and the name '**high\_speed**' was given to the check button.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **QApplication** class of Qt4 and from the **AVC** class of AVC. (`class Example(QApplication,AVC):`).
- A integer variable with an initial value of 0 and name '**counter**' is declared in the application to hold the counter value (`self.counter = 0`).
- A boolean variable with an initial value of False and name '**high\_speed**' is declared in the application to hold the speed status of the counter increment speed

```
(self.high_speed = False).
```

- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections between the '**counter**' variable and the label widget and between the the '**high\_speed**' variable and the check button, the label widget is initialized with the initial value of the '**counter**' variable .

Example files in directory 'examples' of distribution: program 'qt4\_counter.py', UI descriptor 'qt4\_counter.ui'.

## 11.5. Label example

This example shows the formatting capabilities of the label widget. For each supported type of the connected variable, a formatting string is defined and a sample value of the connected variable is displayed into two label widgets: one with formatting and the other with the standard python string representation.

AVC Qt4 label example			
Control type	Format string	Label with format	Label without format
<b>bool</b>	<code>&lt;b&gt;%d&lt;/b&gt;</code>	<b>1</b>	True
<b>float</b>	<code>&lt;b&gt;%f&lt;/b&gt;</code>	<b>1.000000</b>	1.0
<b>int</b>	<code>&lt;b&gt;%d&lt;/b&gt;</code>	<b>1</b>	1
<b>list</b>	<code>&lt;b&gt;%d,%d,%d&lt;/b&gt;</code>	<b>1,2,3</b>	[1, 2, 3]
<b>string</b>	<code>&lt;b&gt;%s&lt;/b&gt;</code>	<b>abc</b>	abc
<b>tuple</b>	<code>&lt;b&gt;%d,%d,%d&lt;/b&gt;</code>	<b>1,2,3</b>	(1, 2, 3)
<b>object</b> with attributes <code>x=1, y=2</code>	<code>&lt;b&gt;(x)d,(y)d&lt;/b&gt;</code>	<b>1,2</b>	<code>&lt;__main__.Obj instance at 0xb6aa00cc&gt;</code>

### 11.5.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *              # ui files realizer
import sys                           # system support

from avc import *                    # AVC

UI_FILE = 'qt4_label.ui'             # qt ui descriptor
```

```

class Example(QApplication,AVC):
    """
    Showcase of formatting capabilities for the label widget
    """

    def __init__(self):

        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # all types of connected variables
        self.bool_value = True
        self.float_value = 1.0
        self.int_value = 1
        self.list_value = [1,2,3]
        self.str_value = 'abc'
        self.tuple_value = (1,2,3)
        class Obj:
            "A generic object with 2 attributes x,y"
            def __init__(self):
                self.x = 1
                self.y = 2
        self.obj_value = Obj()

##### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.exec_()                                    # run Qt event loop until quit

##### END

```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_label.ui'. Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- For each control type (for each row) the two label widgets, one in the column "Label with format" and one in the column "Label without format", are connected to the variable of the corresponding type. For example, in row "boolean", both label widgets are called "bool\_value", so they connect to the variable `self.bool_value`.
- When the Qt4 event loop is entered both columns are set to display the initial values of the connected variables. For example, in row "integer", both labels are set to display the integer value 1.
- The differences of representation between the column "Label with format" and the column "Label without format" reflect the different printout results coming from the formatting capabilities of the label widget and from `str`, the generic textual rendering function of python.

Example files in directory 'examples' of distribution: program 'qt4\_label.py' , UI descriptor 'qt4\_label.ui'.

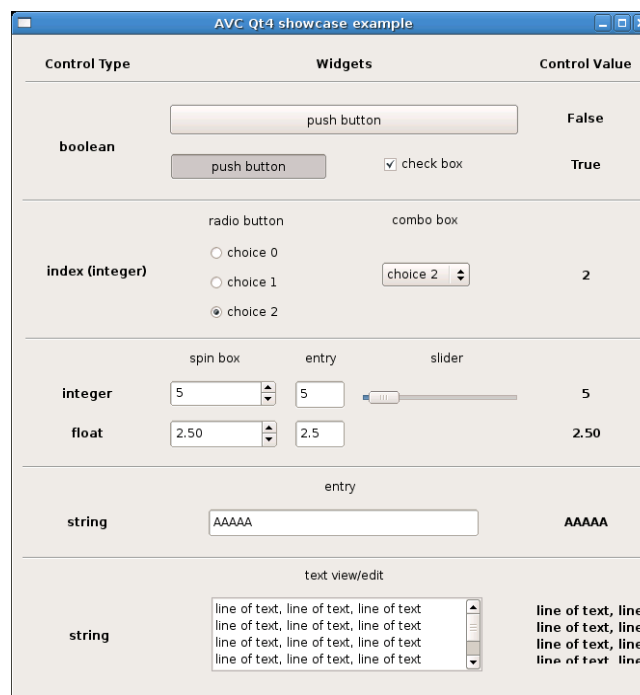
## 11.6. Showcase example

This example shows a table of all widget/variable type combinations supported by **AVC**. The program creates a window with three columns: the first shows the type of the connected

variable, the second shows all the widgets that can be connected to that type of variable, the third shows the current value of each variable. Each row of the window represent a widgets/variable combination.

- Row 1: memoryless button with boolean variable, pressed = True, unpressed = False.
- Row 2: buttons with memory, toggle and check buttons, pressed = True, unpressed = False.
- Row 3: mutually exclusive choices widgets, radio buttons numbered from 0 to 2 and a combo box with 3 items, index variable = number of checked radio button and selected item of combo box.
- Row 4: integer input/output widgets, spin button, entry and slider.
- Row 5: float input/output widgets, spin button and entry.
- Row 6: string input/output widget, entry.
- Row 7: string input/output widget, text view/edit.

The text label widget is used in all output modes for the column of the connected variable values. The program increment the value of each connected variable looping top-bottom at three rows per seconds. The user can also change the values of the connected variables interacting with the widgets.



## 11.6.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *              # ui files realizer
```

```

import sys                                # system support

from avc import *                          # AVC

UI_FILE = 'qt4_showcase.ui'               # qt ui descriptor
INCREMENTER_PERIOD = 333                  # ms

class Example(QApplication,AVC):
    """
    A table of all supported widget/control type combinations
    """

    def __init__(self):

        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # group all radio buttons into a button group. Button group not
        # managed by Qt4 Designer ?!
        self.radio_button0 = self.root.findChild(QWidget,'radio__button0')
        self.radio_button1 = self.root.findChild(QWidget,'radio__button1')
        self.radio_button2 = self.root.findChild(QWidget,'radio__button2')
        self.radio_button_group = QButtonGroup()
        self.radio_button_group.addButton(self.radio_button0,0)
        self.radio_button_group.addButton(self.radio_button1,1)
        self.radio_button_group.addButton(self.radio_button2,2)

        # the control variables
        self.boolean1 = False
        self.boolean2 = False
        self.radio = 0
        self.integer = 0
        self.float = 0.0
        self.string = ''
        self.textview = ''

        # start variables incrementer
        self.increment = self.incrementer()
        self.timer = QTimer(self)
        self.connect(self.timer,SIGNAL("timeout()"),self.timer_function)
        self.timer.start(int(INCREMENTER_PERIOD))

    def timer_function(self):
        self.increment.next()

    def incrementer(self):
        """
        Booleans are toggled, radio button index is rotated from first to last,
        integer is incremented by 1, float by 0.5, string is appended a char
        until maxlen when string is cleared, text view/edit is appended a line
        of text until maxlen when text is cleared, status bar message is toggled.
        Return True to keep timer alive.
        """
        while True:

            self.boolean1 = not self.boolean1
            yield True

```



```

self.boolean2 = not self.boolean2
yield True

if self.radio == 2:
    self.radio = 0
else:
    self.radio += 1
yield True

self.integer += 1
yield True

self.float += 0.5
yield True

if len(self.string) >= 10:
    self.string = 'A'
else:
    self.string += 'A'
yield True

if len(self.textview) >= 200:
    self.textview = ''
else:
    self.textview += 'line of text, line of text, line of text\n'
yield True

#### MAIN

example = Example()
example.avc_init()
example.exec_()

##### END
# instantiate the application
# connect widgets with variables
# run Qt event loop until quit

```

The GUI layout was previously edited with Qt4 Designer and saved to the file 'qt4\_showcase.ui'. The key points of the example regarding **AVC** are the following.

- During Qt designer editing, the following names were given to the widgets.

widget	name
Row 1:	
button	<b>boolean1__button</b>
output value label	<b>boolean1__var</b>
Row 2:	
togglebutton	<b>boolean2__togglebutton</b>
checkboxbutton	<b>boolean2__checkboxbutton</b>
output value label	<b>boolean2__var</b>
Row 3:	
radiobutton0	<b>radio__radiobutton0</b>
radiobutton1	<b>radio__radiobutton1</b>
radiobutton2	<b>radio__radiobutton2</b>
combobox	<b>radio__combobox</b>
output value label	<b>radio__var</b>
Row 4:	

spinbutton	<b>integer_spinbox</b>
entry	<b>integer_entry</b>
slider	<b>integer_slider</b>
output value label	<b>integer_var</b>
Row 5:	
spinbutton	<b>float_spinbutton</b>
entry	<b>float_entry</b>
output value label	<b>float_var</b>
Row 6:	
entry	<b>string_entry</b>
output value label	<b>string_var</b>
Row 7:	
textview	<b>textview_textview</b>
output value label	<b>textview_var</b>

- The **AVC** package is imported at program begin (from `avc import *`).
- The application class is derived from the **QApplication** class of Qt4 and from the **AVC** class of AVC (`class Example(QApplication,AVC):`).
- The following variables are declared in the application.

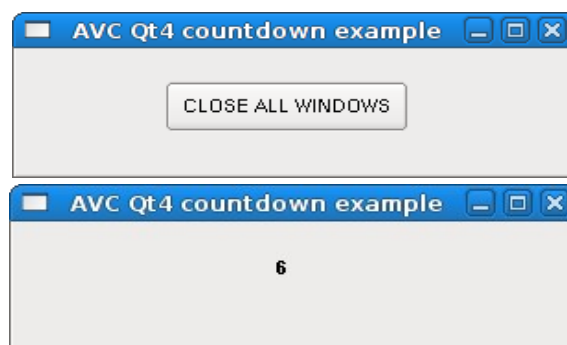
```
self.boolean1 = False
self.boolean2 = False
self.radio = 0
self.integer = 0
self.float = 0.0
self.string = ''
self.textview = ''
```

- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections of all widegts/variable combinations and to initialize the widgets values with the initial value of the connected variable.

Example files in directory 'examples' of distribution: program 'qt4\_showcase.py', UI descriptor 'qt4\_showcase.ui'.

## 11.7. Countdown example

This example continuously creates at random intervals windows displaying a counter. Each counter starts from 10 and is independently decremented. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.



## 11.7.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *             # ui files realizer
import sys                           # system support

from avc import *                   # AVC

from random import randint           # random integer generator

UI_MAIN = 'qt4_countdown_main.ui'    # qt ui descriptor for main window
UI_CD = 'qt4_countdown.ui'          # qt ui descriptor for countdown window
TOPLEVEL_NAME = 'countdown'         # name of the top level widget
COUNTDOWN_PERIOD = 500             # count down at 2 unit per second
MAX_CREATION_PERIOD = 4000          # create a new count down at 1/2 this

class Countdown(AVC):
    """
    A countdown counter displayed in a Label widget. Count starts at given
    value. When count reaches zero the counter and its GUI are destroyed.
    """

    def __init__(self, count_start=10):

        # create GUI
        self.root = loadUi(UI_CD)
        self.root.show()

        # init the counter variable
        self.counter = count_start

        # connect counter variable with label widget
        self.avc_connect(self.root)

        # start count down
        self.timer = QTimer(self.root)
        self.root.connect(self.timer, SIGNAL("timeout()"), self.decrementer)
        self.timer.start(COUNTDOWN_PERIOD)

    def decrementer(self):
        "Counter decrementer. Return False to destroy previous timer."
        self.counter -= 1
        # if counter reached zero, destroy this countdown and its GUI
        if not self.counter:
            self.timer.stop()
            del self.timer
            self.root.close()

class Example(QApplication, AVC):
    """
    Continuously create at random intervals windows with a countdown from 10 to 0.
    When a countdown reaches zero, its window is destroyed. Also create a main
    """
```

```

window with a "close all" button.
"""

def __init__(self):

    # create main window
    QApplication.__init__(self,sys.argv)
    self.root = loadUi(UI_MAIN)
    self.root.show()

    # close all button connected variable
    self.close_all = False

    # start count down
    self.timer = QTimer(self)
    self.connect(self.timer,SIGNAL("timeout()"),self.new_countdown)
    self.timer.start(randint(1,MAX_CREATION_PERIOD))

def new_countdown(self,count_start=10):
    "Create a new countdown"

    # create a new countdown
    Countdown(count_start)

    # autocall after a random delay
    self.timer.stop()
    self.timer.start(randint(1,MAX_CREATION_PERIOD))

def close_all_changed(self,value):
    "Terminate program at 'close all' button pressing"
    self.quit()

#### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.exec_()                                    # run Qt event loop until quit

#### END

```

The GUI layout was previously edited with Qt Designer and saved to the file 'qt4\_countdown\_main.ui' for the main window and to the file 'qt4\_countdown.ui' for the counter windows.

The key points of the example regarding **AVC** are the following.

- During Designer editing of the main window, the name '**close\_all**' was given to the button widget; during Designer editing of the counter window, the name '**counter**' was given to the label widget.
- The **AVC** package is imported at program begin (from avc import \*).
- Both the application class and the counter class are derived from the **AVC** class (class Example(QApplication,AVC): | class Countdown(AVC):).
- A boolean variable with an initial value of False and name '**close\_all**' is declared in the application (self.close\_all = False).
- The method '**close\_all\_changed**' is defined in the application to handle the press event of the 'close all windows' button.
- The avc\_init method is called after the instantiation of the application class

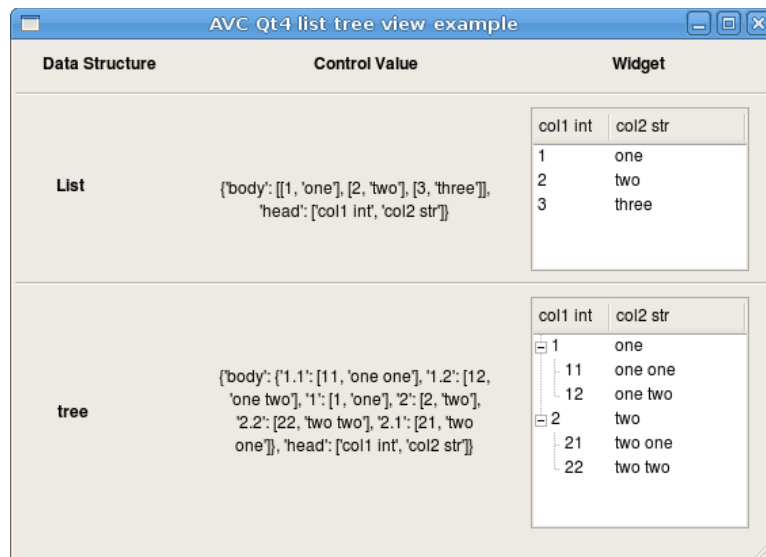
(`example.avc_init()`) to init AVC logic and to realize the connection of the 'close all windows' button to the '**close\_all**' variable.

- A integer variable with an initial default value of 10 and name '**counter**' is declared in the Countdown class (`self.counter = count_start`)
- The `avc_connect` method is called at the instantiation of the Countdown class (`self.avc_connect(self.root)`) with argument the window widget of the counter. This call realizes the connection of the label widget to the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'qt4\_countdown.py' , Qt Designer descriptors 'qt4\_countdown\_main.ui' anc 'qt4\_countdown.ui'.

## 11.8. List tree view example

The first row of this example shows the display capabilities of a widget in list view mode: display of 2D tabular data. The second row shows the display capabilities of a widget in tree mode: display of a hierarchical data tree. For each row, it is showed the connected python data equivalent to data displayed by each widget. The rows of the list view are rolled down by one position every 2 seconds.



### 11.8.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from PyQt4.QtCore import *           # Qt core
from PyQt4.QtGui import *           # Qt GUI interface
from PyQt4.uic import *              # ui files realizer

import copy                          # object cloning support
import sys                          # system support

from avc import *                    # AVC

UI_FILE = 'qt4_listtreeview.ui'      # qt ui descriptor
```

```

UPDATE_PERIOD = 2000                                # ms

class Example(QApplication,AVC):
    """
    Showcase of display capabilities for the list tree view widget
    """

    def __init__(self):

        # create GUI
        QApplication.__init__(self,sys.argv)
        self.root = loadUi(UI_FILE)
        self.root.show()

        # connected variables
        self.list = {'head':['col1 int','col2 str'], \
                     'body':[[1,'one'],[2,'two'],[3,'three']]}
        self.list_work = copy.deepcopy(self.list)
        self.tree = {'head':['col1 int','col2 str'],'body':{ \
            # root rows
            '1':[1,'one'], \
            '2':[2,'two'], \
            # children of root row '1'
            '1.1':[11,'one one'], \
            '1.2':[12,'one two'], \
            # children of root row '2'
            '2.1':[21,'two one'], \
            '2.2':[22,'two two']}}

        # start variables update
        update = self.update()
        self.timer1 = QTimer()
        QObject.connect(self.timer1,SIGNAL("timeout()"),update.next)
        self.timer1.start(UPDATE_PERIOD)

    def update(self):
        """
        Tabular data rows data are rolled down.
        """
        rows_num = len(self.list['body'])
        while True:
            # save last row of data
            last_row = self.list_work['body'][-1]
            # shift down one position each data row
            for i in range(1,rows_num):
                self.list_work['body'][-i] = \
                    self.list_work['body'][-1-i]
            # copy last row into first position
            self.list_work['body'][0] = last_row
            # copy working copy into connected variable
            self.list = self.list_work
            yield True

##### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.exec_()                                    # run Qt event loop until quit

```

```
#### END
```

The GUI layout was previously edited with Qt Designer and saved to the file 'qt4\_listtreeview.ui'.

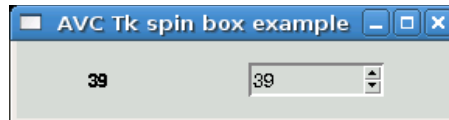
Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the list tree view example are the same of the GTK+ "List tree view example" example at page 41.

Example files in directory 'examples' of distribution: program 'qt4\_listtreeview.py' , Qt Designer descriptor 'qt4\_listtreeview.ui'.

## 12. Tk examples

### 12.1. Spin box example

For a functional description of the graphical interface see the GTK+ “Spin button example” at page 27 .



#### 12.1.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2007 Fabrizio Pollastri
# .license   : GNU General Public License v3

from Tkinter import *          # Tk interface
from avc import *              # AVC
TCL_FILE = 'tk_spinbox.tcl'    # GUI description as tcl script

class Example(AVC):
    """
    A spin control whose value is replicated into a label
    """
    def __init__(self):
        # create GUI
        self.root = Tk()
        self.root.eval('set argc {}; set argv {}; proc ::main {argc argv} {};')
        self.root.tk.evalfile(TCL_FILE)

        # terminate program at toplevel window destroy: connect toplevel
        # destroy signal to termination handler.
        self.root.bind_class('Toplevel', '<Destroy>', lambda event: self.root.quit())

        # the variable holding the spin control value
        self.spin_value = 0

#### MAIN

example = Example()            # instantiate the application
example.avc_init()             # connect widgets with variables
Tkinter.mainloop()            # run Tk event loop until quit
```



```
#### END
```

The GUI layout was previously edited with Visual Tcl and saved to the file 'tk\_spinbox.tcl'.

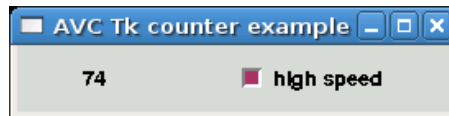
The key points of the example regarding **AVC** are the following.

- During Visual Tcl editing, the name '**spin\_value\_spinbox**' was given to the spin box and the name '**spin\_value\_label**' was given to the label.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **AVC** class of AVC (`class Example(AVC):`).
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (`self.spin_value = 0`).
- The `avc_init` method is called after the instantiation of the application class, to realize the connections of the two widgets through the '**spin\_value**' variable and to initialize the widgets values with the initial value of the variable (`example.avc_init()`).

Example files in directory 'examples' of distribution: program 'tk\_spinbox.py', graphic interface descriptor as tcl script 'tk\_spinbox.tcl'.

## 12.2. Counter example

For a functional description of the graphical interface see the GTK+ "Counter example" at page 31.



### 12.2.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2006 Fabrizio Pollastri
# .license   : GNU General Public License v3

from Tkinter import *           # Tk interface
from avc import *               # AVC

TCL_FILE = 'tk_counter.tcl'     # GUI description as tcl script
LOW_SPEED = 500                 #-
HIGH_SPEED = 100                #- low and high speed count period (ms)

class ExampleGUI:
    "Counter GUI creation"

    def __init__(self):
        # create GUI
        self.root = Tk()
        self.root.eval('set argc {}; set argv {}; proc ::main {argc argv} {};' )
        self.root.tk.evalfile(TCL_FILE)
```

```

# terminate program at toplevel window destroy: connect toplevel
# destroy signal to termination handler.
self.root.bind_class('Toplevel','<Destroy>',lambda event: self.root.quit())

def timer(self,period,function):
    "Start a Tk timer calling back 'function' every 'period' seconds."
    self.root.after(period,function)

class ExampleMain(AVC):
    """
    A counter displayed in a Label widget whose count speed can be doubled
    by pressing a Toggle Button.
    """

    def __init__(self,gui):

        # save GUI
        self.gui = gui

        # the counter variable and its speed status
        self.counter = 0
        self.high_speed = False

        # start incrementer timer
        self.gui.timer(LOW_SPEED,self.incrementer)

    def incrementer(self):
        """
        Counter incrementer: increment period = LOW_SPEED, if high speed is False,
        increment period = HIGH_SPEED otherwise.
        """
        self.counter += 1
        if self.high_speed:
            period = HIGH_SPEED
        else:
            period = LOW_SPEED
        self.gui.timer(period,self.incrementer)

    def high_speed_changed(self,value):
        "Notify change of counting speed to terminal"
        if value:
            print 'counting speed changed to high'
        else:
            print 'counting speed changed to low'

#### MAIN

example_gui = ExampleGUI()                # create the application GUI
example = ExampleMain(example_gui)         # instantiate the application
example.avc_init()                       # connect widgets with variables
mainloop()                                # run Tk event loop until quit

#### END

```

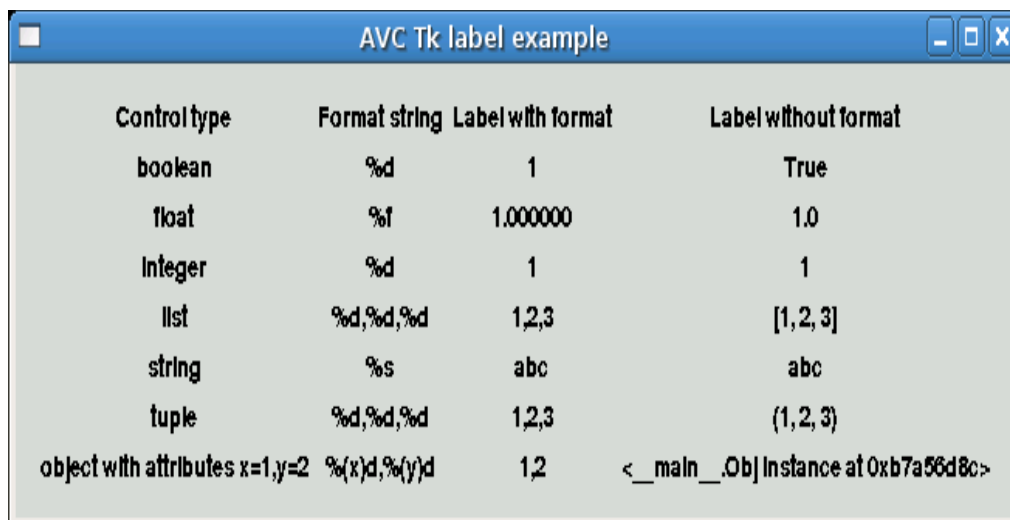
The GUI layout was previously edited with Visual Tcl and saved to the file 'tk\_counter.tcl'. The key points of the example regarding **AVC** are the following.

- During Visual Tcl editing, the name '**counter**' was given to the label and the name '**high\_speed**' was given to the check button.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the **AVC** class of AVC. (`class Example(AVC):`).
- A integer variable with an initial value of 0 and name '**counter**' is declared in the application to hold the counter value (`self.counter = 0`).
- A boolean variable with an initial value of False and name '**high\_speed**' is declared in the application to hold the speed status of the counter increment (`self.high_speed = False`).
- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections between the '**counter**' variable and the label widget and between the the '**high\_speed**' variable and the check button, the label widget is initialized with the initial value of the '**counter**' variable .

Example files in directory 'examples' of distribution: program 'tk\_counter.py', graphic interface descriptor as tcl script 'tk\_counter.tcl'.

## 12.3. Label example

This example shows the formatting capabilities of the label widget. For each supported type of the connected variable, a formatting string is defined and a sample value of the connected variable is displayed into two label widgets: one with formatting and the other with the standard python string representation.



Control type	Format string	Label with format	Label without format
boolean	%d	1	True
float	%f	1.000000	1.0
Integer	%d	1	1
list	%d,%d,%d	1,2,3	[1, 2, 3]
string	%s	abc	abc
tuple	%d,%d,%d	1,2,3	(1, 2, 3)
object with attributes x=1,y=2	%(x)d,%(y)d	1,2	<__main__.Obj Instance at 0xb7a56d8c>

### 12.3.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license   : GNU General Public License v3
```

```

from Tkinter import *                # Tk interface

from avc import *                    # AVC

TCL_FILE = 'tk_label.tcl'            # GUI description as tcl script


class Example(AVC):
    """
    Showcase of formatting capabilities for the label widget
    """

    def __init__(self):

        # create GUI
        self.root = Tk()
        self.root.eval('set argc {}; set argv {}; proc ::main {argc argv} {};')
        self.root.tk.evalfile(TCL_FILE)

        # terminate program at toplevel window destroy: connect toplevel
        # destroy signal to termination handler.
        self.root.bind_class('Toplevel', '<Destroy>', lambda event: self.root.quit())

        # all types of connected variables
        self.bool_value = True
        self.float_value = 1.0
        self.int_value = 1
        self.list_value = [1,2,3]
        self.str_value = 'abc'
        self.tuple_value = (1,2,3)
        class Obj:
            "A generic object with 2 attributes x,y"
            def __init__(self):
                self.x = 1
                self.y = 2
        self.obj_value = Obj()

#### MAIN

example = Example()                  # instantiate the application
example.avc_init()                   # connect widgets with variables
Tkinter.mainloop()                  # run Tk event loop until quit

#### END

```

The GUI layout was previously edited with Visual Tcl and saved to the file 'tk\_label.tcl'. Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- For each control type (for each row) the two label widgets, one in the column "Label with format" and one in the column "Label without format", are connected to the variable of the corresponding type. For example, in row "boolean", both label widgets are called "bool\_value", so they connect to the variable `self.bool_value`.
- When the Tk event loop is entered both columns are set to display the initial values of the connected variables. For example, in row "integer", both labels are set to display the integer value 1.
- The differences of representation between the column "Label with format" and the column "Label without format" reflect the different printout results coming from the formatting capabilities of the label widget and from `str`, the generic textual rendering function of python.

## 12.4. Showcase example

- Row 1: memoryless button with boolean variable, pressed = True, unpressed = False.
- Row 2: button with memory, check button, pressed = True, unpressed = False.
- Row 3: mutually exclusive choices widgets, radio buttons numbered from 0 to 2, index variable = number of checked radio button.
- Row 4: integer input/output widgets, spin button, entry and slider.
- Row 5: float input/output widgets, spin button, entry and slider.
- Row 6: string input/output widget, entry.
- Row 7: string input/output widget, text view/edit.

Control Type	Widgets	Control Value
boolean1	button	True
boolean2	check button	True
Index	radio button 0 radio button 1 radio button 2	2
Integer	5 5 5	5
float	2.5 2.5 2.5	2.5
string	AAAAA	AAAAA
string	line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text	line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text line of text, line of text, line of text

### 12.4.1. Python source

```
#!/usr/bin/python
# .copyright   : (c) 2007 Fabrizio Pollastri
# .license     : GNU General Public License v3

from Tkinter import *                # Tk interface

from avc import *                    # AVC

TCL_FILE = 'tk_showcase.tcl'         # GUI description as tcl script
INCREMENTER_PERIOD = 0.333           # seconds
```

```
class Example(AVC):
    "A table of all supported widget/control type combinations"

    def __init__(self):

        # create GUI
        self.root = Tk()
        self.root.eval('set argc {}; set argv {}; proc ::main {argc argv} {};' )
        self.root.tk.evalfile(TCL_FILE)

        # terminate program at toplevel window destroy: connect toplevel
        # destroy signal to termination handler.
        self.root.bind_class('Toplevel','<Destroy>',lambda event: self.root.quit())

        # the control variables
        self.boolean1 = False
        self.boolean2 = False
        self.radio = 0
        self.integer = 0
        self.float = 0.0
        self.string = ''
        self.textview = ''

        # start variables incrementer
        increment = self.incrementer()
        self.timer_function = increment.next
        self.root.after(int(INCREMENTER_PERIOD * 1000.0),self.timer_wrap)

    def timer_wrap(self):
        "Call given function, reschedule it after return"
        self.timer_function()
        self.root.after(int(INCREMENTER_PERIOD * 1000.0),self.timer_wrap)

    def incrementer(self):
        """
        Booleans are toggled, radio button index is rotated from first to last,
        integer is incremented by 1, float by 0.5, string is appended a char
        until maxlen when string is cleared, text view/edit is appended a line
        of text until maxlen when it is cleared.
        Return True to keep timer alive.
        """
        while True:
            self.boolean1 = not self.boolean1
            yield True

            self.boolean2 = not self.boolean2
            yield True

            if self.radio == 2:
                self.radio = 0
            else:
                self.radio += 1
            yield True

            self.integer += 1
            yield True

            self.float += 0.5
            yield True
```

```

    if len(self.string) >= 20:
        self.string = 'A'
    else:
        self.string += 'A'
    yield True

    if len(self.textview) >= 200:
        self.textview = ''
    else:
        self.textview += 'line of text, line of text, line of text\n'
    yield True

#### MAIN

example = Example()
example.avc_init()
Tkinter.mainloop()

##### END

```

The GUI layout was previously edited with Visual Tcl and saved to the file 'tk\_showcase.tcl'. The key points of the example regarding **AVC** are the following.

- During Visual Tcl editing, the following names were given to the widgets.

Row	widget	name
1	button	<b>boolean1_button</b>
	output value label	<b>boolean1_var</b>
2	checkboxbutton	<b>boolean2_checkboxbutton</b>
	output value label	<b>boolean2_var</b>
3	radiobutton0	<b>radio_radiobutton0</b>
	radiobutton1	<b>radio_radiobutton1</b>
	radiobutton2	<b>radio_radiobutton2</b>
	output value label	<b>radio_var</b>
4	spinbutton	<b>integer_spinbox</b>
	entry	<b>integer_entry</b>
	slider	<b>integer_hscale</b>
	output value label	<b>integer_var</b>
5	spinbutton	<b>float_spinbox</b>
	entry	<b>float_entry</b>
	slider	<b>float_hscale</b>
	output value label	<b>float_var</b>
6	entry	<b>string_entry</b>
	output value label	<b>string_var</b>
7	textview	<b>textview_textview</b>
	output value label	<b>textview_var</b>

- The **AVC** package is imported at program begin (from avc import \*).
- The application class is derived from the **AVC** class (class Example(AVC):).
- The following variables are declared in the application.

```
self.boolean1 = False
```

```

self.boolean2 = False
self.radio = 0
self.integer = 0
self.float = 0.0
self.string = ''
self.textview = ''
self.status = ''

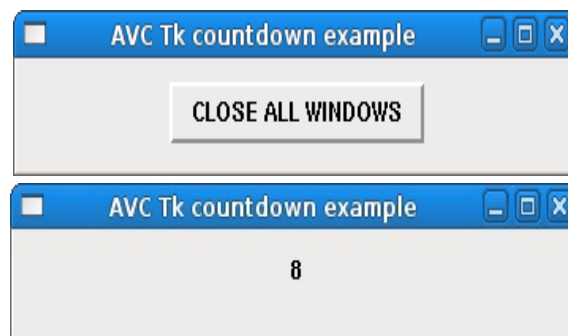
```

- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections of all widegts/variable combinations and to initialize the widgets values with the initial value of the connected variable .

Example files in directory 'examples' of distribution: program 'tk\_showcase.py', graphic interface descriptor as tcl script 'tk\_showcase.tcl'.

## 12.5. Countdown example

This example continuously creates at random intervals windows displaying a counter. Each counter starts from 10 and is independently decremented. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.



### 12.5.1. Python source

```

#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license   : GNU General Public License v3

from Tkinter import *           # Tk interface
from avc import *               # AVC for Tk
from random import randint      # random integer generator

TOPLEVEL_NAME = 'countdown'     # name of the top level widget
COUNTDOWN_PERIOD = 500        # count down at 2 unit per second
MAX_CREATION_PERIOD = 4000      # create a new count down at 1/2 this

class Countdown(AVC):
    """
    A countdown counter displayed in a Label widget. Count starts at given
    value. When count reaches zero the counter and its GUI are destroyed.
    """

```



```

"""
def __init__(self, count_start=10):
    ## create GUI

    # main window
    self.root = Tk()
    self.root.title('AVC Tk countdown example')
    self.frame = Frame(self.root, name='countdown', width=350, height=50)
    self.frame.pack(expand=1)

    # count down label
    self.label = Label(self.frame, name='counter')
    self.label.place(relx=0.5, rely=0.4, anchor=CENTER)

    # terminate program at toplevel window destroy: connect toplevel
    # destroy signal to termination handler.
    self.root.bind_class('Toplevel', '<Destroy>', lambda event: self.root.quit())

    # init the counter variable
    self.counter = count_start

    # connect counter variable with label widget
    self.avc_connect(self.root)

    # start count down
    self.root.after(COUNTDOWN_PERIOD, self.decrementer)

def decrementer(self):
    "Counter decrementer. Return False to destroy previous timer."
    self.counter -= 1
    if self.counter:
        # if counter not zero: reschedule count timer
        self.root.after(COUNTDOWN_PERIOD, self.decrementer)
    else:
        # counter reached zero: destroy this countdown and its GUI
        self.root.destroy()

class Example(AVC):
    """
    Continuously create at random intervals windows with a countdown from 10 to 0.
    When a countdown reaches zero, its window is destroyed. Also create a main
    window with a "close all" button.
    """

    def __init__(self):
        ## create GUI

        # main window
        self.root = Tk()
        self.root.title('AVC Tk countdown example')
        self.frame = Frame(self.root, name='countdown', width=350, height=50)
        self.frame.pack(expand=1)

        # close all button
        self.button = Button(self.frame, name='close_all', text='CLOSE ALL WINDOWS')
        self.button.place(relx=0.5, rely=0.5, anchor=CENTER)

```

```

# terminate program at toplevel window destroy: connect toplevel
# destroy signal to termination handler.
self.root.bind_class('Toplevel','<Destroy>',lambda event: self.root.quit())

# create the first countdown
self.new_countdown()

# close all button connected variable
self.close_all = False

def new_countdown(self,count_start=10):
    "Create a new countdown"

    # create a new countdown
    Countdown(count_start)

    # autocall after a random delay
    self.root.after(randint(1,MAX_CREATION_PERIOD),self.new_countdown)

def close_all_changed(self,value):
    "Terminate program at 'close all' button pressing"
    self.root.quit()

#### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
mainloop()                                         # run Tk event loop until quit

#### END

```

The key points of the example regarding **AVC** are the following.

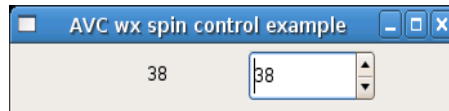
- In the main window, the name '**close\_all**' was given to the button widget; in the counter window, the name '**counter**' was given to the label widget.
- The **AVC** package is imported at program begin (from `avc import *`).
- Both the application class and the counter class are derived from the **AVC** class (`class Example(AVC):` | `class Countdown(AVC):`).
- A boolean variable with an initial value of False and name '**close\_all**' is declared in the application (`self.close_all = False`).
- The method '**close\_all\_changed**' is defined in the application to handle the press event of the 'close all windows' button.
- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to init AVC logic and to realize the connection of the 'close all windows' button to the '**close\_all**' variable.
- A integer variable with an initial default value of 10 and name '**counter**' is declared in the Countdown class (`self.counter = count_start`).
- The `avc_connect` method is called at the instantiation of the Countdown class (`self.avc_connect(self.root)`) with argument the window widget of the counter. This call realizes the connection of the label widget to the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'tk\_countdown\_progui.py'.

## 13. wxWidgets examples

### 13.1. Spin control example

For a functional description of the graphic interface see the GTK+ “Spin button example” at page 27.



#### 13.1.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2007 Fabrizio Pollastri
# .license   : GNU General Public License v3

import wx                                # wx tool kit bindings
from wx import xrc                       # xml resource support

from avc import *                        # AVC

WXGLADE_XML = 'wx_spinctrl.xrc'         # GUI wxGlade descriptor

class Example(wx.PySimpleApp,AVC):
    """
    A spin button whose value is replicated into a static text
    """

    def __init__(self):

        ## create GUI

        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None,'frame_1')
        self.root.Show()

        ## the variable holding the spin button value
        self.spin_value = 0

#### MAIN

example = Example()                      # instantiate the application
example.avc_init()                       # connect widgets with variables
example.MainLoop()                      # run wx event loop until quit
```

```
#### END
```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_spinctrl.xrc'.

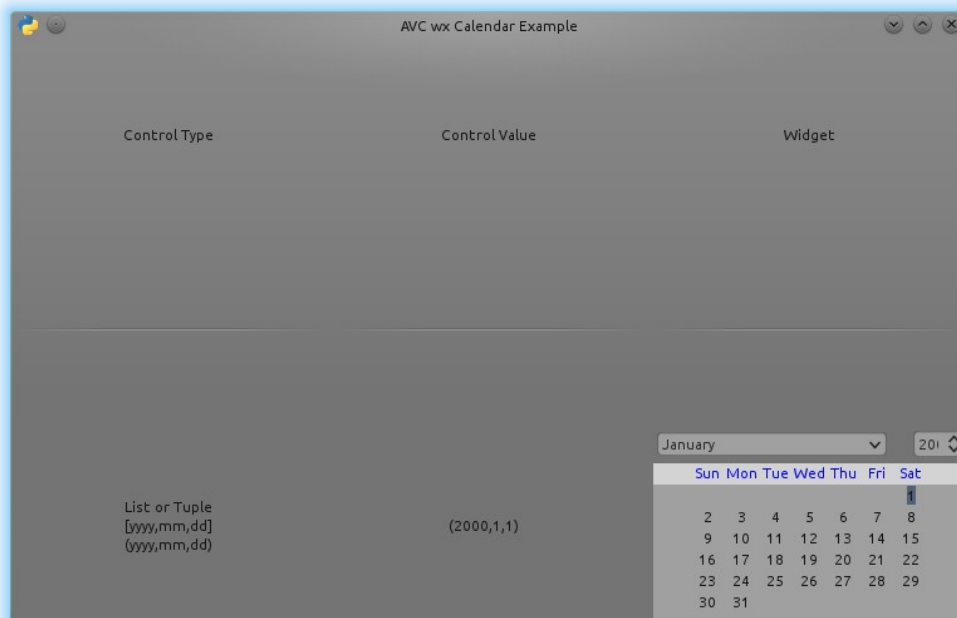
The key points of the example regarding **AVC** are the following.

- During wxGlade editing, the same name '**spin\_value**' was given to the spin button and to the label.
- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the class **PySimpleApp** of wxWidgets and from the class **AVC** of AVC (`class Example(wx.PySimpleApp,AVC):`).
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (`self.spin_value = 0`).
- The `avc_init` method is called after the instantiation of the application class, to realize the connections of the two widgets through the '**spin\_value**' variable and to initialize the widgets values with the initial value of the variable (`example.avc_init()`).

Example files in directory 'examples' of distribution: program 'wx\_spinctrl.py' , UI descriptor 'wx\_spinctrl.xrc'.

## 13.2. Calendar example

This example shows the graphic rendering of the calendar widget displaying the default date of January 1, 2000.



The connected variable can be a list or a tuple with the format yyyy, mm, dd: four digit year, two digit month, two digit day. Month and day numbers start from 1.

## 13.2.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2013 Fabrizio Pollastri
# .license   : GNU General Public License v3

import wx                                # wx tool kit bindings
from wx import xrc                       # xml resource support

from avc import *                        # AVC for wx

WXGLADE_XML = 'wx_calendar.xrc' # GUI wxGlade descriptor

class Example(wx.PySimpleApp, AVC):
    """
    Calendar widget connected to label widget (GTK)
    """

    def __init__(self):

        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None, 'frame_1')
        self.root.Show()

        # all types of connected variables
        self.calendar_value = (2000,1,1)

##### MAIN

example = Example()                      # instantiate the application
example.avc_init()                     # connect widgets with variables
example.MainLoop()                       # run wx event loop until quit

##### END
```

The GUI layout was previously edited with wxGlade Designer and saved to the file 'wx\_calendar.xrc'.

Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

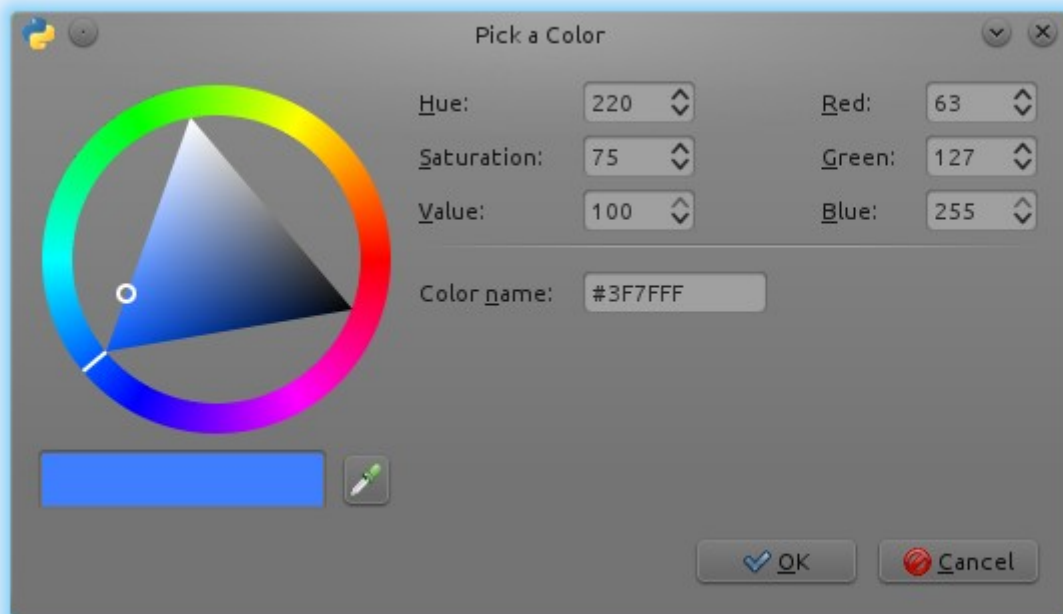
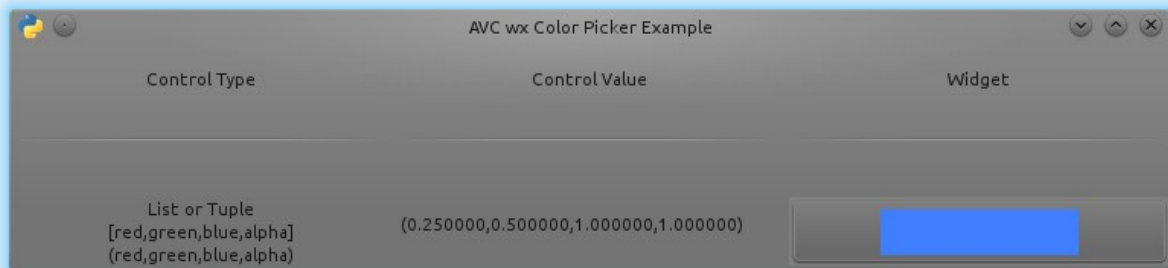
- When the Wx event loop is entered the calendar date is set to the initial value of the connected variable: January 1, 2000.

Example files in directory 'examples' of distribution: program 'wx\_calendar.py', GUI descriptor 'wx\_calendar.xrc'.

## 13.3. Color dialog example

This example shows the graphic rendering of the color selection widget displaying the default

color of 0.25 red, 0.5 green, 1.0 blue, 1.0 alpha. Color selection has two windows. The base window displaying the connected variable with the default color values (first image). The color dialog window displaying graphically the current color and allowing user interaction to choose a new color (second image).



The connected variable can be a list or a tuple with the format red, green, blue, alpha, where each color component spans the value range 0.0 - 1.0 . Alpha is the color opacity: 1.0 is the maximum opacity.

### 13.3.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2013 Fabrizio Pollastri
# .license   : GNU General Public License v3
```

```

import wx                                # wx tool kit bindings
from wx import xrc                       # xml resource support

from avc import *                        # AVC for wx

WXGLADE_XML = 'wx_colorpicker.xrc'      # GUI wxGlade descriptor

class Example(wx.PySimpleApp,AVC):
    """
    Color picker widget connected to label widget (wx)
    """

    def __init__(self):

        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None,'frame_1')
        # since color picker not supported by wxglade add it by hand
        self.gridSizer = self.root.GetSizer()
        self.colorpicker = wx.ColourPickerCtrl(self.root,
            name='color_value_colorpicker')
        self.gridSizer.Add(self.colorpicker,0,wx.CENTER|wx.EXPAND)

        self.root.Show()

        # the connected variable
        self.color_value = (0.25,0.5,1.,1.)

#### MAIN

example = Example()                      # instantiate the application
example.avc_init()                       # connect widgets with variables
example.MainLoop()                       # run wx event loop until quit

#### END

```

The GUI layout was previously edited with wxGlade Designer and saved to the file 'wx\_colorpicker.xrc'.

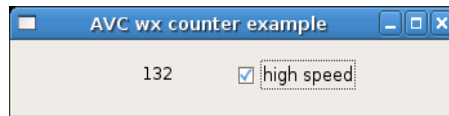
Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- When the Wx event loop is entered the color is set to the initial value of the connected variable: 0.25,0.5,1.0,1.0 .

Example files in directory 'examples' of distribution: program 'wx\_colorpicker.py', GUI descriptor 'wx\_colorpicker.xrc'.

## 13.4. Counter example

For a functional description of the graphical interface see the GTK+ “Counter example” at page 31.



## 13.4.1. Python source

```
#!/usr/bin/python
# .copyright   : (c) 2007 Fabrizio Pollastri
# .license     : GNU General Public License v3

import wx                                     # wx tool kit bindings
from wx import xrc                           # xml resource support

from avc import *                            # AVC

WXGLADE_XML = 'wx_counter.xrc'               # GUI wxGlade descriptor
LOW_SPEED = 0.5                              #-
HIGH_SPEED = 0.1                             #- low and high speed period (ms)

class ExampleGUI(wx.PySimpleApp):
    "Counter GUI creation"

    def __init__(self):
        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None, 'frame_1')
        self.root.Show()

        # timer
        self.timer1 = None

    def timer(self, period, function):
        "Start a wx timer calling back 'function' every 'period' seconds."
        if not self.timer1:
            self.timer1 = wx.Timer(self.root, wx.NewId())
            self.root.Bind(wx.EVT_TIMER, function, self.timer1)
            self.timer1.Start(period * 1000, oneShot=True)

class ExampleMain(AVC):
    """
    A counter displayed in a Label widget whose count speed can be
    accelerated by checking a check button.
    """

    def __init__(self, gui):
        # save gui
        self.gui = gui
```



```

# the counter variable and its speed status
self.counter = 0
self.high_speed = False

# start incrementer timer
self.gui.timer(LOW_SPEED,self.incrementer)

def incrementer(self,event):
    """
    Counter incrementer: increment period = LOW_SPEED, if high speed is False,
    increment period = HIGH_SPEED otherwise. Return False to destroy previous
    timer.
    """
    self.counter += 1
    if self.high_speed:
        period = HIGH_SPEED
    else:
        period = LOW_SPEED
    self.gui.timer(period,self.incrementer)

def high_speed_changed(self,value):
    "Notify change of counting speed to terminal"
    if value:
        print 'counting speed changed to high'
    else:
        print 'counting speed changed to low'

#### MAIN

example_gui = ExampleGUI()                # create the application GUI
example = ExampleMain(example_gui)        # instantiate the application
example.avc_init()                        # connect widgets with variables
example_gui.MainLoop()                   # run wx event loop until quit

#### END

```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_counter.xrc'.  
The key points of the example regarding **AVC** are the following.

- During wxGlade editing, the name '**counter**' was given to the static text and the name '**high\_speed**' was given to the check box.
- The **AVC** package is imported at program begin (from avc import \*).
- The application class is derived from the class **PySimpleApp** for wxWidgets and from the class **AVC** of AVC (class Example(wx.PySimpleApp,AVC):).
- A integer variable with an initial value of 0 and name '**counter**' is declared in the application to hold the counter value (self.counter = 0).
- A boolean variable with an initial value of False and name '**high\_speed**' is declared in the application to hold the speed status of the counter increment speed (self.high\_speed = False).
- The avc\_init method is called after the instantiation of the application class (example.avc\_init()) to realize the connections between the '**counter**' variable and the label widget and between the '**high\_speed**' variable and the check button, the label widget is initialized with the initial value of the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'wx\_counter.py' , UI descriptor 'wx\_counter.xrc'.

## 13.5. Label example

This example shows the formatting capabilities of the label widget. For each supported type of the connected variable, a formatting string is defined and a sample value of the connected variable is displayed into two label widgets: one with formatting and the other with the standard python string representation.

AVC wx static text example			
Control type	Format string	Label with format	Label without format
boolean	%d	1	True
float	%f	1.000000	1.0
int	%d	1	1
list	%d,%d,%d	1,2,3	[1, 2, 3]
string	%s	abc	abc
tuple	%d,%d,%d	%d,%d,%d	(1, 2, 3)
object with attributes x=1,y=2	%(x)d,%(y)d	1,2	<__main__.Obj instance at 0xb67dd2ac>

### 13.5.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri
# .license : GNU General Public License v3

import wx                                # wx tool kit bindings
from wx import xrc                       # xml resource support

from avc import *                        # AVC

WXGLADE_XML = 'wx_label.xrc'            # GUI wxGlade descriptor

class Example(wx.PySimpleApp,AVC):
    """
    Showcase of formatting capabilities for the label widget
    """

    def __init__(self):
        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None,'frame_1')
        self.root.Show()

        # all types of connected variables
        self.bool_value = True
```

```

self.float_value = 1.0
self.int_value = 1
self.list_value = [1,2,3]
self.str_value = 'abc'
self.tuple_value = (1,2,3)
class Obj:
    "A generic object with 2 attributes x,y"
    def __init__(self):
        self.x = 1
        self.y = 2
self.obj_value = Obj()

#### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.MainLoop()                                # run wx event loop until quit

#### END

```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_label.xrc'. Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- For each control type (for each row) the two label widgets, one in the column "Label with format" and one in the column "Label without format", are connected to the variable of the corresponding type. For example, in row "boolean", both label widgets are called "bool\_value", so they connect to the variable `self.bool_value`.
- When the wxWidget event loop is entered both columns are set to display the initial values of the connected variables. For example, in row "integer", both labels are set to display the integer value 1.
- The differences of representation between the column "Label with format" and the column "Label without format" reflect the different printout results coming from the formatting capabilities of the label widget and from `str`, the generic textual rendering function of python.

Example files in directory 'examples' of distribution: program 'wx\_label.py', UI descriptor 'wx\_label.xrc'.

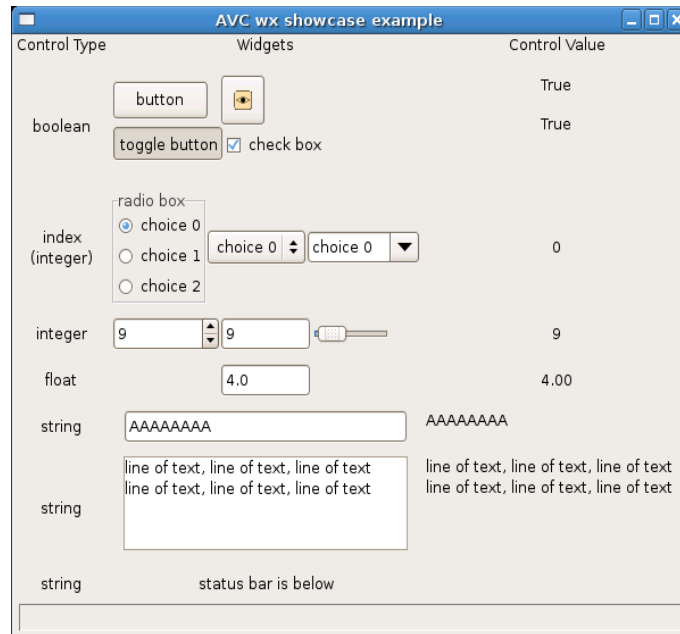
## 13.6. Showcase example

This example shows a table of all widget/variable type combinations supported by **AVC**. The program creates a window with three columns: the first shows the type of the connected variable, the second shows all the widgets that can be connected to that type of variable, the third shows the current value of each variable. Each row of the window represent a widgets/variable combination as follows.

- Row 1: memoryless button and bitmap button with boolean variable, pressed = True, unpressed = False.
- Row 2: buttons with memory, toggle and check box, pressed = True, unpressed = False.
- Row 3: mutually exclusive choices widgets, radio box buttons numbered from 0 to 2, a choice with 3 items and a combo box with 3 items, index variable = number of checked radio button and selected item of combo box.
- Row 4: integer input/output widgets, spin control, text control and slider.

- Row 5: float input/output widget, text control.
- Row 6: string input/output widget, text control.
- Row 7: string input/output widget, text control view/edit.
- Row 8: status messages, status bar.

The text label widget is used in all output modes for the column of the connected variable values. The program increment the value of each connected variable looping top-bottom at three rows per seconds. The user can also change the values in the connected variables interacting with the widgets.



## 13.6.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2007 Fabrizio Pollastri
# .license   : GNU General Public License v3

import wx                                     # wx tool kit bindings
from wx import xrc                           # xml resource support

from avc import *                            # AVC

WXGLADE_XML = 'wx_showcase.xrc'              # GUI wxGlade descriptor
INCREMENTER_PERIOD = 333                     # ms

class Example(wx.PySimpleApp,AVC):
    "A table of all supported widget/control type combinations"

    def __init__(self):
        # init wx application base class
        wx.PySimpleApp.__init__(self)
```

```
# create GUI
xml_resource = xrc.XmlResource(WXGLADE_XML)
self.root = xml_resource.LoadFrame(None, 'frame_1')
self.root.Show()

# the control variables
self.boolean1 = False
self.boolean2 = False
self.index = 0
self.integer = 0
self.float = 0.0
self.string = ''
self.textview = ''
self.status = ''

# start counter incrementer at low speed
self.timer = wx.Timer(self.root,wx.NewId())
self.root.Bind(wx.EVT_TIMER,self.incrementer_wrap,self.timer)
self.timer.Start(int(INCREMENTER_PERIOD),oneShot=False)
self.increment = self.incrementer()

def incrementer_wrap(self,event):
    "Discard event argument and call the real incrementer iterator"
    self.increment.next()

def incrementer(self,*args):
    """
    Booleans are toggled, radio button index is rotated from first to last,
    integer is incremented by 1, float by 0.5, string is appended a char
    until maxlen when string is cleared, text view/edit is appended a line
    of text until maxlen when it is cleared. Status bar message is toggled.
    Return True to keep timer alive.
    """
    while True:

        self.boolean1 = not self.boolean1
        yield True

        self.boolean2 = not self.boolean2
        yield True

        if self.index >= 2:
            self.index = 0
        else:
            self.index += 1
        yield True

        self.integer += 1
        yield True

        self.float += 0.5
        yield True

        if len(self.string) >= 10:
            self.string = ''
        else:
            self.string += 'A'
        yield True

        if len(self.textview) >= 200:
```

```

        self.textview = ''
    else:
        self.textview += 'line of text, line of text, line of text\n'
    yield True

    if not self.status:
        self.status = 'status message'
    else:
        self.status = ''
    yield True

#### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.MainLoop()                                # run wx event loop until quit

#### END

```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_showcase.xrc'. The key points of the example regarding **AVC** are the following.

- During Glade editing, the following names were given to the widgets.

Row	widget	name
1	button	<b>boolean1_button</b>
	bitmap button	<b>boolean1_bitmapbutton</b>
	output value label	<b>boolean1_var</b>
2	togglebutton	<b>boolean2_togglebutton</b>
	checkbox	<b>boolean2_checkbox</b>
	output value label	<b>boolean2_var</b>
3	radiobox	<b>index_radiobox</b>
	choice	<b>index_choice</b>
	combobox	<b>index_combobox</b>
	output value label	<b>index_var</b>
4	spinctrl	<b>integer_spinctrl</b>
	textctrl	<b>integer_textctrl</b>
	slider	<b>integer_slider</b>
	output value label	<b>integer_var</b>
5	textctrl	<b>float_entry</b>
	output value label	<b>float_var</b>
6	textctrl	<b>string_textctrl</b>
	output value label	<b>string_var</b>
7	textctrl	<b>textview_textctrl</b>
	output value label	<b>textview_var</b>
8	statusbar	<b>status_statusbar</b>
	output value label	<b>status_var</b>

- The **AVC** package is imported at program begin (from avc import \*).
- The application class is derived from the class **PySimpleApp** of wxWidgets and from the class **AVC** of AVC (class Example(wx.PySimpleApp,AVC):).
- The following variables are declared in the application.

```

self.boolean1 = False
self.boolean2 = False
self.index = 0
self.integer = 0

```

```

self.float = 0.0
self.string = ''
self.textview = ''
self.status = ''

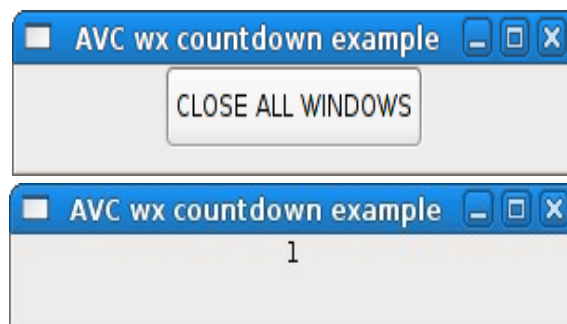
```

- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to realize the connections of all widegts/variable combinations and to initialize the widgets values with the initial value of the connected variable .

Example files in directory 'examples' of distribution: program 'wx\_showcase.py' , UI descriptor 'wx\_showcase.xrc'.

## 13.7. Countdown example

This example continuously creates at random intervals windows displaying a counter. Each counter starts from 10 and is independently decremented. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.



### 13.7.1. Python source

```

#!/usr/bin/python
# .copyright   : (c) 2008 Fabrizio Pollastri
# .license    : GNU General Public License v3

import wx                                     # wx tool kit bindings
from wx import xrc                           # xml resource support

from avc import *                            # AVC

from random import randint                    # random integer generator

WXGLADE_MAIN = 'wx_countdown_main.xrc'       # main window glade descriptor
WXGLADE_CD = 'wx_countdown.xrc'              # count down window glade descriptor
COUNTDOWN_PERIOD = 500                     # count down at 2 unit per second
MAX_CREATION_PERIOD = 4000                   # create a new count down at 1/2 this

class Countdown(AVC):
    """
    A countdown counter displayed in a Label widget. Count starts at given
    value. When count reaches zero the counter and its GUI are destroyed.
    """

```

```

"""
def __init__(self, count_start=10):

    # create GUI
    xml_resource = xrc.XmlResource(WXGLADE_CD)
    self.root = xml_resource.LoadFrame(None, 'frame_1')
    self.root.Show()

    # init the counter variable
    self.counter = count_start

    # connect counter variable with label widget
    self.avc_connect(self.root)

    # start count down
    self.timer = wx.Timer(self.root, wx.NewId())
    self.root.Bind(wx.EVT_TIMER, self.decrementer, self.timer)
    self.timer.Start(COUNTDOWN_PERIOD)

def decrementer(self, event):
    "Counter decrementer. Return False to destroy previous timer."
    self.counter -= 1
    if not self.counter:
        # counter reached zero: destroy this countdown and its GUI
        self.root.Close()

class Example(wx.PySimpleApp, AVC):
    """
    Continuously create at random intervals windows with a countdown from 10 to 0.
    When a countdown reaches zero, its window is destroyed. Also create a main
    window with a "close all" button.
    """

    def __init__(self):

        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_MAIN)
        self.root = xml_resource.LoadFrame(None, 'frame_1')
        self.root.Show()

        # terminate application at main window close
        self.root.Bind(wx.EVT_CLOSE, self.on_destroy)

        # close all button connected variable
        self.close_all = False

        # create count down creation timer
        self.timer = wx.Timer(self.root, wx.NewId())
        self.root.Bind(wx.EVT_TIMER, self.new_countdown, self.timer)

        # create the first countdown
        self.new_countdown(None)

    def new_countdown(self, event, count_start=10):
        "Create a new countdown"

```



```

# create a new countdown
Countdown(count_start)

# autocall after a random delay
self.timer.Start(randint(1,MAX_CREATION_PERIOD),oneShot=True)

def on_destroy(self,window):
    "Terminate program at window destroy"
    self.Exit()

def close_all_changed(self,value):
    "Terminate program at 'close all' button pressing"
    self.Exit()

#### MAIN

example = Example()                                # instantiate the application
example.avc_init()                                # connect widgets with variables
example.MainLoop()                                # run wx event loop until quit

#### END

```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_countdown\_main.xrc' for the main window and to the file 'wx\_countdown.xrc' for the counter windows.

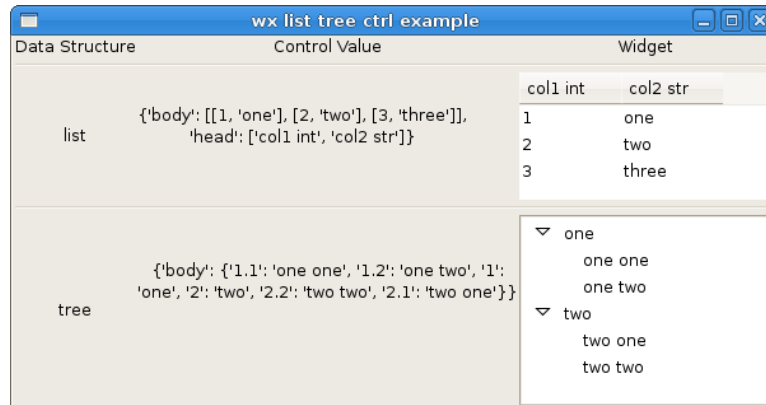
The key points of the example regarding **AVC** are the following.

- During wxGlade editing of the main window, the name '**close\_all**' was given to the button widget; during wxGlade editing of the counter window, the name '**counter**' was given to the label widget.
- The **AVC** package is imported at program begin (from avc import \*).
- Both the application class and the counter class are derived from the **AVC** class (class Example(PySimpleApp,AVC): | class Countdown(AVC):).
- A boolean variable with an initial value of False and name '**close\_all**' is declared in the application (self.close\_all = False).
- The method '**close\_all\_changed**' is defined in the application to handle the press event of the 'close all windows' button.
- The avc\_init method is called after the instantiation of the application class (example.avc\_init()) to init AVC logic and to realize the connection of the 'close all windows' button to the '**close\_all**' variable.
- A integer variable with an initial default value of 10 and name '**counter**' is declared in the Countdown class (self.counter = count\_start)
- The avc\_connect method is called at the instantiation of the Countdown class (self.avc\_connect(self.root)) with argument the window widget of the counter. This call realizes the connection of the label widget to the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'wx\_countdown.py' , wxGlade descriptors 'wx\_countdown\_main.xrc' anc 'wx\_countdown.xrc'.

## 13.8. List tree control example

The first row of this example shows the display capabilities of a widget in list view mode: display of 2D tabular data. The second row shows the display capabilities of a widget in tree mode: display of a hierarchical data tree. For each row, it is showed the connected python data equivalent to data displayed by each widget. The rows of the list view are rolled down by one position every 2 seconds.



## 13.8.1. Python source

```
#!/usr/bin/python
# .copyright : (c) 2008 Fabrizio Pollastri.
# .license   : GNU General Public License v3

import wx                                # wx tool kit bindings
from wx import xrc                       # xml resource support

from avc import *                        # AVC

import copy                              # object cloning support

WXGLADE_XML = 'wx_listtreectrl.xrc'     # GUI wxGlade descriptor

UPDATE_PERIOD = 2000                    # ms

class Example(wx.PySimpleApp,AVC):
    """
    Showcase of display capabilities for the list control and tree control widgets
    """

    def __init__(self):
        # init wx application base class
        wx.PySimpleApp.__init__(self)

        # create GUI
        xml_resource = xrc.XmlResource(WXGLADE_XML)
        self.root = xml_resource.LoadFrame(None, 'frame_1')
        self.root.Show()

        # connected variables
        self.list = {'head':['col1 int','col2 str'], \
                     'body':[[1,'one'],[2,'two'],[3,'three']]}
        self.list_work = copy.deepcopy(self.list)
        self.tree = {'body':{ \
```

```

# root rows
'1':'one', \
'2':'two', \
# children of root row '1'
'1.1':'one one', \
'1.2':'one two', \
# children of root row '2'
'2.1':'two one', \
'2.2':'two two'}}

# start a wx timer calling back 'function' every 'period' seconds."
self.timer1 = wx.Timer(self.root,wx.NewId())
self.root.Bind(wx.EVT_TIMER,self.update_wrap,self.timer1)
self.timer1.Start(UPDATE_PERIOD,oneShot=False)

def update_wrap(self,event):
    "Discard event argument and call the real update iterator"
    self.update().next()

def update(self):
    """
    Tabular data rows data are rolled down.
    """
    rows_num = len(self.list['body'])
    while True:
        # save last row of data
        last_row = self.list_work['body'][-1]
        # shift down one position each data row
        for i in range(1,rows_num):
            self.list_work['body'][-i] = \
                self.list_work['body'][-1-i]
        # copy last row into first position
        self.list_work['body'][0] = last_row
        # copy working copy into connected variable
        self.list = self.list_work
        yield True

#### MAIN

example = Example()
example.avc_init()
example.MainLoop()

##### END

```

The GUI layout was previously edited with wxGlade and saved to the file 'wx\_listtreectrl.xrc'. Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the list tree view example are the same of the GTK+ "List tree view example" example at page 41.

Example files in directory 'examples' of distribution: program 'wx\_listtreectrl.py' , wxGlade descriptor 'wx\_listtreectrl.xrc'.

## 14. Swing examples

### 14.1. Button example

The pressed status of a button is replicated as a boolean into a label.



#### 14.1.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

class Example(AVC):
    """
    A button whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing button example',size=(300,80),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('boolean',swing.SwingConstants.CENTER,
            name='boolean__label',))
        root.add(swing.JButton('button',name='boolean__button'))
        root.show()

        # the variable holding the button state
        self.boolean = False

#### MAIN

example = Example()              # instantiate the application
example.avc_init()               # connect widgets with variables

#### END
```

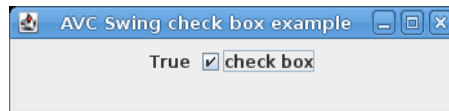
The key points of the example regarding **AVC** are the following.

- The **AVC** package is imported at program begin (`from avc import *`).
- The application class is derived from the class **AVC** of AVC (`class Example(AVC):`).
- In GUI creation statements, the same name '**boolean**' was given to the button and to the label widgets.
- A boolean variable with an initial value of False and name '**boolean**' is declared in the application (`self.boolean = False`).
- The `avc_init` method is called after the instantiation of the application class, to realize the connections of the two widgets through the '**boolean**' variable and to initialize the widgets values with the initial value of the variable (`example.avc_init()`).

Example files in directory 'examples' of distribution: program 'swing\_button.py'.

## 14.2. Check box example

The clicked status of a check box is replicated into a label.



### 14.2.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

class Example(AVC):
    """
    A check box whose value is replicated into a label
    """

    def __init__(self):
        # create GUI
        root = swing.JFrame('AVC Swing check box example',size=(350,80),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('boolean',swing.SwingConstants.CENTER,
            name='boolean__label',))
        root.add(swing.JCheckBox('check box',name='boolean__checkbox'))
        root.show()

        # the variable holding the check box value
        self.boolean = False

#### MAIN
```

```

example = Example()           # instantiate the application
example.avc_init()           # connect widgets with variables

#### END

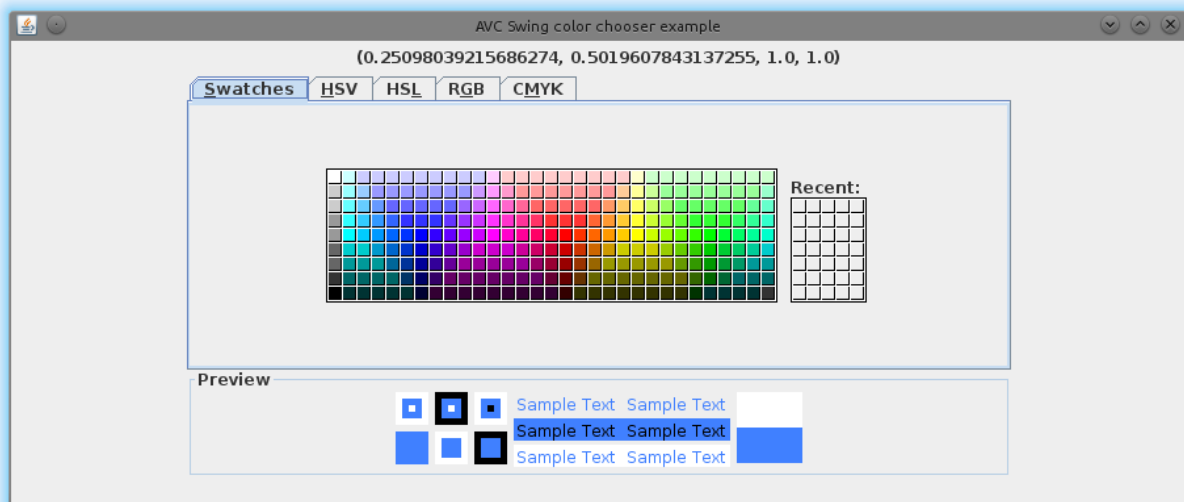
```

The key points of the example regarding **AVC** are the same of button example.

Example files in directory 'examples' of distribution: program 'swing\_checkbox.py'.

## 14.3. Color chooser example

This example shows the graphic rendering of the color selection widget displaying the default color of 0.25 red, 0.5 green, 1.0 blue, 1.0 alpha, the top tuple of numbers. Below, the color dialog window displaying graphically the current color and allowing user interaction to choose a new color.



The connected variable can be a list or a tuple with the format red, green, blue, alpha, where each color component spans the value range 0.0 - 1.0. Alpha is the color opacity: 1.0 is the maximum opacity.

### 14.3.1. Python source

```

#!/usr/bin/env jython
# .copyright : (c) 2013 Fabrizio Pollastri
# .license   : GNU General Public License v3

from javax import swing           # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

```

```

class Example(AVC):
    """
    A color chooser replicated into a label (Swing),
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing color chooser example',size=(900,380),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('%s',name='color_value__label'))
        root.add(swing.JColorChooser(name='color_value__colorchooser'))
        root.show()

        # the variable holding the color chooser value
        self.color_value = (0.25,0.5,1.,1.)

##### MAIN

example = Example()           # instantiate the application
example.avc_init()           # connect widgets with variables

##### END

```

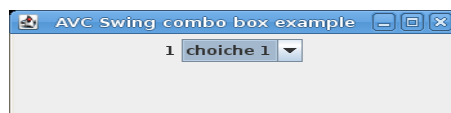
Apart the general requirements of AVC, already pointed out in the other examples, the relevant points of the label example about AVC are the following.

- When the SWING event loop is entered the color is set to the initial value of the connected variable: 0.25,0.5,1.0,1.0 .

Example files in directory 'examples' of distribution: program 'swing\_colorchooser.py'.

## 14.4. Combo box example

The selection of a combo box is replicated into a label.



### 14.4.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

```

```
from avc import *                # AVC for Swing

class Example(AVC):
    """
    A combo box whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing combo box example',size=(350,110),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('index',name='radio__label',))
        root.add(swing.JComboBox(['choiche 0','choiche 1','choiche 2'],
                                  name='radio__combobox'))
        root.show()

        # the variable holding the combo box selection index
        self.radio = 0

#### MAIN

example = Example()              # instantiate the application
example.avc_init()               # connect widgets with variables

#### END
```

The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

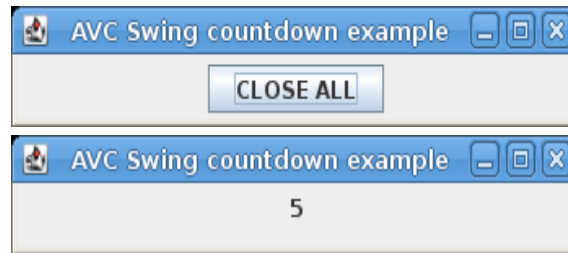
- In GUI creation statements, the same name '**radio**' was given to the combo box and to the label widgets.
- A integer variable with an initial value of 0 and name '**radio**' is declared in the application (`self.radio = 0`).

Example files in directory 'examples' of distribution: program 'swing\_combobox.py'.

## 14.5. Countdown example

This example continuously creates at random intervals windows displaying a counter. Each counter starts from 10 and is independently decremented. When the count reaches zero, the counter window is destroyed. Also a main window with a “close all windows” button is displayed.





## 14.5.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri
# .license   : GNU General Public License v3

from javax import swing                # swing toolkit bindings
from java import awt                  # awt toolkit bindings

from avc import *                     # AVC for Swing

from random import randint            # random integer generator
import sys                            # system support

FIRST_COUNT_DELAY = 1000              # let avc_init be called
COUNTDOWN_PERIOD = 500              # count down at 2 unit per second
MAX_CREATION_PERIOD = 4000           # create a new count down at 1/2 this

class Countdown(AVC):
    """
    A countdown counter displayed in a Label widget. Count starts at given
    value. When count reaches zero the counter and its GUI are destroyed.
    """

    def __init__(self, count_start=10):

        # create GUI
        self.root = swing.JFrame('AVC Swing countdown example', size=(350, 60),
                                defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        self.root.layout = awt.FlowLayout()
        self.root.add(swing.JLabel('counter', name='counter__label',))
        self.root.show()

        # init the counter variable
        self.counter = count_start

        # connect counter variable with label widget
        self.avc_connect(self.root)

        # start count down
        self.timer = swing.Timer(COUNTDOWN_PERIOD, None)
        self.timer.actionPerformed = self.decrementer
        self.timer.start()

    def decrementer(self, *args):
        "Counter decrementer. Return False to destroy previous timer."
        self.counter -= 1

        if not self.counter:
            # counter reached zero: destroy this countdown and its GUI
```

```

        self.root.dispose()

class Example(AVC):
    """
    Continuously create at random intervals windows with a countdown from 10 to 0.
    When a countdown reaches zero, its window is destroyed. Also create a main
    window with a "close all" button.
    """

    def __init__(self):

        # create main window
        self.root = swing.JFrame('AVC Swing countdown example',size=(350,60),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        self.root.layout = awt.FlowLayout()
        self.root.add(swing.JButton('CLOSE ALL',name='close_all__button',))
        self.root.show()

        # create the first countdown after avc_init call
        self.timer = swing.Timer(FIRST_COUNT_DELAY,None)
        self.timer.actionPerformed = self.new_countdown
        self.timer.start()

        # close all button connected variable
        self.close_all = False

    def new_countdown(self,event,count_start=10):
        "Create a new countdown"

        # create a new countdown
        Countdown(count_start)

        # autocall after a random delay
        self.timer.setDelay(MAX_CREATION_PERIOD)

    def close_all_changed(self,value):
        "Terminate program at 'close all' button pressing"
        for frame in self.root.getFrames():
            frame.dispose()
        sys.exit()

#### MAIN

example = Example()                # instantiate the application
example.avc_init()                 # connect widgets with variables

#### END

```

The key points of the example regarding **AVC** are the following.

- In GUI creation statements of the main window, the name '**close\_all**' was given to the button widget, while in counter window creation, the name '**counter**' was given to the label widget.
- The **AVC** package is imported at program begin (`from avc import *`).
- Both the application class and the counter class are derived from the **AVC** class (`class`

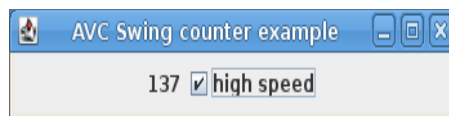
```
Example(AVC): | class Countdown(AVC):
```

- A boolean variable with an initial value of False and name '**close\_all**' is declared in the application (`self.close_all = False`).
- The method '**close\_all\_changed**' is defined in the application to handle the press event of the 'close all windows' button.
- The `avc_init` method is called after the instantiation of the application class (`example.avc_init()`) to init AVC logic and to realize the connection of the 'close all windows' button to the '**close\_all**' variable.
- A integer variable with an initial default value of 10 and name '**counter**' is declared in the Countdown class (`self.counter = count_start`).
- The `avc_connect` method is called at the instantiation of the Countdown class (`self.avc_connect(self.root)`) with argument the window widget of the counter. This call realizes the connection of the label widget to the '**counter**' variable.

Example files in directory 'examples' of distribution: program 'swing\_countdown.py'.

## 14.6. Counter example

For a functional description of the graphical interface see the GTK+ "Counter example" at page 31.



### 14.6.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

LOW_SPEED = 500                  #- -
HIGH_SPEED = 100                 #- low and high speed period (ms)

class ExampleGUI:
    "Counter GUI creation"

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing counter example',size=(350,60),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('counter',name='counter_label',))
        root.add(swing.JCheckBox('high speed',name='high_speed_checkbox'))
        root.show()

        # create a timer for incrementer
        self.timer = swing.Timer(LOW_SPEED,None)
```

```

class ExampleMain(AVC):
    """
    A counter displayed in a Label widget whose count speed can be
    accelerated by checking a check box.
    """

    def __init__(self,gui):

        # save GUI
        self.gui = gui

        # the counter variable and its speed status
        self.counter = 0
        self.high_speed = False

        # start variable incrementer
        self.gui.timer.actionPerformed = self.incrementer
        self.gui.timer.start()

    def incrementer(self,*args):
        """
        Counter incrementer: increment period = LOW_SPEED, if high speed is False,
        increment period = HIGH_SPEED otherwise. Return False to destroy previous
        timer.
        """
        self.counter += 1
        if self.high_speed:
            period = HIGH_SPEED
        else:
            period = LOW_SPEED
        self.gui.timer.setDelay(period)
        return True

    def high_speed_changed(self,value):
        "Notify change of counting speed to terminal"
        if value:
            print 'counting speed changed to high'
        else:
            print 'counting speed changed to low'

##### MAIN

example_gui = ExampleGUI()           # create the application GUI
example = ExampleMain(example_gui)    # instantiate the application
example.avc_init()                   # connect widgets with variables

##### END

```

The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the name '**counter**' was given to the label and the name '**high\_speed**' was given to the check box.
- A integer variable with an initial value of 0 and name '**counter**' is declared in the application to hold the counter value (`self.counter = 0`).
- A boolean variable with an initial value of False and name '**high\_speed**' is declared in the application to hold the speed status of the counter increment speed

```
(self.high_speed = False).
```

Example files in directory 'examples' of distribution: program 'swing\_counter.py'.

## 14.7. Progress bar example

A progress bar is continuously first pulsed and then advanced from 0% to 100%. Its value (negative when pulsed, 0.0 – 1.0 when advanced from 0% to 100%) is replicated into a label.



### 14.7.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

from avc import *               # AVC for Swing

INCREMENTER_PERIOD = 333       # ms

class Example(AVC):
    """
    A progress bar whose value is replicated into a label
    """
    def __init__(self):
        # create GUI
        root = swing.JFrame('AVC Swing progress bar example',size=(350,60),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('progressbar',name='progressbar__label',))
        root.add(swing.JProgressBar(name='progressbar__progressbar'))
        root.show()

        # the variable holding the progress bar value
        self.progressbar = -1.0

        # start variables incrementer
        increment = self.incrementer()
        self.timer = swing.Timer(INCREMENTER_PERIOD,None)
        self.timer.actionPerformed = lambda event: increment.next()
        self.timer.start()

    def incrementer(self):
        """
        Progress bar is alternatively shuttled or incremented from 0 to 100%
        """
        while True:
```

```

        if self.progressbar >= 0.9999:
            self.progressbar = -1.0
        else:
            self.progressbar = round(self.progressbar + 0.1,1)
        yield

#### MAIN

example = Example()           # instantiate the application
example.avc_init()           # connect widgets with variables

#### END

```

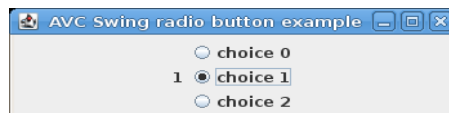
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**progressbar**' was given to the progress bar and to the label widgets.
- A float variable with an initial value of -1.0 and name '**progressbar**' is declared in the application (`self.progressbar = -1.0`).

Example files in directory 'examples' of distribution: program 'swing\_progressbar.py'.

## 14.8. Radio button example

The selection status of three radio buttons is replicated into a label.



### 14.8.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

from avc import *               # AVC for Swing

class Example(AVC):
    """
    A radio button whose value is replicated into a label
    """

    def __init__(self):
        # create GUI
        root = swing.JFrame('AVC Swing radio button example',size=(350,100),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)

```

```

root.layout = awt.FlowLayout()
root.add(swing.JLabel('index',name='radio__label',))
radio_button1 = swing.JRadioButton('choice 0',name='radio__radiobutton1')
radio_button2 = swing.JRadioButton('choice 1',name='radio__radiobutton2')
radio_button3 = swing.JRadioButton('choice 2',name='radio__radiobutton3')
radio_group = swing.ButtonGroup()
radio_group.add(radio_button1)
radio_group.add(radio_button2)
radio_group.add(radio_button3)
radio_box = swing.Box(swing.BoxLayout.Y_AXIS)
radio_box.add(radio_button1)
radio_box.add(radio_button2)
radio_box.add(radio_button3)
root.add(radio_box)
root.show()

# the variable holding the radio button selection index
self.radio = 0

#### MAIN

example = Example()           # instantiate the application
example.avc_init()           # connect widgets with variables

#### END

```

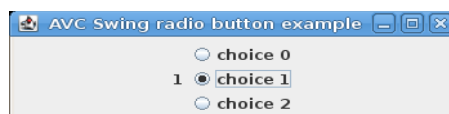
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**radio**' was given to the three radio button and to the label widgets.
- A integer variable with an initial value of 0 and name '**radio**' is declared in the application (`self.radio = 0`).

Example files in directory 'examples' of distribution: program 'swing\_radiobutton.py'.

## 14.9. Slider example

A slider whose value is replicated into a label.



### 14.9.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing      # swing toolkit bindings
from java import awt         # awt toolkit bindings

from avc import *           # AVC for Swing

```

```

class Example(AVC):
    """
    A slider whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing slider example',size=(320,60),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('integer',name='integer_label',))
        root.add(swing.JSlider(name='integer_slider'))
        root.show()

        # the variable holding the slider value
        self.integer = 0

#### MAIN

example = Example()                # instantiate the application
example.avc_init()                 # connect widgets with variables

#### END

```

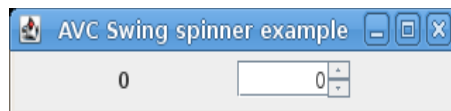
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**integer**' was given to the slider and to the label widgets.
- A integer variable with an initial value of 0 and name '**integer**' is declared in the application (self.integer = 0).

Example files in directory 'examples' of distribution: program 'swing\_slider.py'.

## 14.10. Spinner example

For a functional description of the graphic interface see the GTK+ “Spin button example” at page 27.



### 14.10.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

```



```

from avc import *                # AVC for Swing

class Example(AVC):
    """
    A spinner whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing spinner example',size=(320,60),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('%s',name='spin_value__label',preferredSize=(80,20)))
        root.add(swing.JSpinner(name='spin_value__spinner',preferredSize=(80,20)))
        root.show()

        # the variable holding the spinner value
        self.spin_value = 0

#### MAIN

example = Example()              # instantiate the application
example.avc_init()               # connect widgets with variables

#### END

```

The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**spin\_value**' was given to the spinner and to the label widgets.
- A integer variable with an initial value of 0 and name '**spin\_value**' is declared in the application (`self.spin_value = 0`).

Example files in directory 'examples' of distribution: program 'swing\_spinner.py'.

## 14.11. Table example

This example shows the display capabilities of a table widget of 2D tabular data arranged as explained in “List view”. The rows of the list view are rolled down by one position every 2 seconds. For each row, it is showed the connected python data equivalent to data displayed by each widget. The same data structure is also displayed as string into a label widget.

col1_int	col2_str
2	two
3	three
1	one

### 14.11.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.

```

```

# .license      : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

from avc import *                # AVC for Swing

import copy                      # object cloning support

UPDATE_PERIOD = 2000            # ms

class Example(AVC):
    """
    Showcase of display capabilities for the table widget
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing table example',size=(500,120),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel(name='list_label',))
        table = swing.JTable(name='list_table')
        scrollpane = swing.JScrollPane()
        scrollpane.setPreferredSize(awt.Dimension(200,65))
        scrollpane.getViewport().setView(table)
        root.add(scrollpane)
        root.show()

        # connected variables
        self.list = {'head':['col1 int','col2 str'], \
            'body':[[1,'one'],[2,'two'],[3,'three']]}
        self.list_work = copy.deepcopy(self.list)

        # start variables update
        update = self.update()
        self.timer = swing.Timer(UPDATE_PERIOD,None)
        self.timer.actionPerformed = lambda event: update.next()
        self.timer.start()

    def update(self):
        """
        Tabular data rows data are rolled down.
        """
        rows_num = len(self.list['body'])
        while True:
            # save last row of data
            last_row = self.list_work['body'][-1]
            # shift down one position each data row
            for i in range(1,rows_num):
                self.list_work['body'][-i] = \
                    self.list_work['body'][-1-i]
            # copy last row into first position
            self.list_work['body'][0] = last_row
            # copy working copy into connected variable
            self.list = self.list_work
            yield

```

```
#### MAIN

example = Example()          # instantiate the application
example.avc_init()          # connect widgets with variables

#### END
```

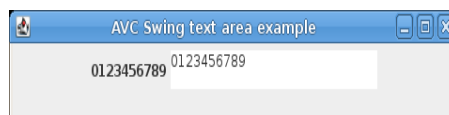
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**list**' was given to the table and to the label widgets.
- A variable with a proper initial value and name '**list**' is declared in the application (`self.list = {'head': ['col1 int', 'col2 str'], 'body': [[1, 'one'], [2, 'two'], [3, 'three']]}`).

Example files in directory 'examples' of distribution: program 'swing\_table.py'.

## 14.12. Text area example

This example shows a string displayed into a text area widget. The string can be edited in the text area. The content of the text area is replicated into a label widget.



### 14.12.1. Jython source

```
#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

from avc import *               # AVC for Swing

class Example(AVC):
    """
    A text area whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing text area example', size=(480,80),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('String', size=(100,60), name='textview__label'))
        root.add(swing.JTextArea(rows=2, columns=20, name='textview__textarea'))
        root.show()

        # the variable holding the text area strings/lines
```

```

self.textview = '0123456789'

#### MAIN

example = Example()           # instantiate the application
example.avc_init()           # connect widgets with variables

#### END

```

The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**textview**' was given to the text area and to the label widgets.
- A string variable with an initial value of '0123456789' and name '**textview**' is declared in the application (`self.textview = '0123456789'`).

Example files in directory 'examples' of distribution: program 'swing\_textarea.py'.

## 14.13. Text field example

This example shows three text field widgets that can be used as data entry: the first for integer, the second for float and the third for string. The value of each text field is replicated into a label widget.



### 14.13.1. Jython source

```

#!/usr/bin/env jython
# .copyright : (c) 2009 Fabrizio Pollastri.
# .license   : GNU General Public License v3

from javax import swing          # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

class Example(AVC):
    """
    A text field whose value is replicated into a label
    """

    def __init__(self):
        # create GUI
        root = swing.JFrame('AVC Swing text field example',size=(320,110),
                             defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('integer entry'))
        root.add(swing.JLabel('integer',name='integer__label',))

```

```

root.add(swing.JTextField(columns=10,name='integer__textfield'))
root.add(swing.JLabel(' float entry '))
root.add(swing.JLabel('float',name='float__label',))
root.add(swing.JTextField(columns=10,name='float__textfield'))
root.add(swing.JLabel('string entry '))
root.add(swing.JLabel('string',name='string__label',))
root.add(swing.JTextField(columns=10,name='string__textfield'))
root.show()

# the variables holding the text field values
self.integer = 0
self.float = 0.0
self.string = 'abc'

#### MAIN

example = Example()          # instantiate the application
example.avc_init()          # connect widgets with variables

#### END

```

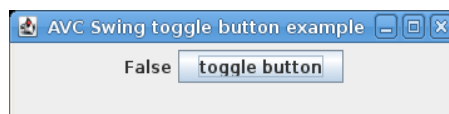
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the name '**integer**' was given to the first text field and label widget pair. The name '**float**' was given to the second widget pair and the name '**string**' was given to the third pair.
- The three widget pairs are respectively connected to an integer variable with an initial value of 0 and name '**integer**' (`self.integer = 0`), to a float variable with an initial value of 0.0 and name '**float**' (`self.float = 0`), to a string variable with an initial value of 'abc' and name '**string**' (`self.string = 'abc'`)

Example files in directory 'examples' of distribution: program 'swing\_textfield.py'.

## 14.14. Toggle button example

The pressed status of a toggle button is replicated as a boolean into a label.



### 14.14.1. Jython source

```

#!/usr/bin/env jython
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from javax import swing          # swing toolkit bindings
from java import awt             # awt toolkit bindings

from avc import *                # AVC for Swing

```

```

class Example(AVC):
    """
    A toggle button whose value is replicated into a label
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing toggle button example',size=(360,80),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel('boolean',swing.SwingConstants.CENTER,
            name='boolean__label',))
        root.add(swing.JToggleButton('toggle button',name='boolean__togglebutton'))
        root.show()

        # the variable holding the toggle button status
        self.boolean = False

##### MAIN

example = Example()                # instantiate the application
example.avc_init()                 # connect widgets with variables

##### END

```

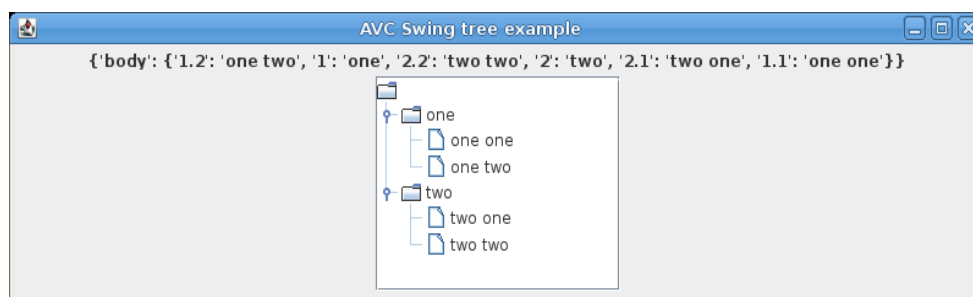
The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**boolean**' was given to the toggle button and to the label widgets.
- A boolean variable with an initial value of False and name '**boolean**' is declared in the application (`self.boolean = False`).

Example files in directory 'examples' of distribution: program 'swing\_togglebutton.py'.

## 14.15. Tree example

This example shows the display capabilities of a tree widget: a hierarchical data tree is displayed. The same data structure is also displayed as string into a label widget.



## 14.15.1. jython source

```
#!/usr/bin/env jython
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from javax import swing          # swing toolkit bindings
from java import awt            # awt toolkit bindings

from avc import *               # AVC for Swing

import copy                     # object cloning support

class Example(AVC):
    """
    Showcase of display capabilities for the tree view widget
    """

    def __init__(self):

        # create GUI
        root = swing.JFrame('AVC Swing tree example',size=(800,220),
            defaultCloseOperation = swing.JFrame.EXIT_ON_CLOSE)
        root.layout = awt.FlowLayout()
        root.add(swing.JLabel(name='tree__label',))
        self.jtree = swing.JTree(name='tree__table')
        self.jtree.setEditable(True)
        scrollpane = swing.JScrollPane()
        scrollpane.setPreferredSize(awt.Dimension(200,160))
        scrollpane.getViewport().setView(self.jtree)
        root.add(scrollpane)
        root.show()

        # connected variables
        self.tree = {'body':{ \
            # root rows
            '1':'one', \
            '2':'two', \
            # children of root row '1'
            '1.1':'one one', \
            '1.2':'one two', \
            # children of root row '2'
            '2.1':'two one', \
            '2.2':'two two'}}

#### MAIN

example = Example()             # instantiate the application
example.avc_init()              # connect widgets with variables

# expand first level rows in the tree
for i in range(example.jtree.getRowCount()):
    example.jtree.expandRow(i)

#### END
```

The key points of the example regarding **AVC** are the same of the Swing “button example”, only the following differs.

- In GUI creation statements, the same name '**tree**' was given to the tree and to the label widgets.
- A variable with a proper initial value and name '**tree**' is declared in the application (`self.tree = {'body':{'1':'one', '2':'two', '1.1':'one one', '1.2':'one two', '2.1':'two one', '2.2':'two two'}}).`

Example files in directory 'examples' of distribution: program 'swing\_tree.py'.



## 15. References

- [1] Python, <http://www.python.org/>
- [2] GTK+, <http://www.gtk.org/>
- [3] Qt4, <http://trolltech.com/products/qt/>
- [4] Tk, <http://www.tcl.tk/>
- [5] wxWidgets, <http://www.wxwidgets.org/>
- [6] Swing, <http://java.sun.com/docs/books/tutorial/uiswing/index.html>
- [7] Java, <http://java.sun.com/>
- [8] Jython, <http://www.jython.org/>
- [9] Pygtk, <http://www.pygtk.org/>
- [10] PyGObject, <https://wiki.gnome.org/Projects/PyGObject>
- [11] PyQt v3 and v4, <http://www.riverbankcomputing.com/software/pyqt/intro>
- [12] Tkinter, <http://effbot.org/tkinterbook/>
- [13] wxPython, <http://www.wxpython.org/>
- [14] Glade, <http://glade.gnome.org/>
- [15] Qt designer, <http://trolltech.com/products/qt/features/designer/>
- [16] Visual Tcl, <http://vtcl.sourceforge.net/>
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