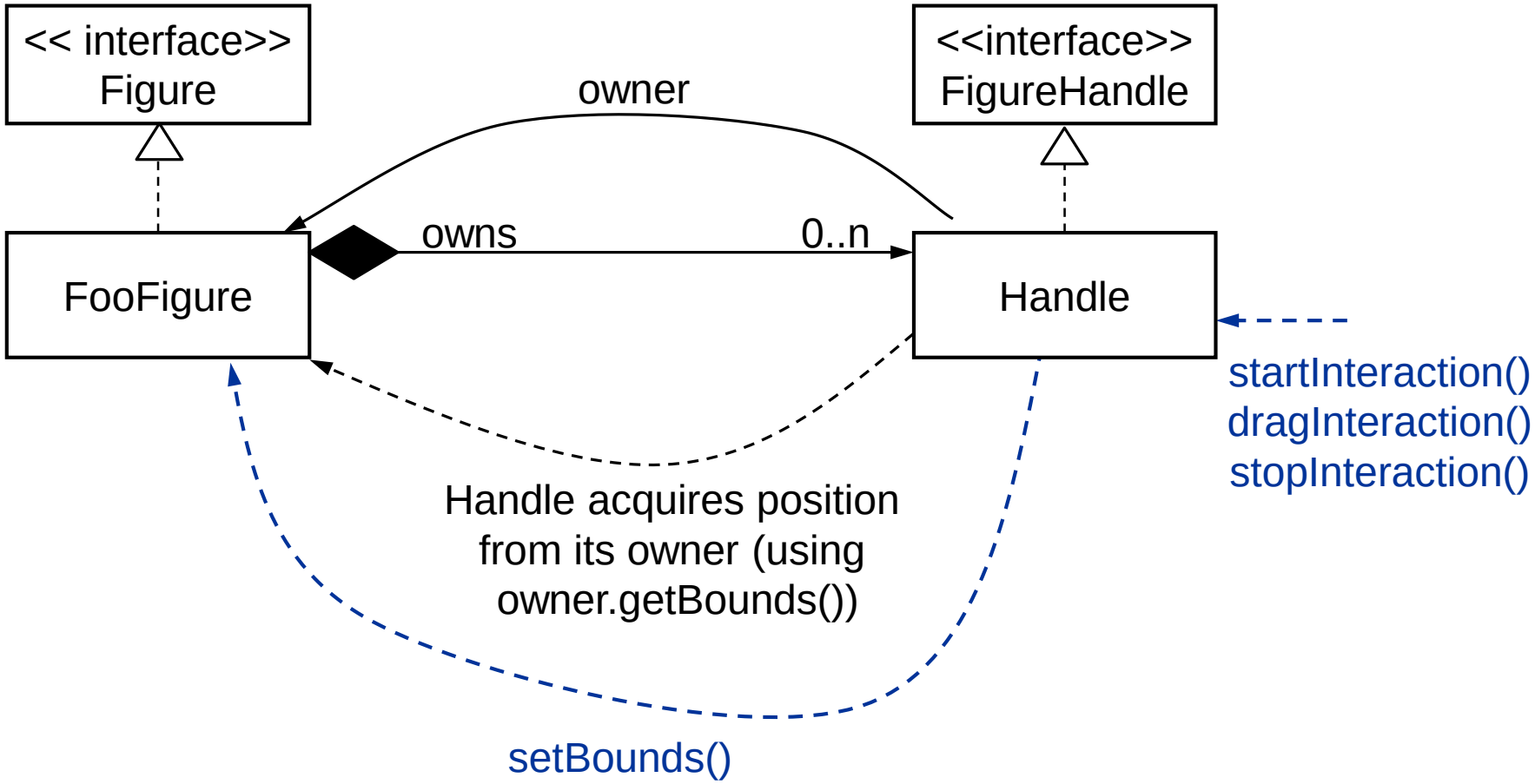
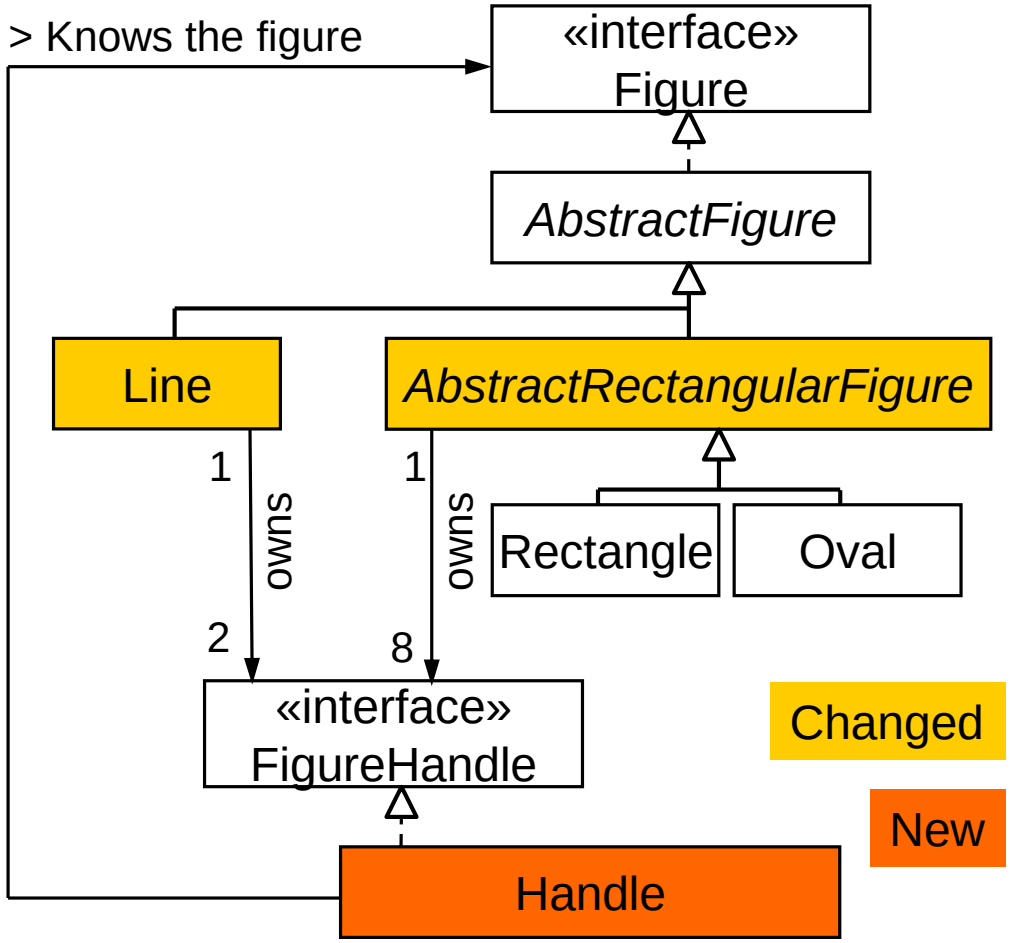
Figure and Handle : Overview



Single Handle Class

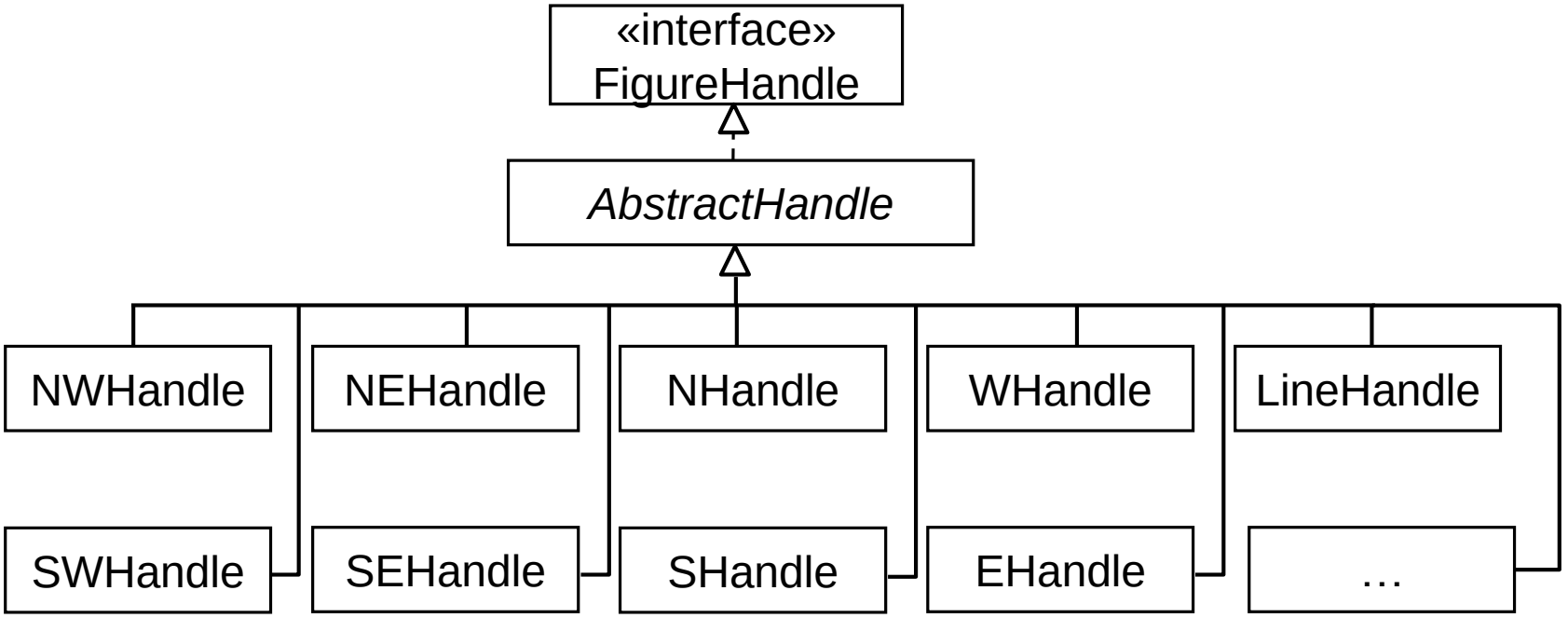
- **Single Handle-Class**
  - Behavior of the handle is determined with the arguments passed to the constructor

  => Many switch / if-else statements in the Handle-Class
- **Variants**
  1. Specialization in subclasses
  2. State-Pattern to out-source behavior



Variant 1: Specialization

- **Outsourcing of state-depending behavior in separate classes**



Variant 1: Specialization: AbstractHandle

```
public abstract class AbstractHandle implements FigureHandle {
  private static final int HANDLE_SIZE = 6;
  private final Figure owner;

  public AbstractHandle(Figure owner) { this.owner = owner; }

  @Override
  public Figure getOwner() { return this.owner; }

  @Override
  public boolean contains(int x, int y) {
    Point loc = getLocation();
    return Math.abs(x - loc.x) < HANDLE_SIZE / 2
        && Math.abs(y - loc.y) < HANDLE_SIZE / 2;
  }

  @Override public void draw(Graphics g) {...}
  ...
```

Many methods are the same for all handles if the handle location is given

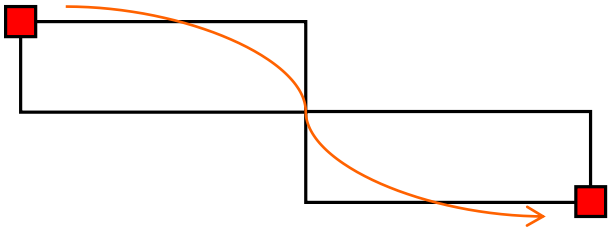
Variant 1: Specialization: NordWestHandle

```
public class NorthWestHandle extends AbstractHandle {
  @Override
  public Point getLocation() {
    Rectangle r = getOwner().getBounds();
    return new Point(r.x, r.y);
  }
  @Override
  public Cursor getCursor() {
    return Cursor.getPredefinedCursor(Cursor.NW_RESIZE_CURSOR);
  }
  @Override
  public void dragInteraction(int x, int y, ...) {
    Rectangle r = getOwner().getBounds();
    getOwner().setBounds(new Point(x,y),
        new Point(r.x+r.width, r.y+r.height));
  }
  ...
```

Variant 1: Specialization: NordWestHandle

```
@Override
public void dragInteraction(int x, int y, ...) {
  Rectangle r = getOwner().getBounds();
  getOwner().setBounds(new Point(x,y),
      new Point(r.x+r.width, r.y+r.height));
}
...
```

- **Problem**



  - Now x == r.x + r.width
    and y == r.y + r.height

Drag Interaction Problem: Solution A

- **Prevent to move beyond opposite side**
  - Visio uses this approach

```
@Override
public void dragInteraction(int x, int y, ...) {
  Rectangle r = getOwner().getBounds();
  getOwner().setBounds(
    new Point(
      Math.min(x, r.x+r.width),
      Math.min(y, r.y+r.height)),
    new Point(r.x+r.width, r.y+r.height)
  );
}
```

Drag Interaction Problem: Solution B

- **Store opposite corner (or original bounds) in startInteraction**
  - Use the fixed point (or the original bounds) for setBounds calls

```
public abstract class AbstractHandle implements FigureHandle {
  private Point fixedCorner;

  @Override public void startInteraction(int x, int y, ...) {
    fixedCorner = getFixedCorner();
  }

  @Override public void dragInteraction(int x, int y, ...) {
    owner.setBounds(getVariableCorner(x, y), fixedCorner);
  }

  @Override public void stopInteraction(int x, int y, ...) {
    fixedCorner = null;
  }
}
```

Drag Interaction Problem: Solution B

- **Store opposite corner (or original bounds) in startInteraction**
  - Use the fixed point (or the original bounds) for setBounds calls

```
public class NorthWestHandle extends AbstractHandle {
  ...

  @Override
  public Point getFixedCorner() {
    Rectangle r = getBounds();
    return new Point(r.x + r.width, r.y + r.height);
  }

  @Override
  public Point getVariableCorner(int x, int y) {
    return new Point(x, y);
  }
```

Drag Interaction Problem: Solution B

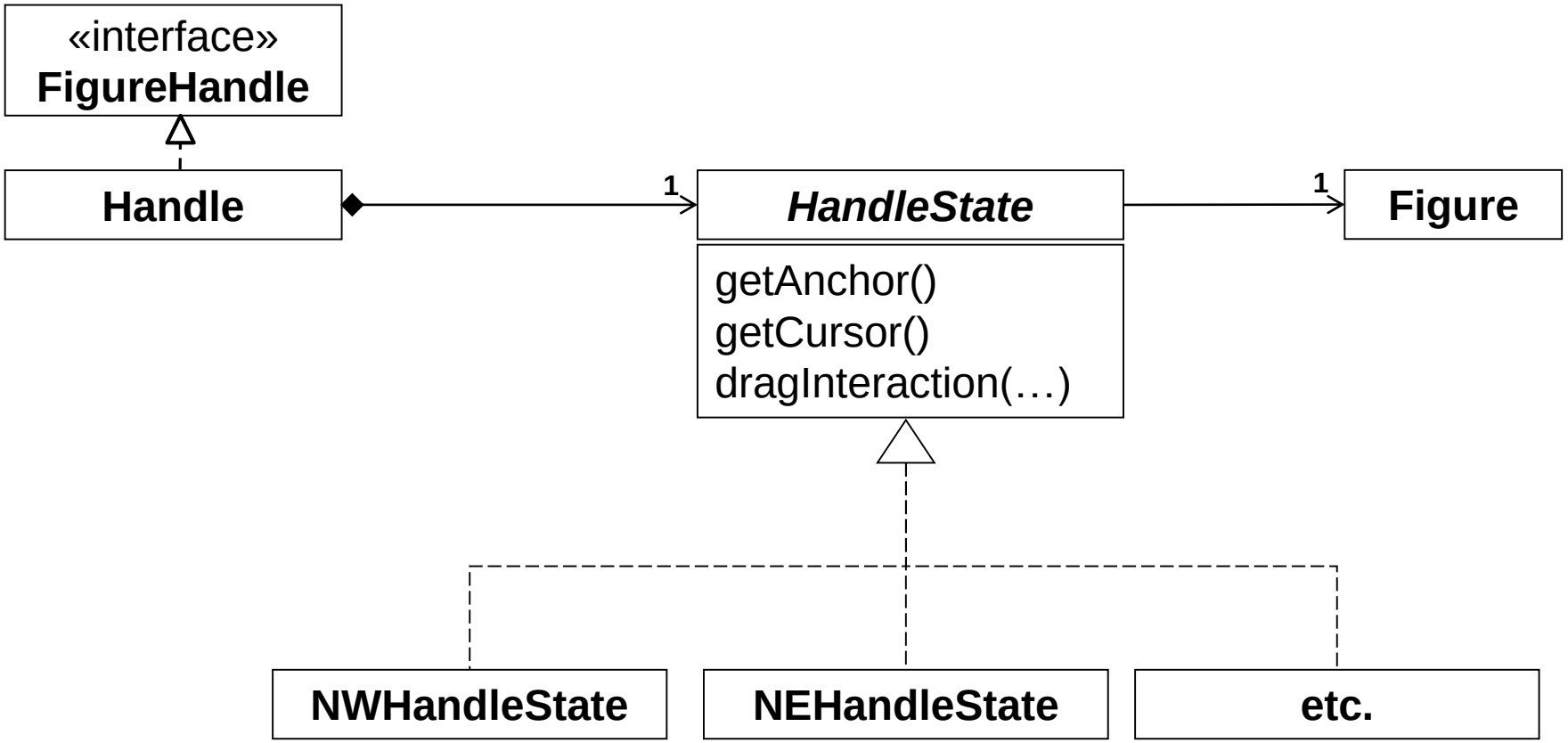
- **Store opposite corner (or original bounds) in startInteraction**
  - Use the fixed point (or the original bounds) for setBounds calls

```
public class NorthHandle extends AbstractHandle {
  ...

  @Override
  public Point getFixedCorner() {
    Rectangle r = getBounds();
    return new Point(r.x + r.width, r.y + r.height);
  }

  @Override
  public Point getVariableCorner(int x, int y) {
    // the x-coordinate of the mouse is ignored
    Rectangle r = getBounds();
    return new Point(r.x, y);
  }
```

Variant 2: State Pattern



Variant 2: State Pattern: Handle

```
public class Handle implements FigureHandle {
  private HandleState state;
  public Handle(HandleState state) { this.state = state; }

  public void setState(HandleState state) {
    this.state = state;
  }
  public HandleState getState() { return state; }

  @Override
  public void dragInteraction(int x, int y, MouseEvent e, DrawView v) {
     state.dragInteraction(x, y, e, v);
  }

  @Override
  public void draw(Graphics g) { … }
  …
```

State of a handle can be changed at run-time

dragInteraction() is delegated to the state object.

Variant 2: State Pattern: NorthWestState

```
public class NorthWestState extends AbstractHandleState {
  public NorthWestState(Figure owner) { super(owner); }

  @Override
  public void dragInteraction(int x, int y, ...) {

    Rectangle r = getOwner().getBounds();
    getOwner().setBounds(new Point(x,y),
                         new Point(r.x+r.width,r.y+r.height));

    if (x > r.x+r.width) {
      owner.swapHorizontal();
    }
    if (y > r.y+r.height) {
      owner.swapVertical();
    }
  }
}
```

This is the code which did not work for variant 1 (slide 6).

If the handle is moved across fix corners, then several handles have to swap their state objects. Thus these swapXXX methods have to be implemented at a common place, e.g. in class Figure.

Variant 2: State Pattern: State Exchanger

```
public class Rect extends AbstractRectangularFigure {
  Handle NW = new Handle(new NorthWestState());
  …
  public void swapHorizontal() {
    HandleState NWstate = NW.getState();
    HandleState NEstate = NE.getState();
    HandleState SWstate = SW.getState();
    HandleState SEstate = SE.getState();
    HandleState WState  = W.getState();
    HandleState EState  = E.getState();
    NW.setState(NEstate);
    NE.setState(NWstate);
    SW.setState(SEstate);
    SE.setState(SWstate);
    W.setState(EState);
    E.setState(WState);
  }
```

All horizontally opposing handles have to be swapped.

swapVertical analog.

Variant 2: State Pattern: State Exchanger

```
public class Rect extends AbstractRectangularFigure {
  …
  private static void swapHorizontal(Figure owner) {
    for(FigureHandle fh : owner.getHandles()) {
      Handle h = (Handle)fh;
      h.setState(h.getState().swapHorizontal());
    };
  }

  public static class NW extends AbstractHandleState {
    …
    @Override public HandleState swapHorizontal() {
      return new NE(getOwner());
    }
    @Override public HandleState swapVertical() {
      return new SW(getOwner());
    }
}
```

Swapping can also be delegated to the state objects