# Transient View Generation in Eclipse

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`www.informatik.uni-kiel.de/rtsys`

ACademics Modelling with Eclipse, July 2, 2012

**K**iel **I**ntegrated **E**nvironment for **L**ayout
Eclipse Rich Client

# Outline

## KIELER

Message

KIELER @ Work – Employment in MENGES

## Related Work

## Transient Views

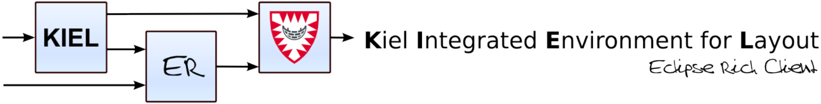
Motivating Examples

Characterization

KRendering Description Model

## Conclusion

# KIELER Message



Challenge: Free user of manual mechanical work

Message: While modeling focus on *model-ing*

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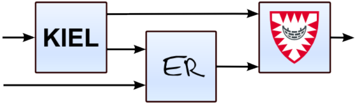

**K**iel **I**ntegrated **E**nvironment for **L**ayout
Eclipse Rich Client

Challenge: Free user of manual mechanical work

Message: While modeling focus on *model-ing*

Our focus: *Pragmatics* of modeling languages

- Apply the MVC to the users' perspective

**Key enabler: flexible & content-aware automatic layout**

H. Fuhrmann and R. v. Hanxleden, Taming Graphical Modeling (MoDELS'10)

# KIELER @ Work – Employment in MENGES KoSSE[1]

- Joint research project of industry & academia
- Aims at developing DSLs for railway signaling systems
- Specifications are of textual nature
  - ☺ easy to formulate
  - ☺ version control
  - ☹ comprehensibility reduces
- Shall be extended by graphical views on various aspects

[1] https://menges.informatik.uni-kiel.de/

# KIELER @ Work – Employment in MENGES[1]

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# Related Work

- Akos Ledeczi et al.
  The Generic Modeling Environment
  IEEE Workshop on Intelligent Signal Processing (WISP 2001)
- Gergely Mezei et al.
  Visual presentation solutions for domain specific languages
  IASTED International Conference on Software Engineering (2006)
- GMF Tooling

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  ACM/IEEE 13th International Conference on Model Driven Engineering Languages and Systems (MoDELS 2010)

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Benjamin B. Bederson et al.
Toolkit Design for Interactive Structured Graphics
IEEE Transactions on Software Engineering, Vol. 30, No. 8 (2004)

# Related Work

Robert Ian Bull
Towards A Model Driven Engineering Approach For Information Visualization
Ph.D. thesis, University of Victoria, BC, Canada (2008)

Graphiti project (http://www.eclipse.org/graphiti/)

Jan Koehnlein
Discovery Diagrams for the Generic Graphical View
http://koehnlein.blogspot.de/2012/01/discovery-diagrams-for-generic.html

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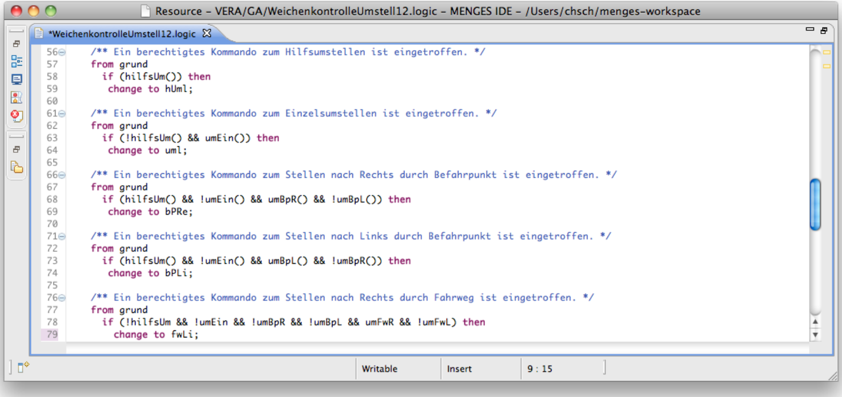
# Example 1: Textual DSLs



Resource – VERA/GA/WeichenkontrolleUmstell12.logic – MENGES IDE – /Users/chsch/menges-workspace

*WeichenkontrolleUmstell12.logic

```
/** Ein berechtigtes Kommando zum Hilfsumstellen ist eingetroffen. */
from grund
  if (hilfsUm()) then
   change to hUml;

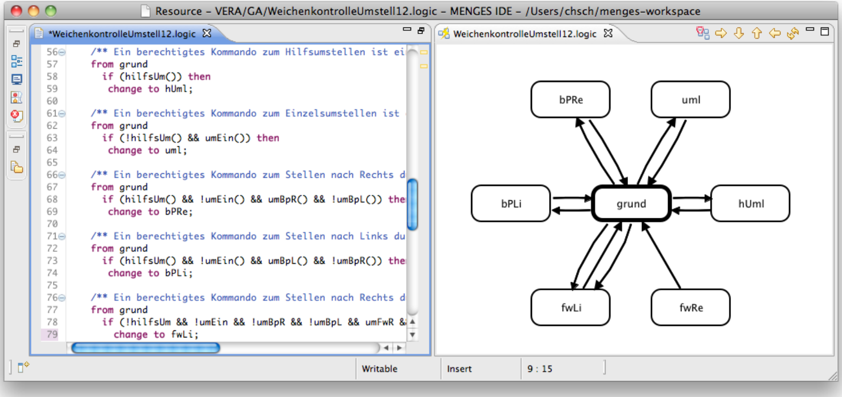
/** Ein berechtigtes Kommando zum Einzelsumstellen ist eingetroffen. */
from grund
  if (!hilfsUm() && umEin()) then
   change to uml;

/** Ein berechtigtes Kommando zum Stellen nach Rechts durch Befahrpunkt ist eingetroffen. */
from grund
  if (hilfsUm() && !umEin() && umBpR() && !umBpL()) then
   change to bPRe;

/** Ein berechtigtes Kommando zum Stellen nach Links durch Befahrpunkt ist eingetroffen. */
from grund
  if (hilfsUm() && !umEin() && umBpL() && !umBpR()) then
   change to bPLi;

/** Ein berechtigtes Kommando zum Stellen nach Rechts durch Fahrweg ist eingetroffen. */
from grund
  if (!hilfsUm && !umEin && !umBpR && !umBpL && umFwR && !umFwL) then
    change to fwLi;
```

# Proposal: Transient Graphical Diagram – Demo



Resource – VERA/GA/WeichenkontrolleUmstell12.logic – MENGES IDE – /Users/chsch/menges-workspace
*WeichenkontrolleUmstell12.logic
WeichenkontrolleUmstell12.logic
bPRe
uml
bPLi
grund
hUml
fwLi
fwRe
Writable
Insert
9 : 15

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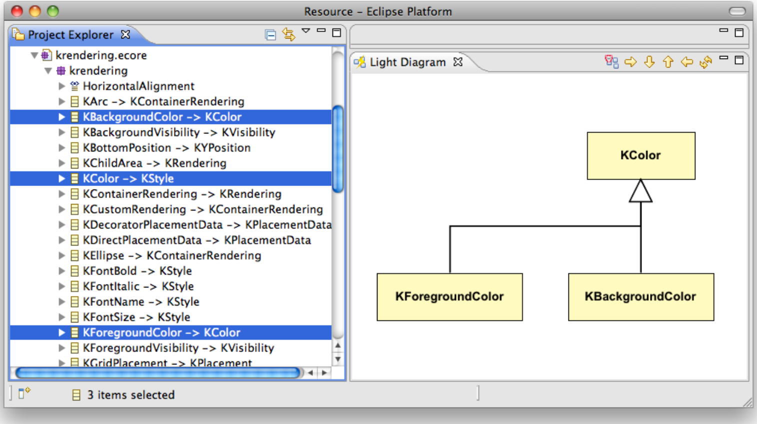
        change to fwLi;
```

# Example 2: Class Diagrams – Demo



- krendering.ecore
  - krendering
    - HorizontalAlignment
    - KArc -> KContainerRendering
    - KBackgroundColor -> KColor
    - KBackgroundVisibility -> KVisibility
    - KBottomPosition -> KYPosition
    - KChildArea -> KRendering
    - KColor -> KStyle
    - KContainerRendering -> KRendering
    - KCustomRendering -> KContainerRendering
    - KDecoratorPlacementData -> KPlacementData
    - KDirectPlacementData -> KPlacementData
    - KEllipse -> KContainerRendering
    - KFontBold -> KStyle
    - KFontItalic -> KStyle
    - KFontName -> KStyle
    - KFontSize -> KStyle
    - KForegroundColor -> KColor
    - KForegroundVisibility -> KVisibility
    - KGridPlacement -> KPlacement

3 items selected

# Transient Graphical Views

Characteristics:

- Lightweight
- Flexible
- “Intelligent”
- Easy to define & contribute

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## Characteristics:

- Lightweight
- Flexible
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## Requirements:

- Automatic arrangement of depicted elements – macro layout
- Local arrangement of the figures’ primitives – micro layout
- Drawing by means of an efficient graphics framework
- Appropriate description language to formulate diagrams

# Our Contribution: KRendering Meta Model

- Designed for describing concrete diagrams
- Is built upon the KGraph meta model used by the KIELER Infrastructure for Meta Layout (KIML)
- Provides primitive figures to be composed to complex ones
- Enables smart micro layout descriptions

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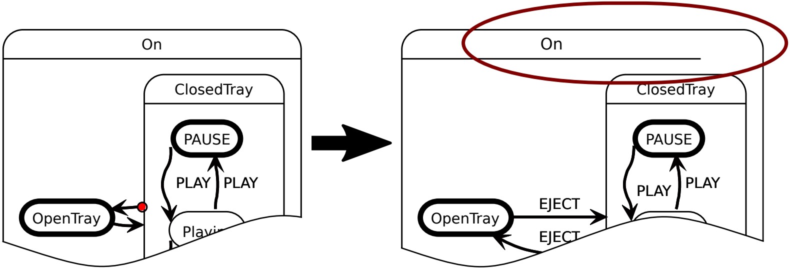
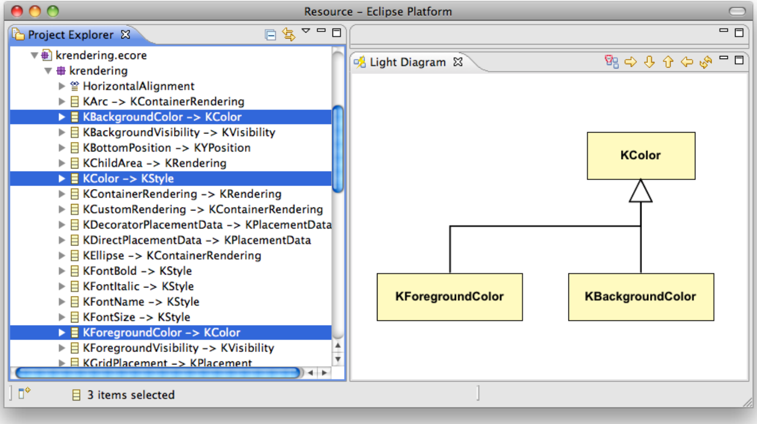


# KRendering Diagram Description – Example



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# KRendering Diagram Description – Example

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    algorithm = "ogdf.planarization",
    direction = UP, spacing = 75.0
  }
  KNode { /* "KColor" figure */
    KShapeLayout {
       width 180.0 height 80.0
    }
    Rectangle {
      lineWidth 2, backgroundColor 255 250 205
      Text "KColor" {
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      }
    }
  }
  KNode { /* "KBackgroundColor" figure */
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      width 242.0 height 80.0
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      }
    }
  }
```

```
  --> "//children.0" {
    KEdgeLayout {
       edgeType = GENERALIZATION
    }
    Polyline  {
      lineWidth 2
      Polygon {
        lineWidth 2, backgroundColor 255 255 255
        polylinePlacementData {
          points:
            left   0.0 0.0 / top 0.0 0.0,
            right  0.0 0.0 / top 0.0 0.5,
            left   0.0 0.0 / bottom 0.0 0.0
          detailedPlacementData:
            decoratorPlacementData {
              relative,  location  1.0,
              xOffset  -35, yOffset -17.5,
              width 35, height 35
            }
        }
      }
    }
  }
  KNode { /* "KForegroundColor" figure */
    KShapeLayout {
      width 242.0 height 80.0
    }
  ...
}
```

# Benefits & Realization

- Enables view synthesis in model-based fashion
- Efficient application of automatic layout (no graph extraction)
- Views can be updated interactively by changing the model
- Forms a basis for efficient view management as proposed by

H. Fuhrmann and R. v. Hanxleden, Taming Graphical Modeling (MoDELS'10)

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- Experimentally implemented in the KIELER Lightweight Diagrams project (KLighD)
  - Is provided with mappings
  - Chooses a fitting one if objects are to be depicted

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# Conclusion & Further Work

- Lots of productivity wasted with drawing diagrams manually
- Transient views appear to be a promising means for visualizing models or model excerpts
- Form a means for browsing and even modifying models

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  - Synthesis of transient views in a generative way
  - General treatment of diagram labels
  - Smart layout configuration
- `http://www.informatik.uni-kiel.de/rtsys/kieler/`

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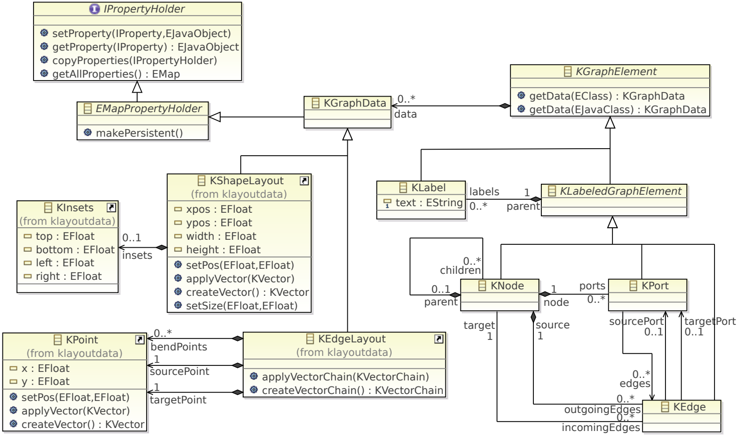
thanks!

questions or comments?

# Appendix

# Appendix – KGraph Meta Model

## with KLayoutData



*IPropertyHolder*
- setProperty(IProperty,EJavaObject)
- getProperty(IProperty) : EJavaObject
- copyProperties(IPropertyHolder)
- getAllProperties() : EMap

*EMapPropertyHolder*
- makePersistent()

KGraphData

*KGraphElement*
- getData(EClass) : KGraphData
- getData(EJavaClass) : KGraphData

KShapeLayout (from klayoutdata)
- xpos : EFloat
- ypos : EFloat
- width : EFloat
- height : EFloat
- setPos(EFloat,EFloat)
- applyVector(KVector)
- createVector() : KVector
- setSize(EFloat,EFloat)

KInsets (from klayoutdata)
- top : EFloat
- bottom : EFloat
- left : EFloat
- right : EFloat

KLabel
- text : EString

*KLabeledGraphElement*

KNode

KPort

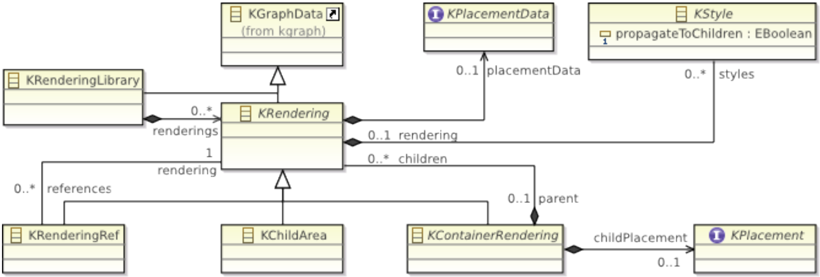
KEdge

KPoint (from klayoutdata)
- x : EFloat
- y : EFloat
- setPos(EFloat,EFloat)
- applyVector(KVector)
- createVector() : KVector

KEdgeLayout (from klayoutdata)
- applyVectorChain(KVectorChain)
- createVectorChain() : KVectorChain

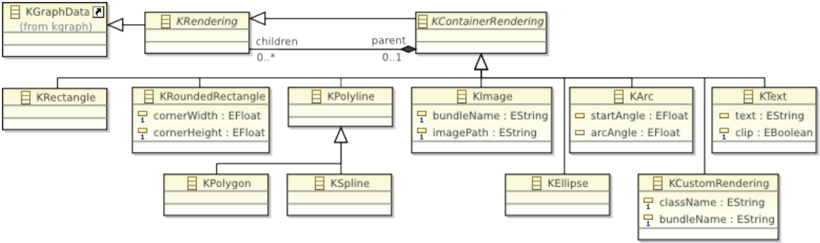
# Appendix – KRendering Meta Model 1/3

## Core Elements



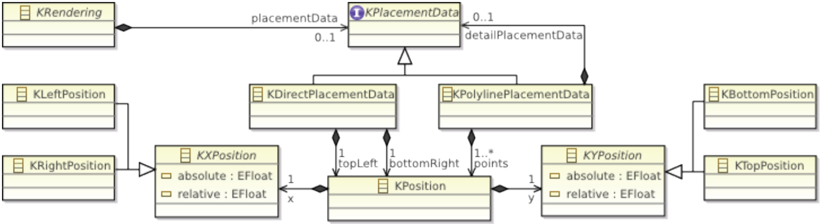
# Appendix – KRendering Meta Model 2/3

## Rendering Primitives

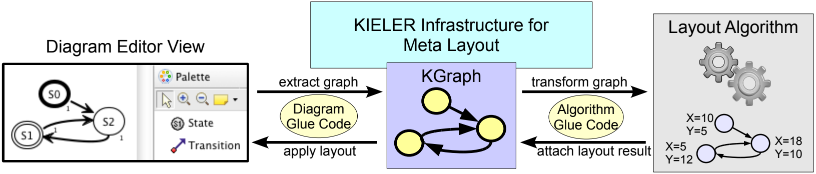


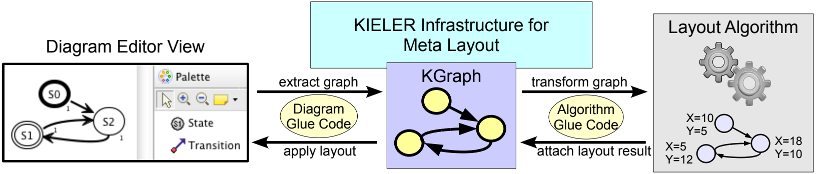
# Appendix – KRendering Meta Model 3/3

## Declarative Micro Layout Definitions (Excerpt)



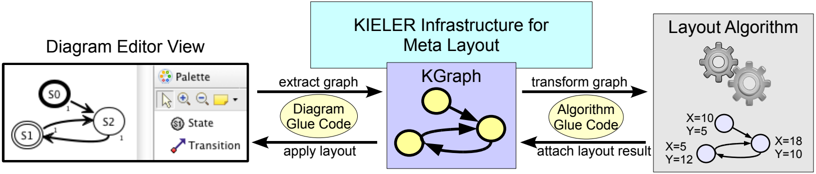
# Infrastructure for Meta Layout





- GMF
- Graphiti
- Papyrus
- Yakindu

- Graphviz (Dot, Neato, FDP, Twopi, Circo)
- Open Graph Drawing Framework (OGDF) (Layer-based, Planarization, Force-directed)
- Own Implementations (Data flow diagrams)



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    }
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  --> "//children.0" {
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       edgeType = GENERALIZATION
    }
    Polyline  {
      lineWidth 2
      Polygon {
        lineWidth 2, backgroundColor 255 255 255
        polylinePlacementData {
          points:
            left  0.0 0.0 / top 0.0 0.0,
            right  0.0 0.0 / top 0.0 0.5,
            left  0.0 0.0 / bottom 0.0 0.0
          detailedPlacementData:
            decoratorPlacementData {
              relative,  location  1.0,
              xOffset  -35, yOffset -17.5,
              width 35, height 35
            }
        }
      }
    }
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    KShapeLayout {
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    }
  ...
}
```

# Appendix – Ecore Mapping in Xtend 1/3

```
Inject
extension KRenderingUtil

Inject
extension KRenderingColors

override KNode transform(EModelElementCollection model, TransformationContext<
      EModelElementCollection, KNode> transformationContext) {

  val rootNode = KimlUtil::createInitializedNode;
  rootNode.KShapeLayout.setProperty(LayoutOptions::ALGORITHM, "de.cau.cs.kieler.kiml.ogdf.
        planarization");
  rootNode.KShapeLayout.setProperty(LayoutOptions::SPACING, 50.float);
  rootNode.KShapeLayout.setProperty(LayoutOptions::DIRECTION, Direction::UP);

  val classifier = model.filter(typeof(EClassifier)).toList;
  classifier.createClassifierFigures(rootNode);
  classifier.createAssociationConnections;
  classifier.createInheritanceConnections;

  model.filter(typeof(EPackage)).forEach[
    val classifiers = it.EClassifiers;
    classifiers.createClassifierFigures(rootNode);
    classifiers.createAssociationConnections;
    classifiers.createInheritanceConnections;
  ];

  return rootNode;
}
```

# Appendix – Ecore Mapping in Xtend 2/3

```
def createClassifierFigures(Iterable<EClassifier> classes, KNode rootNode) {
  classes.forEach[
    val boxWidth = if (it.name.length < 10) 180 else it.name.length*12+50;
    val classNode = it.createRectangulareNode(80, boxWidth);
    classNode.KRendering.add(
    factory.createKText.of(it.name).add(factory.createKFontSize.of(20))
      .add(factory.createKFontBold.setbold).add("lemon".bgColor)
    );
    classNode.KRendering.add(factory.createKLineWidth.of(2)).add("lemon".bgColor);
    rootNode.children.add(classNode);
  ];
}

def createAssociationConnections(Iterable<EClassifier> classes) {
  val list = classes.toList;
  list.filter(typeof(EClass)).forEach[
    it.EStructuralFeatures.filter(typeof(EReference))
      .filter[list.contains(it.EType)]
      .forEach[it.createAssociationConnection];
  ];
}

def createAssociationConnection(EReference ref) {
  val edge = ref.createPolyLineEdge;
  edge.KRendering.add(factory.createKLineWidth.of(2));
  (edge.KRendering as KPolyline).addConnectionArrow(2, true);
  edge.source = ref.eContainer.node;
  edge.target = ref.EType.node;
  ref.eContainer.node.outgoingEdges.add(edge);
}
```

# Appendix – Ecore Mapping in Xtend 3/3

```
def createInheritanceConnections(Iterable<EClassifier> classes) {
  val list = classes.toList;
  list.filter(typeof(EClass)).forEach[
    child | child.ESuperTypes.filter[ list.contains(it) ]
      .forEach[ parent | child.createInheritanceConnection(parent) ];
  ];
}

def createInheritanceConnection(EClass child, EClass parent) {
  val edge = new Pair(child, parent).createPolyLineEdge;
  val line = edge.KRendering as KPolyline
  edge.KEdgeLayout.setProperty(LayoutOptions::EDGE_TYPE, EdgeType::GENERALIZATION)
  line.add(factory.createKLineWidth.of(2))
  line.addInheritanceConnectionArrow(2, true);
  edge.source = child.node;
  edge.target = parent.node;
  child.node.outgoingEdges.add(edge);
}
```