

Test, beauty, cleanness

d'après le cours de
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Problem description

Nous aimerions construire une bibliothèque de graphiques à deux dimensions pour l'édition de dessins structurés

des *Widgets* comme le cercle et rectangle doivent être supportés

des *Opérations* telles que traduire, mettre à l'échelle doivent être offertes

What are the responsibilities?

Containing the widgets

Modeling the widgets

Applying the operations

Version 1

Créer un canvas qui contient les widgets

Testing the canvas

```
public class HotDrawTest {  
    @Test public void testEmptyCanvas() {  
        Canvas canvas = new Canvas ();  
        assertEquals(canvas.getNumberOfElements(), 0);  
    }  
}
```

The class Canvas is not created yet!

Creating the class Canvas

```
public class Canvas {  
    public Object getNumberOfElements() {  
        return 0;  
    }  
}
```

Introducing the containment

We need to be able to add objects in a canvas!

```
@Test public void testCanvas() {  
    Canvas canvas = new Canvas ();  
  
    canvas.add(new Object());  
    assertEquals(1, canvas.getNumberOfElements());  
  
    canvas.add(new Object());  
    canvas.add(new Object());  
    assertEquals(3, canvas.getNumberOfElements());  
}
```

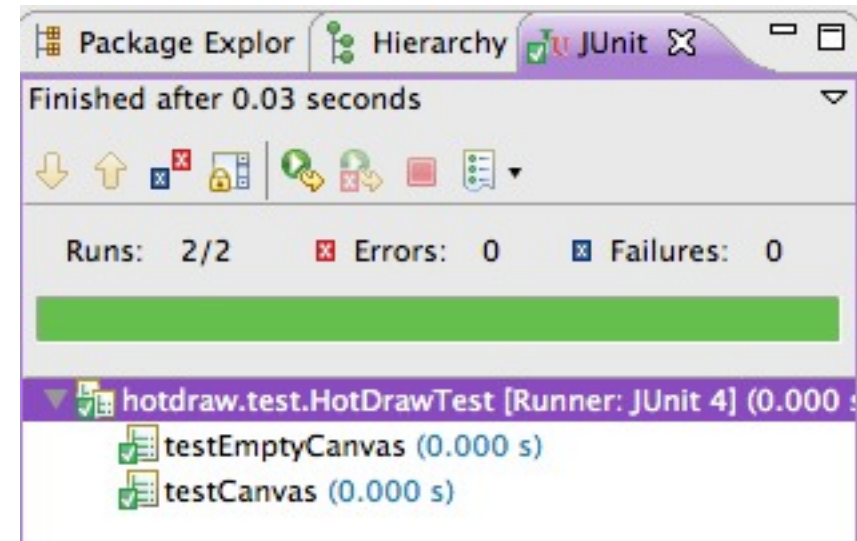
Revising the definition of Canvas

```
public class Canvas {  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public int getNumberOfElements() {  
        return elements.size();  
    }  
  
    public void add(Object object) {  
        elements.add(object);  
    }  
}
```


Revising the definition of Canvas

```
public class Canvas {  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public int getNumberOfElements() {  
        return elements.size();  
    }  
  
    public void add(Object object) {  
        elements.add(object);  
    }  
}
```

Tests are green!



Version 2

Introducing some widgets

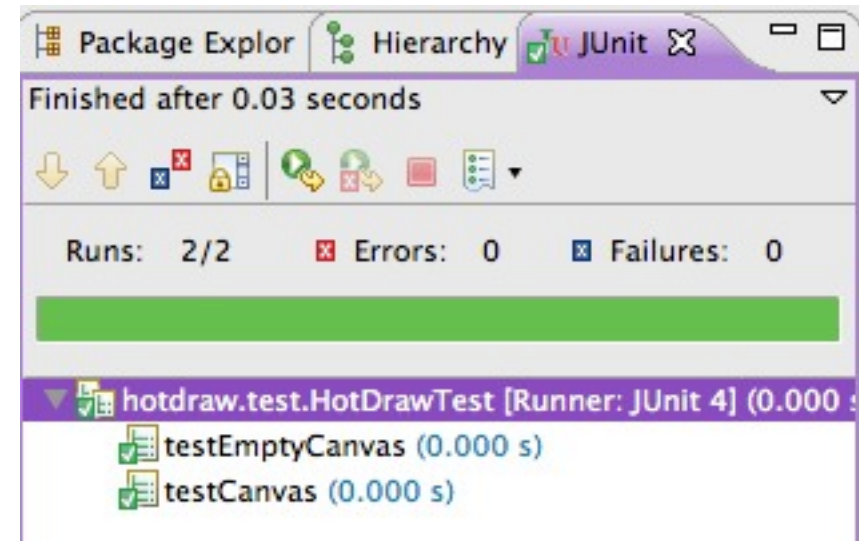
We revise our testCanvas

```
@Test public void testCanvas() {  
    Canvas canvas = new Canvas ();  
  
    canvas.add(new Circle());  
    assertEquals(1, canvas.getNumberofElements());  
  
    canvas.add(new Circle());  
    canvas.add(new Rectangle());  
    assertEquals(3, canvas.getNumberofElements());  
}
```

Circle and Rectangle

```
public class Circle {  
}
```

```
public class Rectangle {  
}
```



Adding position to circle and rectangle

```
@Test public void testCanvas() {
    Canvas canvas = new Canvas ();

    //(10, 20), radius 5
    canvas.add(new Circle(10,20, 5));
    assertEquals(1, canvas.getNumberOfElements());

    canvas.add(new Circle());

    //(5,6) -> (10,8)
    canvas.add(new Rectangle(5, 6, 10, 8));
    assertEquals(3, canvas.getNumberOfElements());
}
```

Generated template

```
public class Circle {  
  
    public Circle(int i, int j, int k) {  
        // TODO Auto-generated constructor stub  
    }  
}
```

Generated template

```
public class Rectangle {  
  
    public Rectangle(int i, int j, int k, int l) {  
        // TODO Auto-generated constructor stub  
    }  
}
```

Filling the template

```
public class Rectangle {  
    private int x1, y1, x2, y2;  
  
    public Rectangle() {  
        this(2, 3, 5, 6);  
    }  
  
    public Rectangle(int x1, int y1, int x2, int y2) {  
        this.x1 = x1;  
        this.y1 = y1;  
        this.x2 = x2;  
        this.y2 = y2;  
    }  
}
```


Version 3

Before moving on, lets step back on what we wrote to see whether there are opportunities for *cleaning* a bit the code

HotDrawTest

```
public class HotDrawTest {  
    @Test public void testEmptyCanvas() {  
        Canvas canvas = new Canvas ();  
        ...  
    }  
  
    @Test public void testCanvas() {  
        Canvas canvas = new Canvas ();  
        ...  
    }  
}
```

HotDrawTest

```
public class HotDrawTest {  
  
    @Test public void testEmptyCanvas() {  
        Canvas canvas = new Canvas ();  
        ...  
    }  
  
    @Test public void testCanvas() {  
        Canvas canvas = new Canvas ();  
        ...  
    }  
}
```



Duplication!

Refactoring our test

```
public class HotDrawTest {
    private Canvas canvas;

    @Before public void initializingFixture() {
        canvas = new Canvas ();
    }

    @Test public void testEmptyCanvas() {
        assertEquals(canvas.getNumberOfElements(), 0);
    }

    @Test public void testCanvas() {
        //(10, 20), radius 5
        canvas.add(new Circle(10,20, 5));
        ...
    }
}
```

Giving a better name to the variable

```
public class HotDrawTest {  
    private Canvas canvas:
```

```
@Before public void  
    canvas = new Can  
}
```

```
@Test public void te  
    assertEquals(can  
}
```

```
@Test public void te  
    //(10, 20), radi  
    canvas.add(new C  
    assertEquals(1,  
  
    canvas.add(new C
```

- Undo Typing F9
- Revert File
- Save
- Open Declaration F3
- Open Type Hierarchy F4
- Open Call Hierarchy ^\H
- Show in Breadcrumb \#B
- Quick Outline #O
- Quick Type Hierarchy #T
- Show In \#W ▶
- Cut ^W
- Copy \W
- Copy Qualified Name
- Paste ^Y
- Quick Fix #1
- Source \#S ▶
- Refactor \#T ▶
- Surround With \#7 ▶

```
, 0);
```

```
s());
```

- Rename... \#R
- Move... \#V

canvas -> emptyCanvas

```
public class HotDrawTest {
    private Canvas emptyCanvas;

    @Before public void initializingFixture() {
        emptyCanvas = new Canvas ();
    }

    @Test public void testEmptyCanvas() {
        assertEquals(emptyCanvas.getNumberofElements(), 0);
    }

    @Test public void testCanvas() {
        //(10, 20), radius 5
        emptyCanvas.add(new Circle(10,20, 5));
        ...
    }
}
```

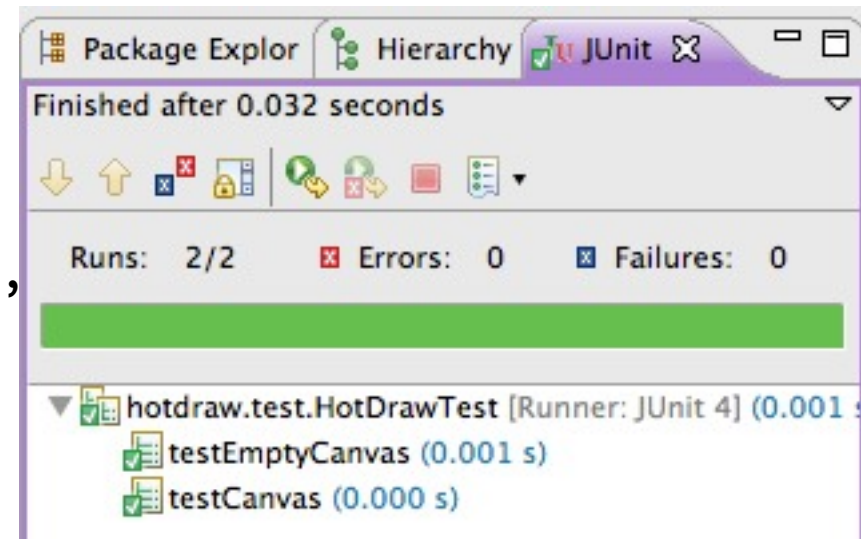
canvas -> emptyCanvas

```
public class HotDrawTest {
    private Canvas emptyCanvas;

    @Before public void initializingFixture() {
        emptyCanvas = new Canvas ();
    }

    @Test public void testEmptyCanvas() {
        assertEquals(emptyCanvas.getNumberOfElements(), 0);
    }

    @Test public void testCanvas() {
        //(10, 20), radius 5
        emptyCanvas.add(new Circle(10,
            ...
        }
    }
}
```



Version 4

Applying the operations on the widget

Note that at that point, *we have not seen the need* to have a *common superclass* for Circle and Rectangle

As well *we have not seen the need* to have a *common interface*

We should be test driven, else it is too easy to go wrong

The class canvas also contains *a list of objects*

Adding an operation

Let's translate our objects

Each widget should now understand the message
translate(deltaX, deltaY)

Let's write some test first

Testing circle first

```
@Test public void translatingCircle() {  
    Circle circle = new Circle();  
    int oldX = circle.getX();  
    int oldY = circle.getY();  
  
    circle.translate(2, 3);  
    assertEquals(circle.getX(), oldX + 2);  
    assertEquals(circle.getY(), oldY + 3);  
}
```

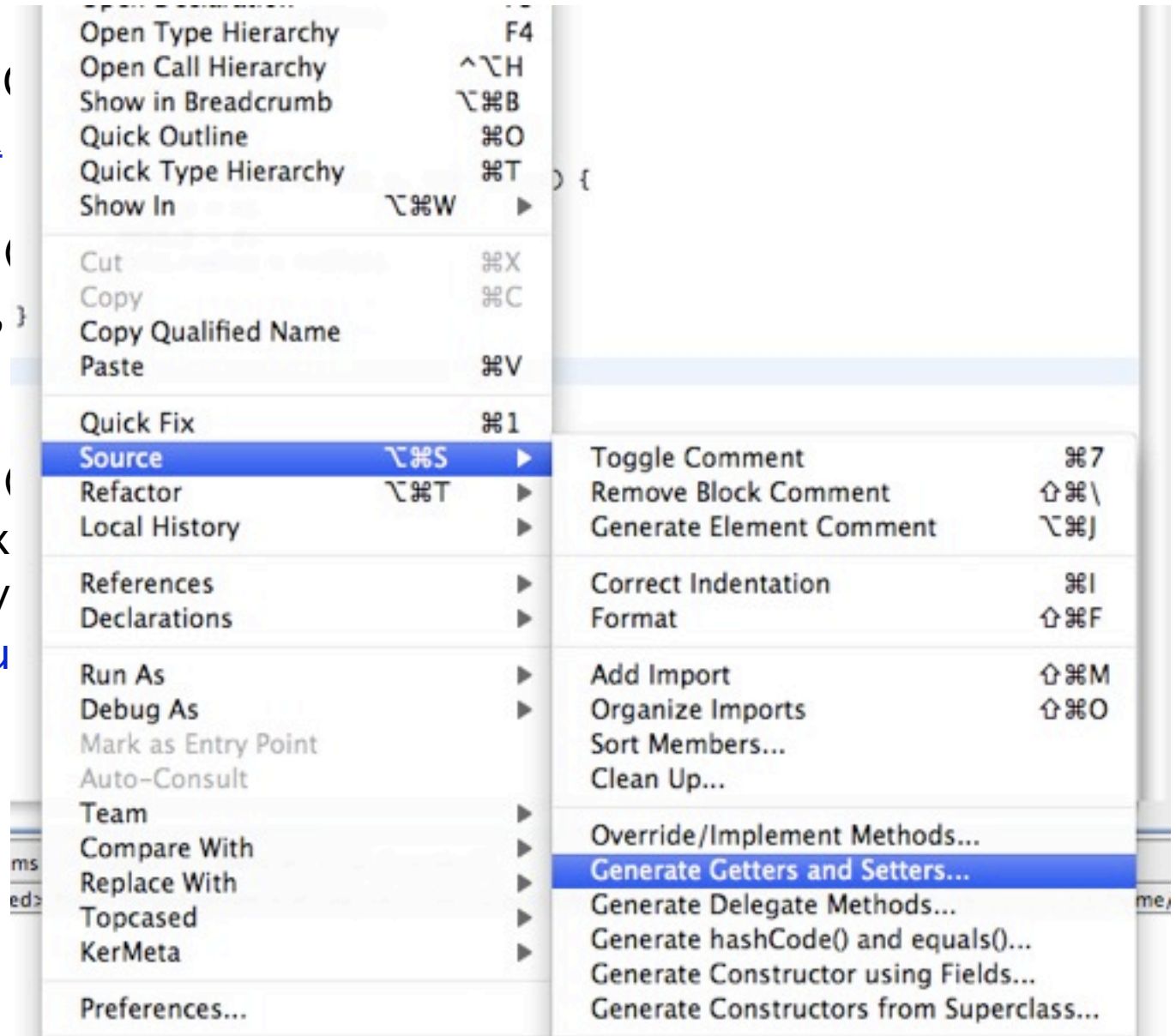
Generate Getters

```
public class (  
private int x
```

```
public Circle(  
    this(5, 5,  
})
```

```
public Circle(  
    this.x = x  
    this.y = y  
    this.radiu
```

```
}  
}
```



Modifying Circle

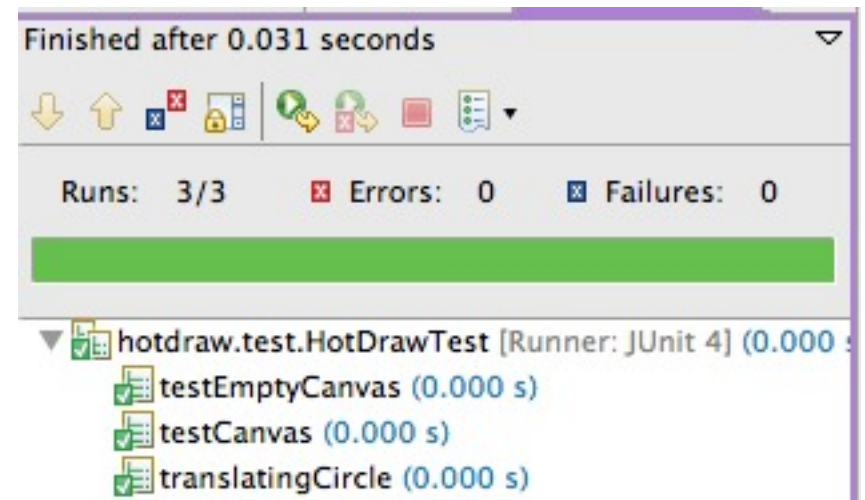
```
public class Circle {  
    private int x, y, radius;  
  
    public int getX() {  
        return x;  
    }  
  
    public int getY() {  
        return y;  
    }  
    ...  
}  
// Note that there is no accessor for radius, we have not  
seen the need of it!
```

Translating Circle

```
public class Circle {  
    ...  
    public void translate(int dx, int dy) {  
        x = x + dx;  
        y = y + dy;  
    }  
    ...  
}
```

Translating Circle

```
public class Circle {  
    ...  
    public void translate(int dx, int dy) {  
        x = x + dx;  
        y = y + dy;  
    }  
    ...  
}
```



Translating the rectangle

```
@Test public void translatingRectangle() {  
    Rectangle rectangle = new Rectangle();  
    int oldX1 = rectangle.getX1();  
    int oldY1 = rectangle.getY1();  
    int oldX2 = rectangle.getX2();  
    int oldY2 = rectangle.getY2();  
  
    rectangle.translate(2, 3);  
    assertEquals(rectangle.getX1(), oldX1 + 2);  
    assertEquals(rectangle.getX2(), oldX2 + 2);  
    assertEquals(rectangle.getY1(), oldY1 + 3);  
    assertEquals(rectangle.getY2(), oldY2 + 3);  
}
```

Updating Rectangle

```
public class Rectangle {
    ...
    public int getX1() {...}
    public int getY1() {...}
    public int getX2() {...}
    public int getY2() {
        return y2;
    }

    public void translate(int dx, int dy) {
        x1 = x1 + dx;
        x2 = x2 + dx;
        y1 = y1 + dy;
        y2 = y2 + dy;
    }
}
```


Important

Note that we have not still see the need to have a common interface and a common superclass

If you doing it upfront, when *your design will look like what you want it to be, and not what it has to be*

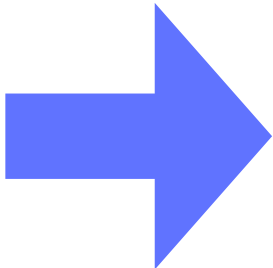
Version 5

It is a bit cumbersome to have to translate each element one by one

Let's ask the canvas to translate all the nodes

Translating the canvas

```
@Test public void translatingTheCanvas() {  
  
    Rectangle rectangle = new Rectangle();  
    int rectangleOldX1 = rectangle.getX1();  
    int rectangleOldY1 = rectangle.getY1();  
    int rectangleOldX2 = rectangle.getX2();  
    int rectangleOldY2 = rectangle.getY2();  
  
    Circle circle = new Circle();  
    int circleOldX = circle.getX();  
    int circleOldY = circle.getY();  
  
    emptyCanvas.add(rectangle);  
    emptyCanvas.add(circle);  
    emptyCanvas.translate(2, 3);  
    ...  
}
```



Translating the canvas

...

```
assertEquals(rectangle.getX1(), rectangleOldX1 + 2);  
assertEquals(rectangle.getX2(), rectangleOldX2 + 2);  
assertEquals(rectangle.getY1(), rectangleOldY1 + 3);  
assertEquals(rectangle.getY2(), rectangleOldY2 + 3);  
assertEquals(circle.getX(), circleOldX + 2);  
assertEquals(circle.getY(), circleOldY + 3);  
}
```

Updating Canvas - what we would like to do

```
public class Canvas {  
  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public void add(Object object) {  
        elements.add(object);  
    }  
  
    public void translate(int dx, int dy) {  
        for(Object o : elements)  
            o.translate(dx, dy);  
    }  
    ...  
}
```

Updating Canvas - what we would like to do

```
public class Canvas {  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public void add(Object object) {  
        elements.add(object);  
    }  
  
    public void translate(int dx, int dy) {  
        for(Object o : elements)  
            o.translate(dx, dy);  
    }  
    ...  
}
```

The compiler will not be happy with this

What is happening?

Only now we see the *need* to introduce a *common interface* that the object have to fulfill

This interface will only be aware of the translate(dx,dy) method

Let's introduce the Widget interface

```
public interface Widget {  
    public void translate(int dx, int dy);  
}  
  
public class Rectangle implements Widget {  
    ...  
}  
  
public class Circle implements Widget {  
    ...  
}
```


Updating Canvas

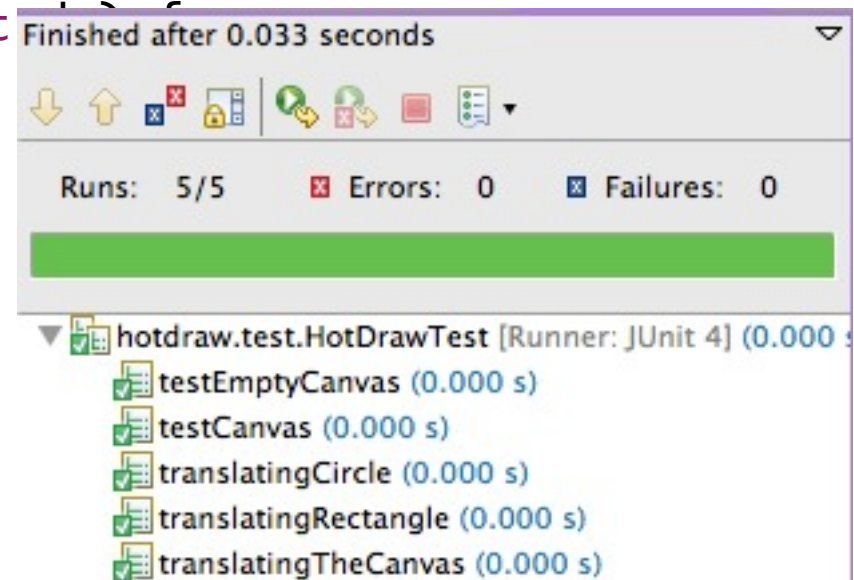
```
public class Canvas {
    private ArrayList<Widget> elements =
        new ArrayList<Widget>();

    public void add(Widget widget) {
        elements.add(widget);
    }

    public void translate(int dx, int dy) {
        for(Widget o : elements)
            o.translate(dx, dy);
    }
    ...
}
```

Updating Canvas

```
public class Canvas {  
    private ArrayList<Widget> elements =  
        new ArrayList<Widget>();  
  
    public void add(Widget widget) {  
        elements.add(widget);  
    }  
  
    public void translate(int dx, int dy) {  
        for(Widget o : elements)  
            o.translate(dx, dy);  
    }  
    ...  
}
```



Version 6

We are doing a pretty good job so far

Let's add a group of widgets that can be commonly manipulated

Testing Group

```
@Test public void groupingWidgets() {  
    Group group = new Group();  
    assertEquals(group.getNumberofElements(), 0);  
  
    group.add(new Circle());  
    group.add(new Rectangle());  
    assertEquals(group.getNumberofElements(), 2);  
}
```

Defining Group

```
public class Group {  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public void add(Object w) {  
        elements.add(w);  
    }  
  
    public int getNumberOfElements() {  
        return elements.size();  
    }  
}
```

Defining Group

```
public class Group {  
    private ArrayList<Object> elements =  
        new ArrayList<Object>();  
  
    public void add(Object w) {  
        elements.add(w);  
    }  
  
    public int getNumber() {  
        return elements.size();  
    }  
}
```



Yes! We haven't seen the need to have Widget here

Defining Group

Finished after 0.103 seconds

Runs: 6/6 Errors: 0 Failures: 0

- hotdraw.test.HotDrawTest [Runner: JUnit 4] (0.040 s)
 - testEmptyCanvas (0.000 s)
 - testCanvas (0.000 s)
 - translatingCircle (0.000 s)
 - translatingRectangle (0.000 s)
 - translatingTheCanvas (0.000 s)
 - groupingWidgets (0.039 s)

```
ject> elements =  
.ist<Object>();
```

```
ct w) {
```

```
}
```

```
public int getNumb  
return elements.
```

```
?
```

Yes! We haven't seen the need to have Widget here

This is the proof that we do not need it!

Translating a group - what we could write, but it contains a lot of duplication

```
@Test public void translatingGroup() {  
    Group group = new Group();  
    group.add(new Circle());  
    group.add(new Rectangle());  
    group.translate(...)  
}
```


But let's refactor first

```
public class HotDrawTest {
    private Canvas emptyCanvas;
    private Group emptyGroup, group;
    private Circle circle;
    private Rectangle rectangle;

    @Before public void initializingFixture() {
        emptyCanvas = new Canvas ();
        emptyGroup = new Group();
        group = new Group();
        group.add(circle = new Circle());
        group.add(rectangle = new Rectangle());
    }
}
```

But let's refactor first

```
@Test public void groupingWidgets() {  
    assertEquals(emptyGroup.getNumberofElements(), 0);  
    assertEquals(group.getNumberofElements(), 2);  
}
```

Translating a group

```
@Test public void translatingGroup() {  
    int circleOldX = circle.getX();  
    int circleOldY = circle.getY();  
    int rOldX1 = rectangle.getX1();  
    int rOldY1 = rectangle.getY1();  
  
    group.translate(2, 3);  
  
    assertEquals(rectangle.getX1(), rOldX1 + 2);  
    assertEquals(rectangle.getY1(), rOldY1 + 3);  
    assertEquals(circle.getX(), circleOldX + 2);  
    assertEquals(circle.getY(), circleOldY + 3);  
}
```

Translating a group

```
public class Group {
    private ArrayList<Widget> elements =
        new ArrayList<Widget>();

    public void add(Widget w) {
        elements.add(w);
    }

    public int getNumberOfElements() {
        return elements.size();
    }

    public void translate(int i, int j) {
        for(Widget w : elements)
            w.translate(i, j);
    }
}
```

Translating a group

```
public class Group {  
    private ArrayList<Widget> elements =  
        new ArrayList<Widget>();  
  
    public void add(Widget w) {  
        elements.add(w);  
    }  
  
    public int getNumberOfElements() {  
        return elements.size();  
    }  
  
    public void translate(int i, int j) {  
        for(Widget w : elements)  
            w.translate(i, j);  
    }  
}
```



Yes, we need an array
of Widgets

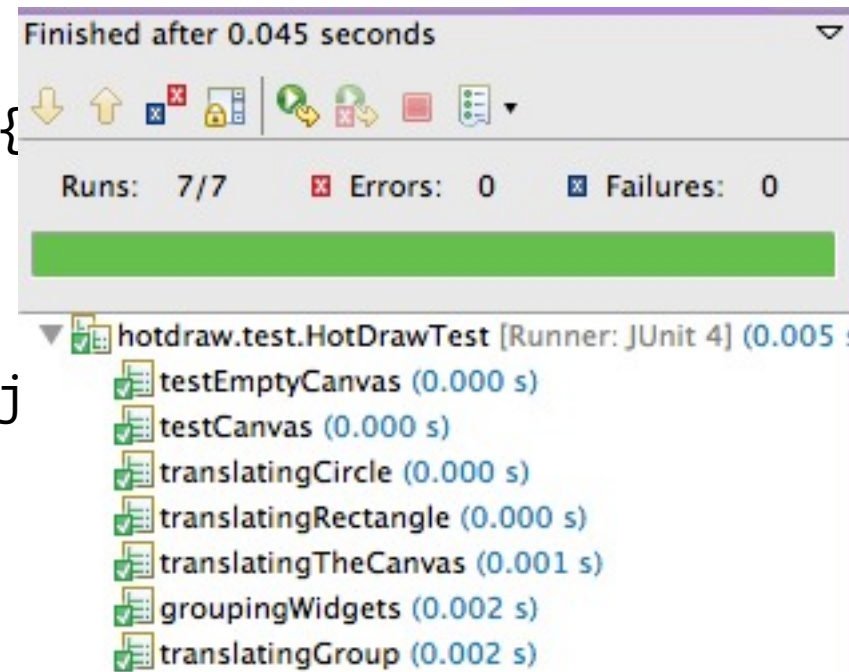
Translating a group

```
public class Group {
    private ArrayList<Widget> elements =
        new ArrayList<Widget>();

    public void add(Widget w) {
        elements.add(w);
    }

    public int getNumberOfElements() {
        return elements.size();
    }

    public void translate(int i, int j
        for(Widget w : elements)
            w.translate(i, j);
    }
}
```



Version 7

Let's refactor Canvas

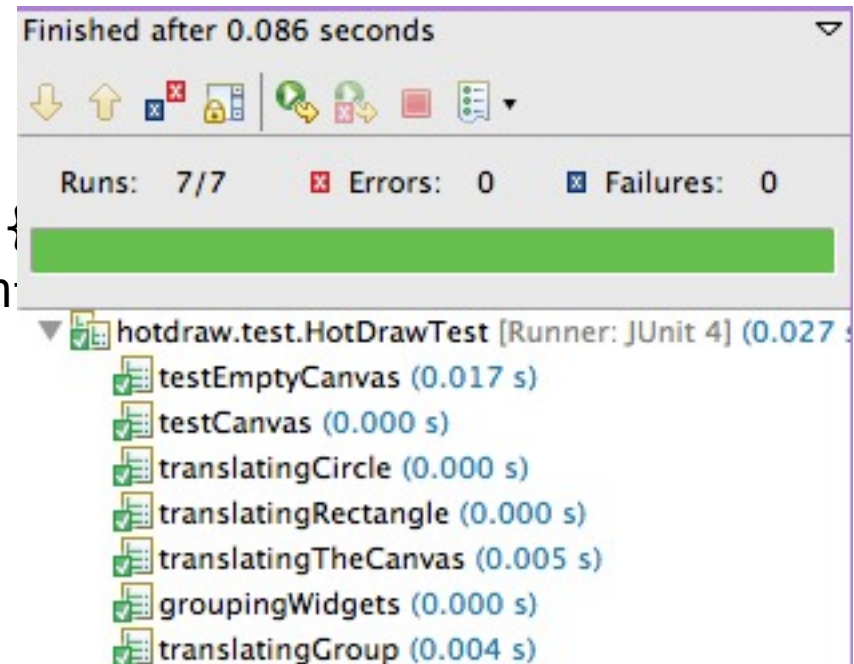
instead of containing a list of elements, it will solely contain a group

Canvas is getting simpler

```
public class Canvas {  
    private Group group = new Group();  
  
    public void add(Widget widget) {  
        group.add(widget);  
    }  
  
    public void translate(int dx, int dy) {  
        group.translate(dx, dy);  
    }  
  
    public int getNumberOfElements() {  
        return group.getNumberOfElements();  
    }  
}
```


Canvas is getting simpler

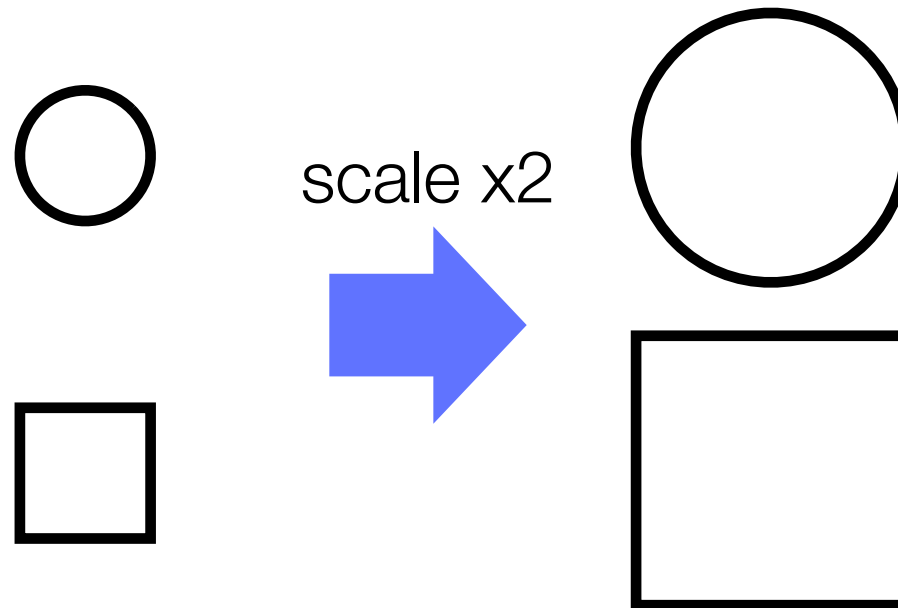
```
public class Canvas {  
    private Group group = new Group();  
  
    public void add(Widget widget) {  
        group.add(widget);  
    }  
  
    public void translate(int dx, int dy) {  
        group.translate(dx, dy);  
    }  
  
    public int getNumberOfElements() {  
        return group.getNumberOfElements();  
    }  
}
```



Version 8

Adding a new operation

We will now scale objects



Adding a test for scalability

```
@Test public void scalingGroup() {  
    int oldRadius = circle.radius();  
    int rectangleWidth = rectangle.width();  
    int rectangleHeight = rectangle.height();  
  
    group.scale(2);  
  
    assertEquals(circle.radius(), 2 * oldRadius);  
    assertEquals(rectangle.width(), 2 * rectangleWidth);  
    assertEquals(rectangle.height(), 2 * rectangleHeight);  
}
```

Adding a test for scalability

Accessing
radius

```
@Test public void scalingGroup() {  
    int oldRadius = circle.radius();  
    int rectangleWidth = rectangle.width();  
    int rectangleHeight = rectangle.height();  
  
    group.scale(2);  
  
    assertEquals(circle.radius(), 2 * oldRadius);  
    assertEquals(rectangle.width(), 2 * rectangleWidth);  
    assertEquals(rectangle.height(), 2 * rectangleHeight);  
}
```

Accessing
width and height

Updating Circle

```
public class Circle implements Widget {  
    private int x, y, radius;  
  
    public int radius() {  
        return radius;  
    }  
    ...  
}
```

Updating Rectangle

```
public class Rectangle implements Widget {  
    public int width() {  
        return Math.abs(x2 - x1);  
    }  
  
    public int height() {  
        return Math.abs(y2 - y1);  
    }  
    ...  
}
```

Scalability

```
public class Group {  
    public void scale(double s) {  
        for(Widget w : elements)  
            w.scale(s);  
    }  
    ... }  
}
```

```
public interface Widget {  
    ...  
    public void scale(double s); }  
}
```

```
public class Circle implements Widget {  
    public void scale(double s) {  
        radius *= s;  
    }  
}
```

```
public class Rectangle implements Widget {  
    public void scale(double s) {  
        x1 *= s; y1 *= s; x2 *= s; y2 *= s;  
    }  
}
```

Scalability

```
public class Group {  
    public void scale(double s) {  
        for(Widget w : elements)  
            w.scale(s);  
    }  
    ... }  
}
```

```
public interface Widget {  
    ...  
    public void scale(double s); }  
}
```

```
public class Circle implements Widget {  
    public void scale(double s) {  
        radius *= s;  
    }  
}
```

```
public class Rectangle implements Widget {  
    public void scale(double s) {  
        x1 *= s; y1 *= s; x2 *= s; y2 *= s;  
    }  
}
```

Finished after 0.032 seconds



Runs: 8/8 Errors: 0 Failures: 0

- hotdraw.test.HotDrawTest [Runner: JUnit 4] (0.001 s)
 - testEmptyCanvas (0.001 s)
 - testCanvas (0.000 s)
 - translatingCircle (0.000 s)
 - translatingRectangle (0.000 s)
 - translatingTheCanvas (0.000 s)
 - groupingWidgets (0.000 s)
 - translatingGroup (0.000 s)
 - scalingGroup (0.000 s)

Version 10

Making group recursive

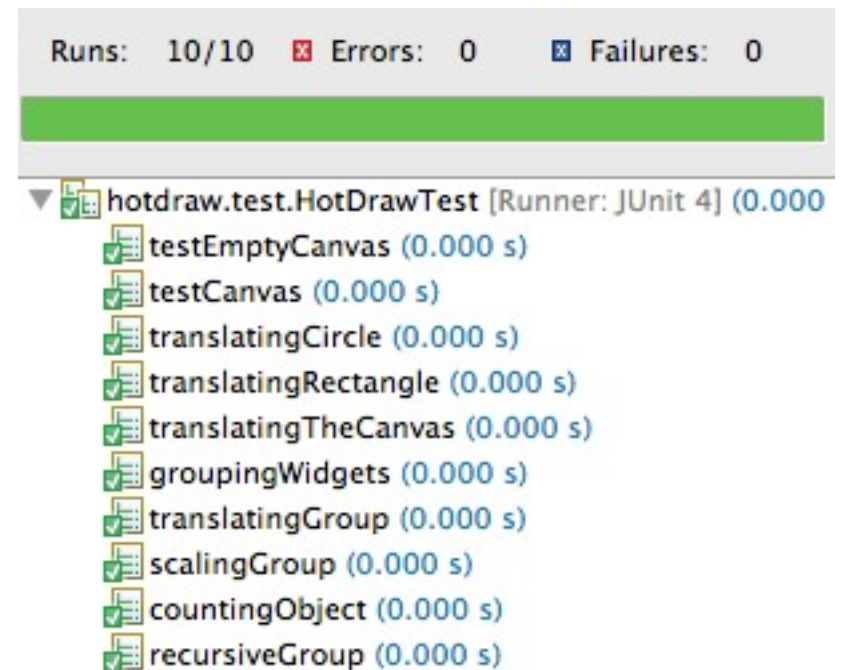
A group can now contain a group

Recursive group

```
@Test public void recursiveGroup() {  
    Group unGroup = new Group();  
    unGroup.add(emptyGroup);  
    group.add(unGroup);  
    assertEquals(emptyGroup.getNumberofElements(), 0);  
    assertEquals(unGroup.getNumberofElements(), 1);  
    assertEquals(group.getNumberofElements(), 3);  
}
```

Group implement Widget

```
public class Group implements Widget {  
    ...  
}
```





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