eclipse CON 2004

The Graphical Editing Framework

Agenda

- About the GEF project
- Draw2d Introduction
- GEF Tutorial
- Tips and Techniques
- On the horizon
- Q & A

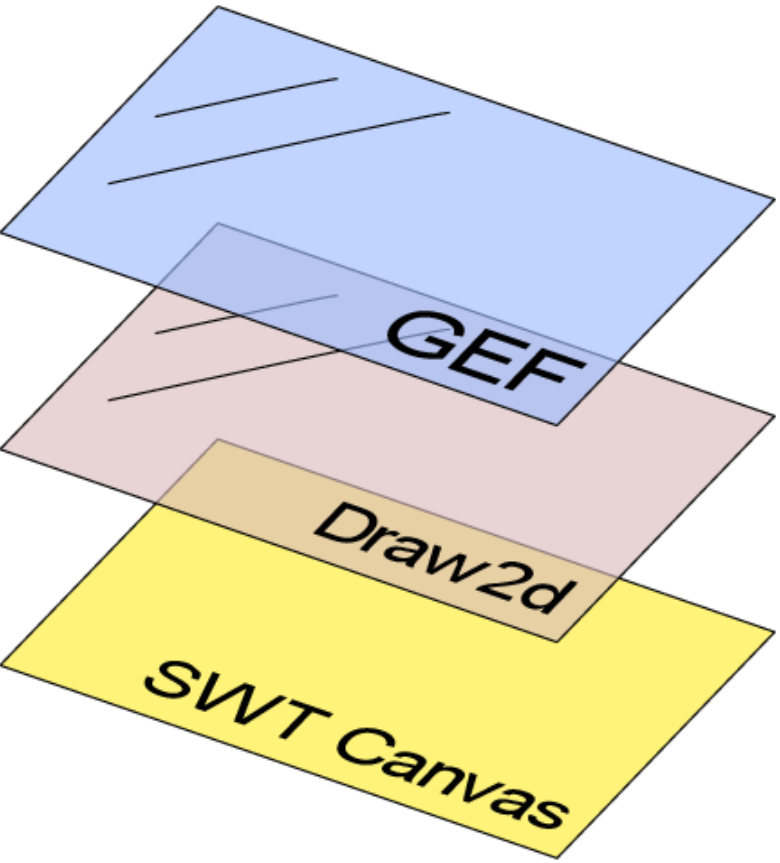
What is GEF?

- Graphical Editing Framework
- Part of the Eclipse Tools Project
  - http://www.eclipse.org/gef
- A feature with 2 plug-ins
  - Draw2d
  - GEF
- Stable
- Active
  - news://news.eclipse.org/eclipse.tools.gef

GEF History

- Visual Age
- Create a foundation for GUI builders, and more
  - (Now the Eclipse Visual Editor Project)
- 4 years active development
- Used for
  - Class diagrams
  - Organization charts
  - Flow/Activity diagrams
  - State machines
  - E-R diagrams
  - GUI builders

GEF Overview

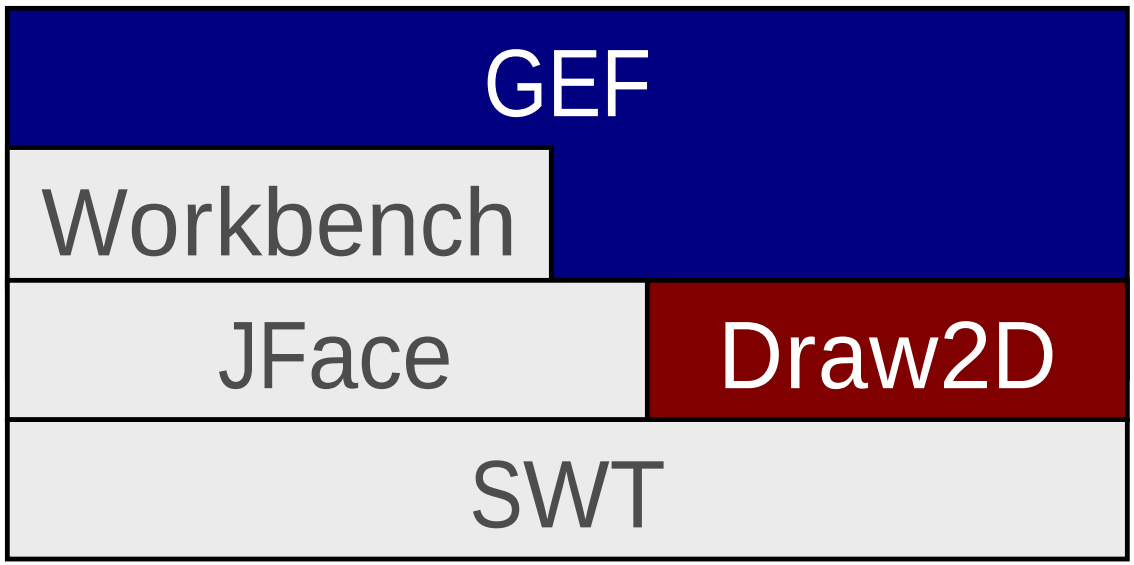


- Interaction Layer
- Model-to-View mapping
- Workbench Integration

- Rendering
- Layout
- Printing

- Native (SWT) Layer

GEF Overview

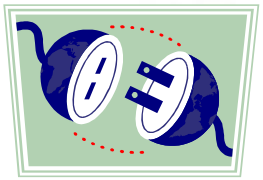


Draw2d

- Lightweight toolkit built with SWT
- Optimized layout and painting

- Features:
  - Zoom
  - Print
  - Overview
  - Layering
  - Hierarchical Tree Layout 3.0
  - Directed Graph Layout 3.0
  - Non-rectangular figures
  - Decorated connections

GEF (the plug-in)



- An editing framework based on *Viewers*
- The “interaction” layer
- **Draw2d** for graphics
- MVC architecture
  - Flexible mappings between model and view
  - B.Y.O.M.

GEF Features

- Palette
  - Standard set of tools
  - User customization allowed
- Undo/Redo support
- Direct-edit (in place editing)
- Rulers and Guides **3.0**
- Snap-to-{Guide, Grid, Geometry} **3.0**
- Accessible: keyboard, voice, magnifier

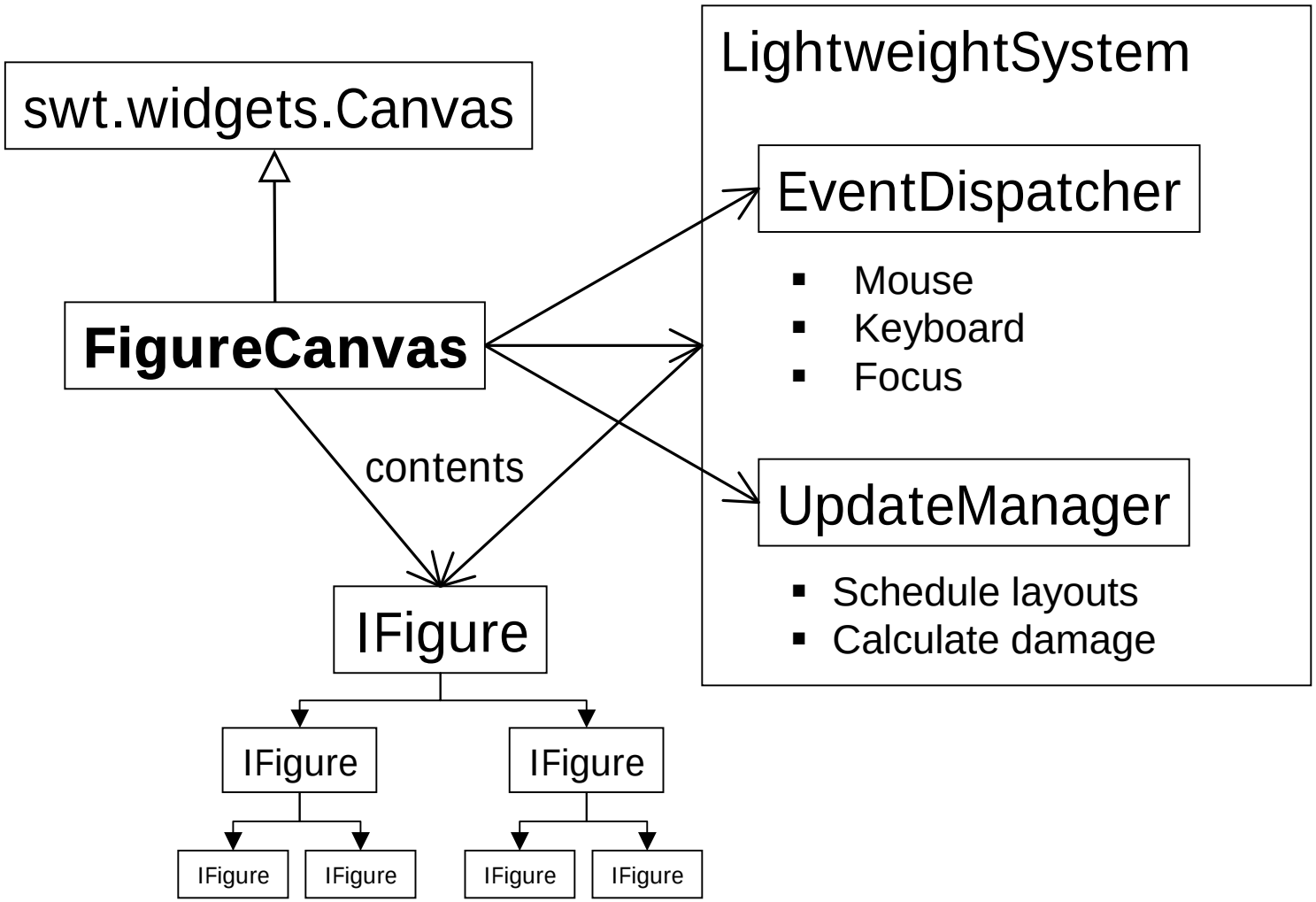
Draw2d – Introduction

- Hello World
- Constructing a UML diagram

Draw2d – Hello World

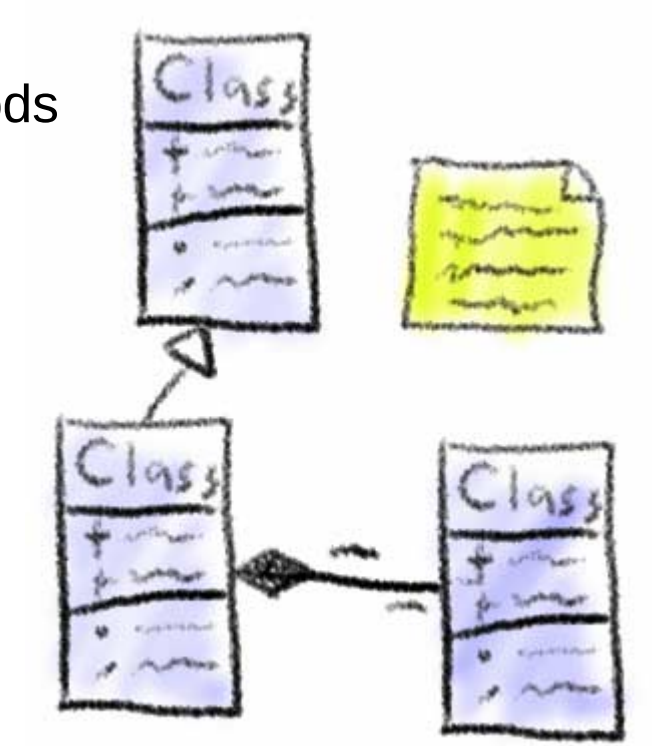

```
Display d = new Display();
Shell shell = new Shell(d);
shell.setLayout(new FillLayout());

FigureCanvas canvas = new FigureCanvas(shell);
canvas.setContents(new Label("Hello World"));

shell.open();
while (!shell.isDisposed())
    while (!d.readAndDispatch())
        d.sleep();
```

Draw2d – Behind the Scenes



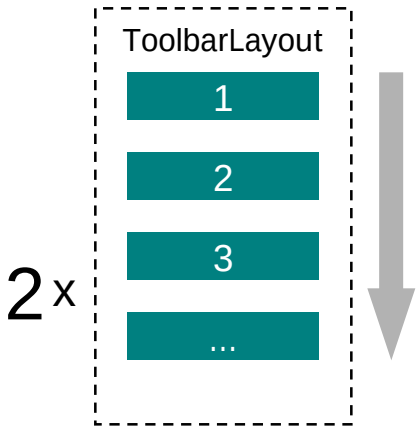
Draw2d – UML Diagram Example

- Class (or type) figure
  - Name and icon
  - Compartments for attributes/methods
- Associations/Inheritance
- “Sticky” notes for documentation



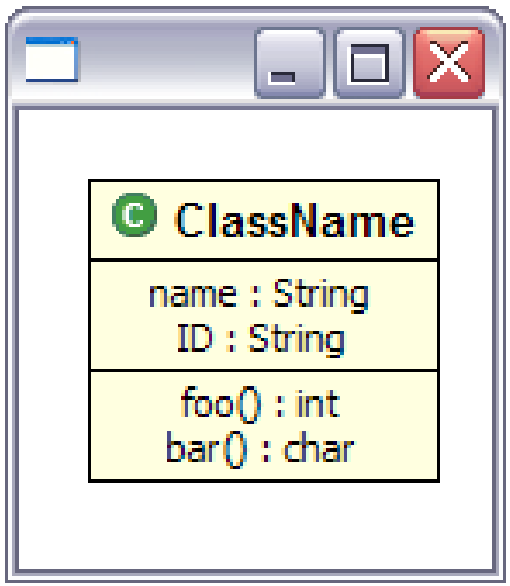
Draw2d – UML Class Figure design

- Extend `Figure`
- Header
  - Just a `Label` figure
- Compartments
  - Vertical `ToolbarLayout`
  - Custom border for separator line
- `LineBorder` around class
- Another ToolbarLayout for the whole figure



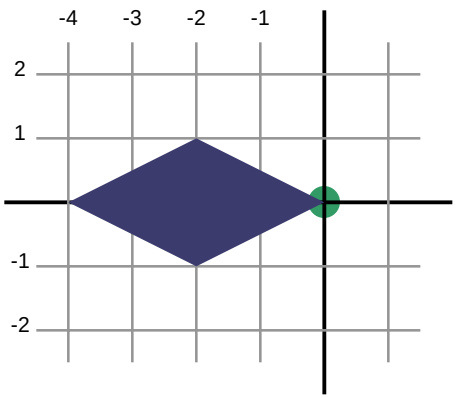
Draw2d – UML Class

- Hmm, Not quite perfect..
- Toolbar layout tweaks
  - #setMinorAlignment(TOP_LEFT)
  - #setStretchMinorAxis(false)

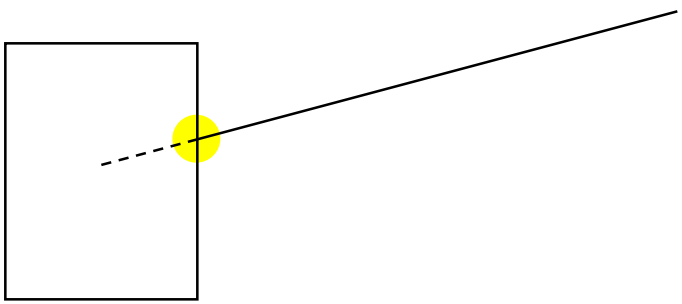


Draw2d – Relationships and Inheritance

- `PolylineConnection`
  - Delegating layout manager
- `PolygonDecoration`
  - #setTemplate(PointList)

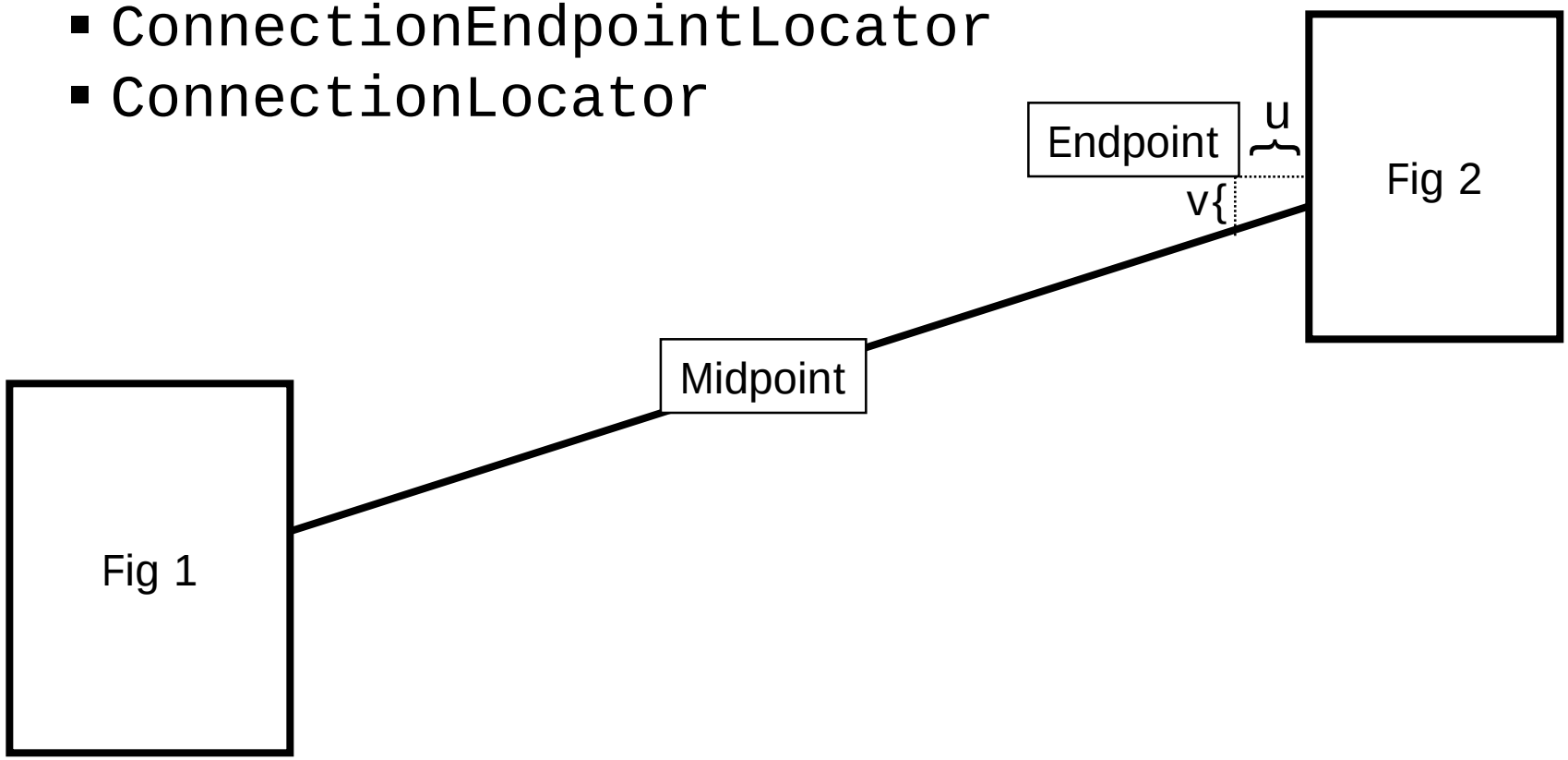


- `ChopboxAnchor`



Draw2d – Labeling Connections

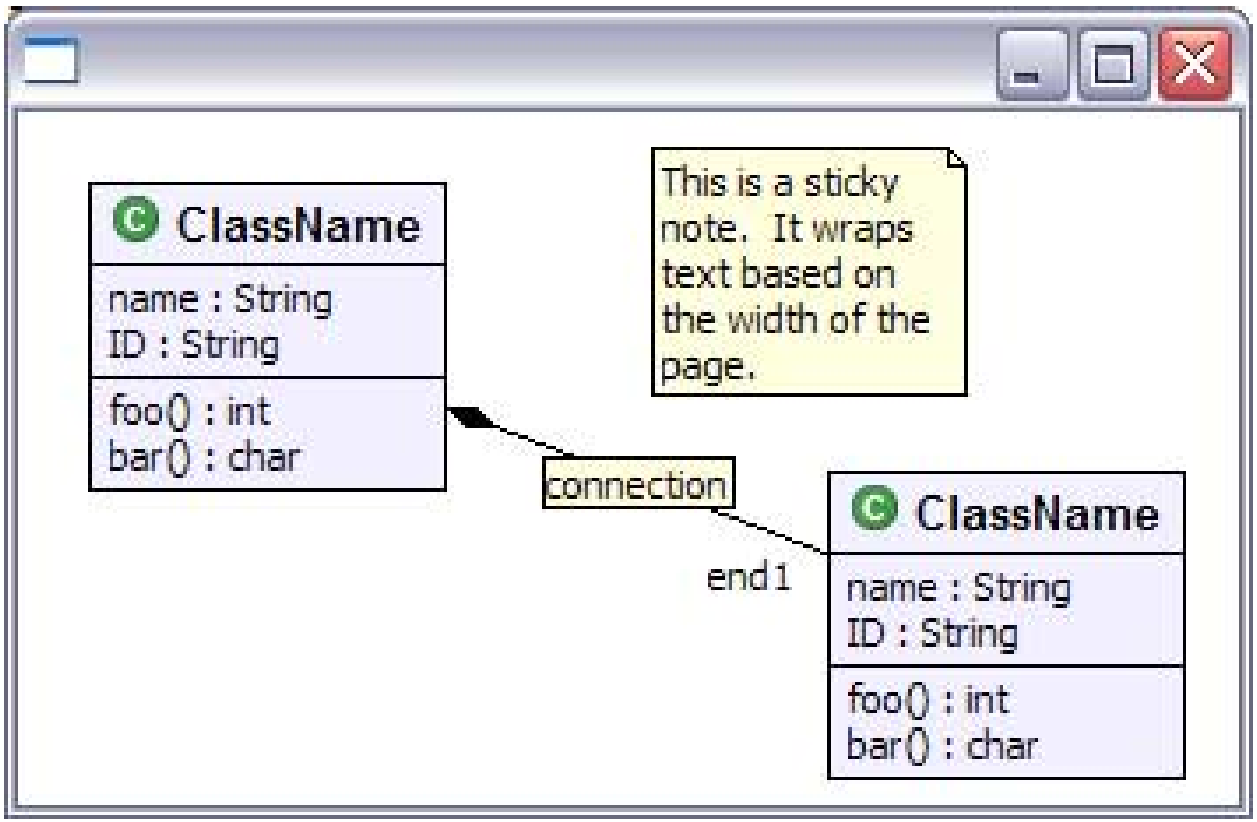
- `ConnectionEndpointLocator`
- `ConnectionLocator`



Draw2d – Sticky Notes

- org.eclipse.draw2d.text
- `FlowPage` – root for “flowing” figures
- `TextFlow` – wraps text in a paragraph
- Custom “folded-corner” border

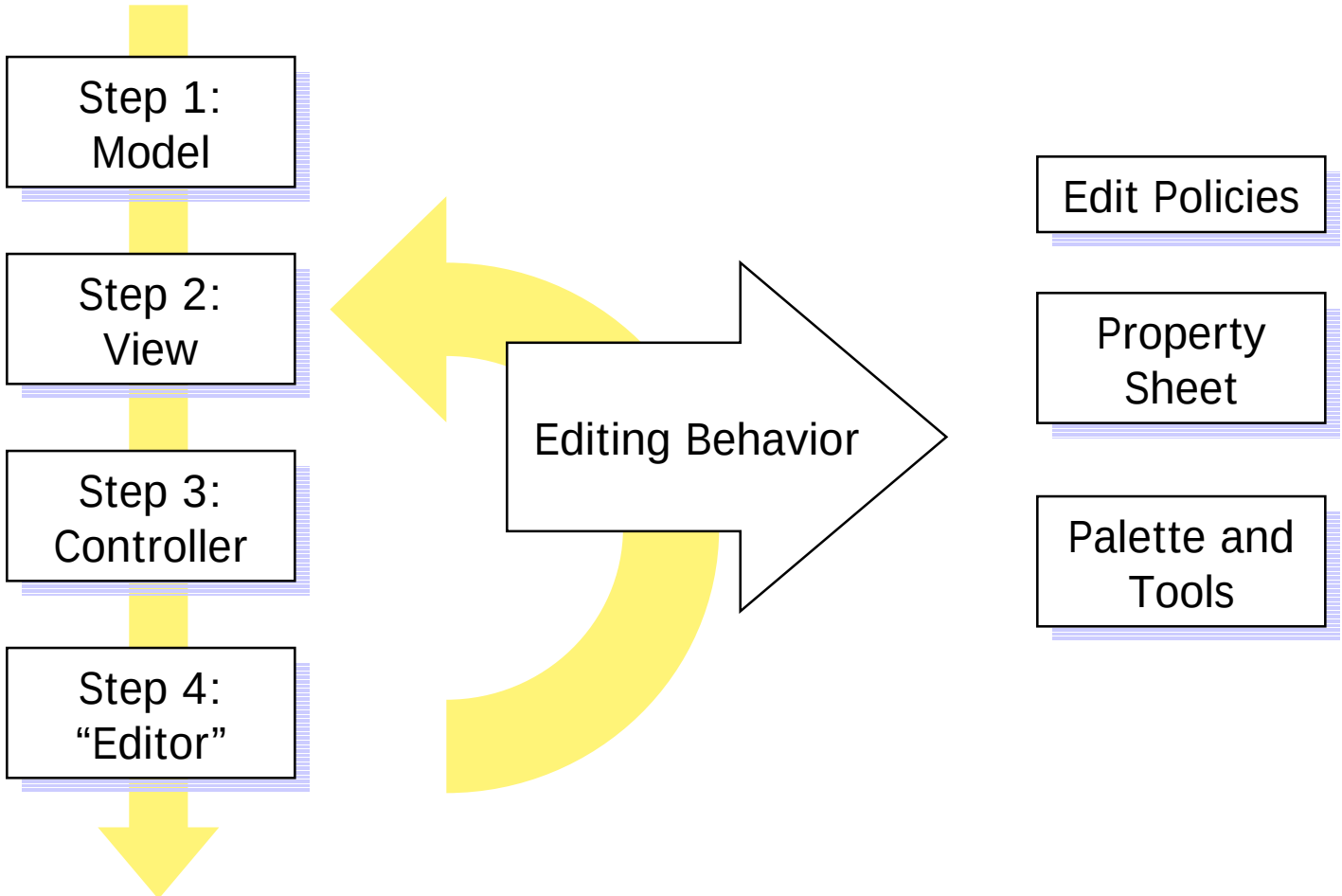
Draw2d – UML Diagram



GEF – Tutorial

- Based on article @ developerWorks
- For more reference articles, go to: http://www.eclipse.org/gef

GEF – Tutorial



Step 1 – The model

- Bring your own model
- Model requirements
  - Notification mechanism
  - Persistence is your responsibility
- Business model vs. Diagram model
- Commands

Step 2 – The View

- Draw2d Figures
- Don’t reinvent the wheel
- Information hiding
- Encapsulate to reduce coupling

Step 3 – Controllers: EditParts

- Unit of “interaction”
- Selection is comprised of EditParts
- Figure or TreeItem-based
- EditPartViewer
- Special EditParts:
  - Root
  - Contents
  - Connections

Step 4 – Bring it all together

- Create your workbench part (`EditorPart`)
- An `EditDomain`
- Instantiate some viewer
- Set the factory and contents for the viewers

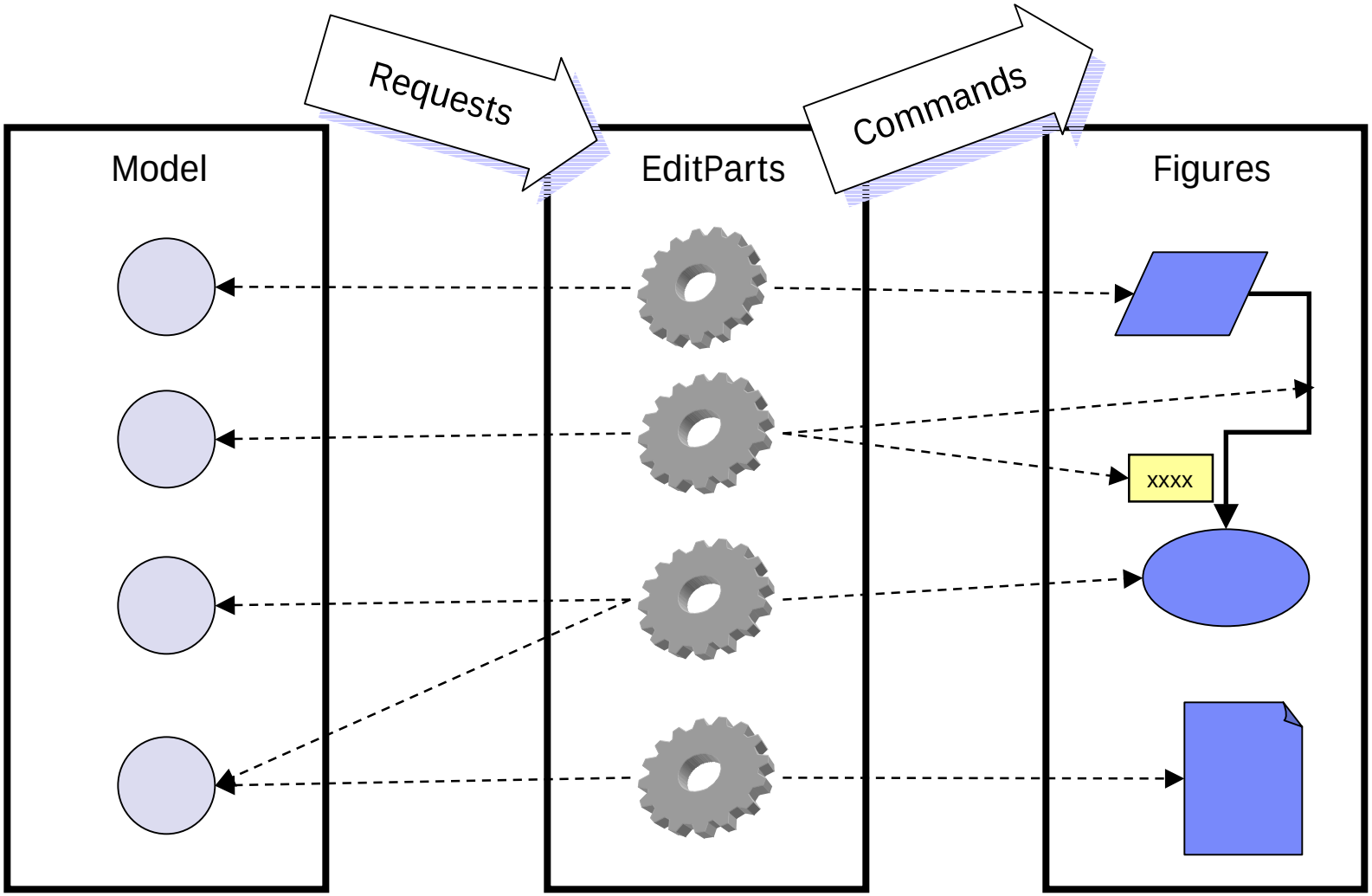
Next – Adding Edit Support

- Add editing capability
  - Commands to change model
  - Install *Edit Policies* for commands and feedback
  - Add listeners to the model to refresh UI
- Edit policies
  - Pluggable helpers on an editpart
  - Handle a specific part feature
  - May contribute to feedback, commands, and targeting
  - Examples include

GEF – Conventions and Patterns

- Tools to interpret mouse and keyboard
- Requests to encapsulate interactions
- Absolute coordinates
- Edit Policies for separation of concerns
- Command pattern for undo/redo
- Use of IAdaptable

GEF: Model - Controller – View



GEF – Tips and Techniques

T&T: Accessibility

- Eclipse is accessible
- GEF is accessible
- `IAdaptable#getAdapter(Class)`
  - `AccessibleEditPart`
    - Magnifier and Screen reader API
- Focus indication (Selection Edit Policies)
- Default keyboard handlers
- Accessible Tools
  - AccessibleAnchorProvider
  - AccessibleHandleProvider

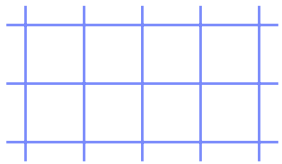
T&T: Auto Scrolling

- During drag operations, including native DND
- Search from target part upwards
- `AutoExposeHelper`
  - #detect(Point)
  - #step(Point)
- Not just for scrolling
  - Expanding
  - Page-flipping
- Related: `ExposeHelper`
  - Programmatically “reveal” an EditPart

T&T: Rulers and Guides

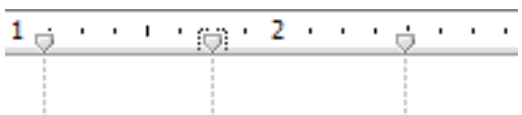
- Work in progress
- Viewers now have properties
- Ruler-specific properties:
  - Horizontal ruler
  - Vertical ruler
  - Ruler visibility
- `RulerComposite`
- `RulerProvider`
  - Provide guide locations

T&T: Snap-To-“G”



- **G**rid
  - Dragging and resizing confined to grid coordinates

- **G**eometry
  - Dragging and resizing snap to the rows or columns implied by existing objects in the diagram



- **G**uides
  - Snap to user defined horizontal or vertical guides

T&T: Snap-To-“G” continued

- IAdaptable#getAdapter(Class)
- `SnapToStrategy`
- Extended data on Request
- Client’s responsibilities
  - Representing guides in the model
  - Model/Command support to attach parts to guides

T&T: Direct Editing

- `DirectEditRequest` sent by select tracker
- May contain mouse location or modifier keys
- DirectEditManager
  - Manages CellEditor lifecycle
  - Tracks modification and committing
  - Live feedback on diagram
  - Value validation
  - Obtains the command for applying value
- Improved CellEditor API in Eclipse 3.0

T&T: Animation

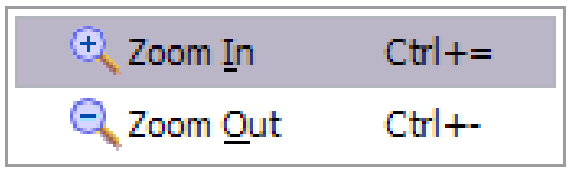
- Demonstrated in GEF palette and Flow Example
- Create an Animation coordinator class
- Capture the effects of layouts as they occur
- Playback the layout incrementally
  - `0 < progress < 1`
  - Each step calls revalidate on participants of animation
- Force layouts without repainting
- It's not always easy

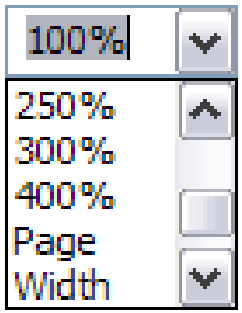
T&T: Property Sheet Support

- Implement `IPropertySource` on
  - the model object
  - the EditPart
  - Custom adapter for combining multiple sources
- GEF provides undo/redo support via commands

T&T: Zoom and Scaling

- Use a root EditPart supporting scaling
- Actions and widgets for toolbars/menus





- Separation and compression
- Use back-to-front painting
- Same issues apply for overview and printing

Future Work

- More and better graph layout algorithms
- Connection Routers
- Investigate new mediums
  - OpenGL
  - Java2D
- Provide common shapes/symbols
- WYSIWYG Documents and Text
- New Palette objects and presentations

Questions?