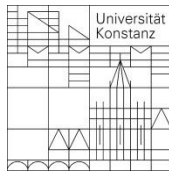




KNIME Extension Points

Tobias Kötter

University of Konstanz



Overview

- Extension points in general
- Extension point development
- KNIME extension points



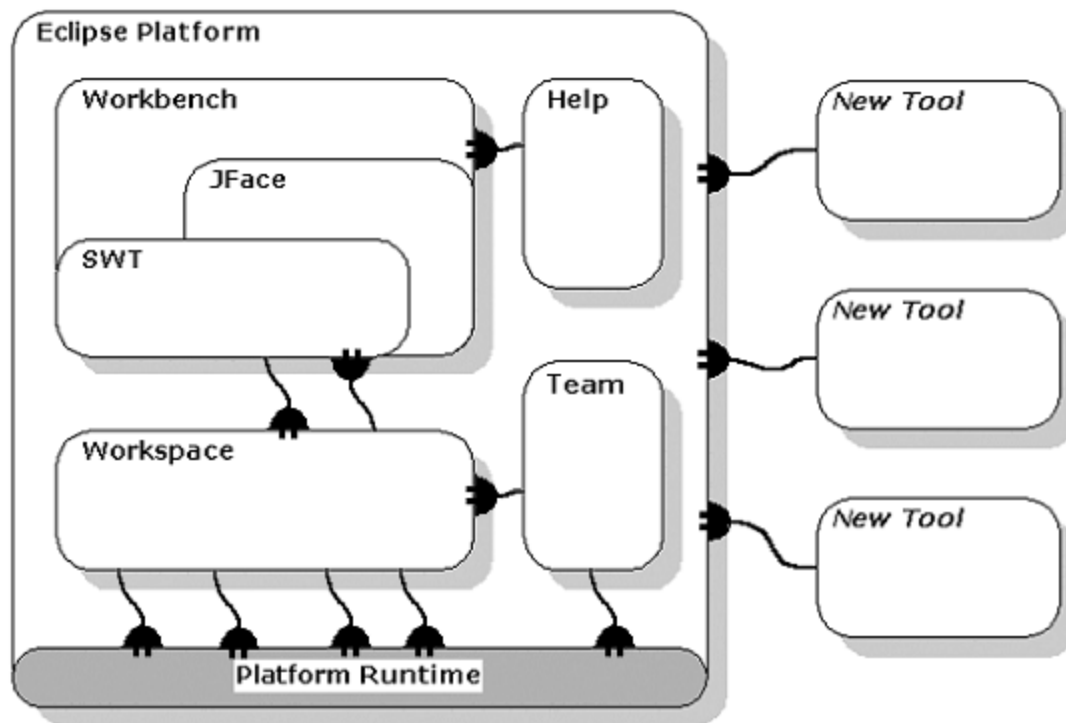
Why Extension Points?

- Modularity
- Re-usability
- Reduce coupling and increase cohesion
- Dynamic
- Classloading
- Documentation



Eclipse Building Blocks

- Eclipse is itself a big box of plug-ins





Nodes Extension Point

The screenshot shows the 'Extensions' dialog in the KNIME IDE. The title bar indicates the current plug-in is 'org.knime.base'. The dialog is divided into two main sections: 'All Extensions' and 'Extension Element Details'.

All Extensions: This section contains a list of extensions for the 'org.knime.workbench.repository.nodes' category. The list includes various node factories such as 'SmoteNodeFactory', 'FileReaderNodeFactory', 'ColorManager', 'SizeManager', 'ShapeManager', 'TableNodeFactory', 'AccurateScorer', 'BinnerNodeFactory', 'CacheNodeFactory', and 'KMeansClusterNodeFactory'. Each entry has a small 'X' icon to its left. To the right of the list are buttons for 'Add...', 'Remove', 'Up', and 'Down'.

Extension Element Details: This section is titled 'Set the properties of "node". Required fields are denoted by "*"'. It contains several input fields:

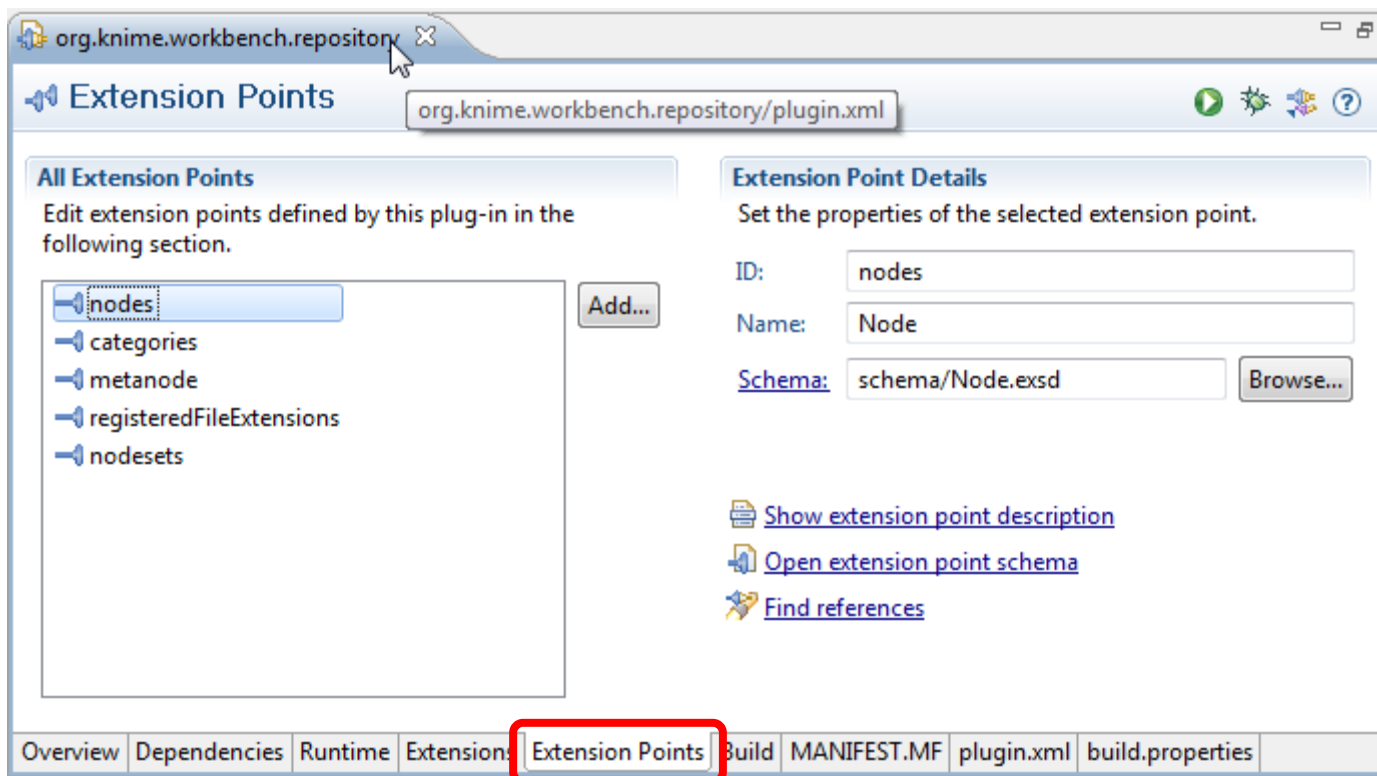
- id*:** org.knime.base.node.io.filereader.FileReaderNodeFactory
- factory-class*:** ase.node.io.filereader.FileReaderNodeFactory (with a 'Browse...' button)
- category-path:** /io/read
- after:** (empty field)
- expert-flag:** (dropdown menu)

At the bottom of the dialog, there is a tabbed interface with the following tabs: Overview, Dependencies, Runtime, Extensions (selected), Extension Points, Build, MANIFEST.MF, plugin.xml, and build.properties.



Extension Point Development

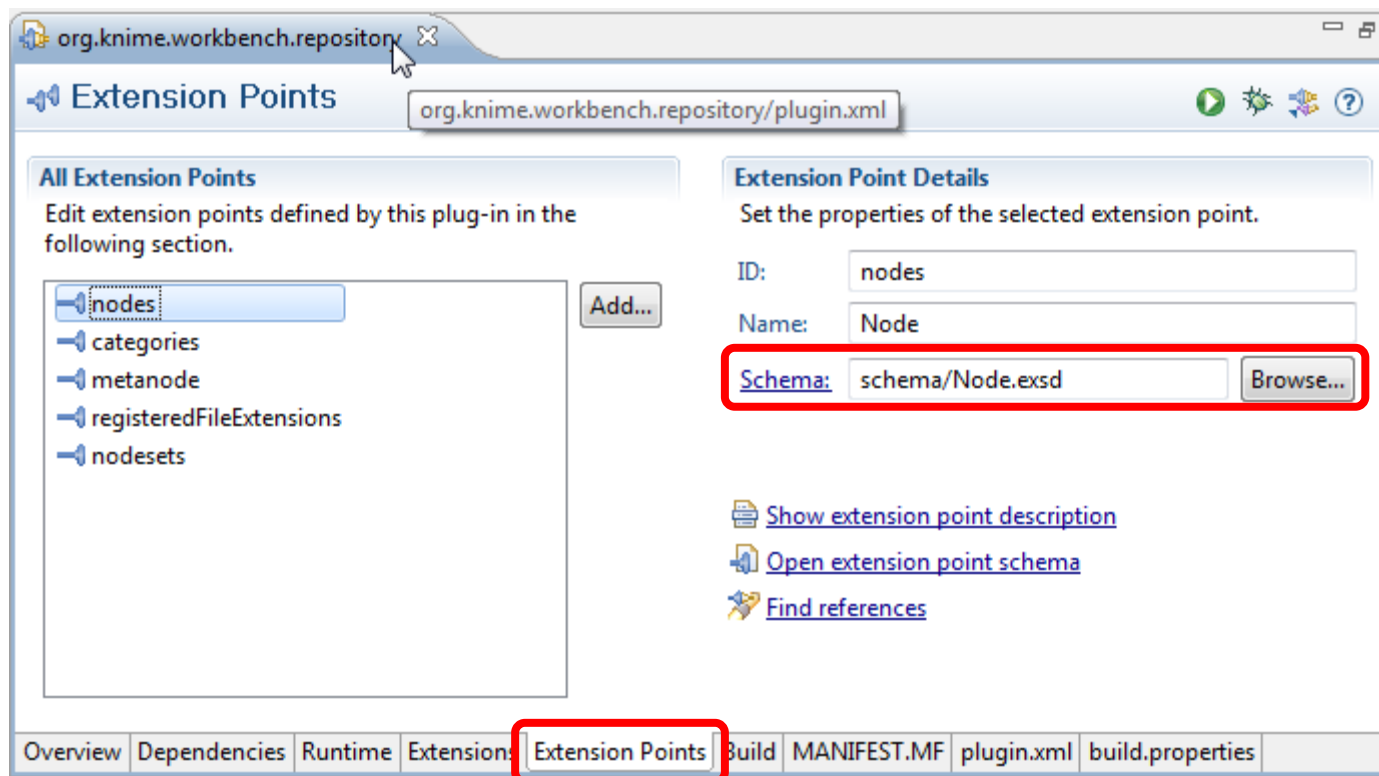
- Declared in plugin.xml





Extension Point Development

- Declared in plugin.xml





Extension Point Definition

The screenshot shows the 'Node.exsd' dialog box in KNIME. It is divided into several sections:

- General Information:** This section describes general information about the schema. It contains three input fields: 'Plug-in ID' with the value 'org.knime.workbench.repository', 'Point ID' with the value 'node', and 'Point Name' with the value 'Node'.
- Schema Inclusions:** This section is for specifying schemas to be included with this schema. It features a large empty text area and two buttons: 'Add...' and 'Remove'.
- Documentation:** This section allows for entering text for the reference HTML document. It includes a list of tabs: 'Description', 'Since', 'Examples', 'API Information', 'Supplied Implementation', and 'Copyright'. The 'Description' tab is selected, and the text area contains the text: 'This extension point can be used to plug new KNIME Nodes into the repository.'

At the bottom of the dialog, there are three tabs: 'Overview', 'Definition', and 'Source'. The 'Definition' tab is currently selected.



Extension Point Definition

The screenshot shows the 'Node' editor window for 'Node.exsd'. The interface is divided into two main sections: 'Extension Point Elements' and 'Attribute Details'.

Extension Point Elements: This section allows defining XML elements and attributes. It includes a tree view on the left showing a hierarchy: 'extension' (containing a 'Sequence (0 - *)' which includes 'point', 'id', and 'name'), and 'node' (containing 'id', 'factory-class', 'category-path', 'after', and 'expert-flag'). The 'id' attribute under 'node' is currently selected. To the right of the tree are buttons for 'New Element', 'New Attribute', 'New Choice', 'New Sequence', and 'Remove'.

Attribute Details: This section provides configuration for the selected 'id' attribute. It includes:

- Name:** A text field containing 'id'.
- Deprecated:** Radio buttons for 'true' and 'false', with 'false' selected.
- Use:** A dropdown menu set to 'required'.
- Type:** A dropdown menu set to 'string'.
- Translatable:** Radio buttons for 'true' and 'false', with 'false' selected.
- Restrictions:** An empty text area with 'Add...' and 'Remove' buttons.
- Description:** A text area containing the text 'A unique identifier for this node'.

At the bottom of the window, there are tabs for 'Overview', 'Definition', and 'Source', with 'Definition' being the active tab.



Extension Point Definition

Node.exsd

Node

[Preview Reference Document](#) ?

Extension Point Elements

Specify the XML elements and attributes which are allowed in this extension point.

- extension
 - Sequence (0 - *)
 - Choice
 - node
 - point
 - id
 - name
- node
 - id
 - factory-class
 - category-path
 - after
 - expert-flag

New Element
New Attribute
New Choice
New Sequence
Remove

Attribute Details

Properties for the "factory-class" attribute.

Name:

Deprecated: true false

Use:

Type:

Extends:

Implements:

Description:

The factory, must implement
`<code>org.knime.knime.node.NodeFactory</code>`

Overview Definition **Source**



Extension Point Definition

The screenshot shows the 'Node' extension point definition editor. The left pane, titled 'Extension Point Elements', shows a tree structure: 'extension' (Sequence 0 - *) containing a 'Choice' with a 'node' element, and another 'node' element containing 'id', 'name', 'factory-class', 'category-path', 'after', and 'expert-flag'. The 'factory-class' element is selected. The right pane, 'Attribute Details', shows properties for the 'factory-class' attribute: Name: 'factory-class', Deprecated: 'false', Use: 'required', Type: 'java', Extends: 'org.knime.core.node.NodeFactory', and Implements: (empty). The description text is: 'The factory, must implement <code>org.knime.knime.node.NodeFactory</code>'. A 'Preview Reference Document' button is highlighted with a red box in the top right. The bottom of the window has tabs for 'Overview', 'Definition', and 'Source'.



Extension Point Documentation

Node.exsd org.knime.workbench.repository.node

Node

Identifier: org.knime.workbench.repository.node

Since: 1.0.0

Description: This extension point can be used to plug new KNIME Nodes into the repository.

Configuration Markup:

```
<!ELEMENT extension ((node))*>
<!ATTLIST extension
  point CDATA #REQUIRED
  id    CDATA #IMPLIED
  name  CDATA #IMPLIED
>

<!ELEMENT node EMPTY>
<!ATTLIST node
  id            CDATA #REQUIRED
  factory-class CDATA #REQUIRED
  category-path CDATA #IMPLIED
  after         CDATA #IMPLIED
  expert-flag   (true | false) "false"
>
```

- **id** - A unique identifier for this node
- **factory-class** - The factory, must implement `org.knime.knime.node.NodeFactory`
- **category-path** - Defines the category path, under which this node should be registered, e.g. `"/knime.readers"`.
- **after** - Specifies the id of the node after which this node should be sorted in. If not defined, the nodes are sorted lexicographically.
- **expert flag** - Set *true* if the node should only appear in the node repository if the expert flag is set (changeable in preference page). If unsure



Extension Point Registry

- No public reusable RegistryReader
- Do not read registry on startup (lazy loading)

```
// Get the extension registry
final IExtensionRegistry registry = Platform.getExtensionRegistry();
// Get the extension point we are interested in
final IExtensionPoint point = registry.getExtensionPoint("node");
if (point != null) {
    for (final IConfigurationElement element
        : point.getConfigurationElements()) {
        NodeFactory<? extends NodeModel> factory =
            (NodeFactory<? extends NodeModel>)element
                .createExecutableExtension("factory-class");
        // ...
    }
}
```



Extension Point Registry

- No public reusable RegistryReader
- Do not read registry on startup (lazy loading)

```
// Get the extension registry
final IExtensionRegistry registry = Platform.getExtensionRegistry();
// Get the extension point we are interested in
final IExtensionPoint point = registry.getExtensionPoint("node");
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        : point.getConfigurationElements()) {
        NodeFactory<? extends NodeModel> factory =
            (NodeFactory<? extends NodeModel> element
                .createExecutableExtension("factory-class"));
        // ...
    }
}
```



Extension Point Registry

Node

Extension Point Elements

Specify the XML elements and attributes which are allowed in this extension point.

- extension
 - Sequence (0 - *)
 - Choice
 - node
 - point
 - id
 - name
- node
 - id
 - factory-class
 - category-path

Attribute Details

Properties for the "factory-class" attribute.

Name: factory-class

Deprecated: true false

Use: required

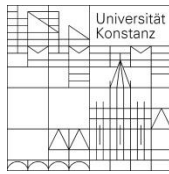
Type: java

Extends: org.knime.core.node.NodeFactory

Implements:

Description: The factory, must implement `org.knime.knime.node.NodeFactory`

```
NodeFactory<? extends NodeModel> factory =  
(NodeFactory<? extends NodeModel> element  
    .createExecutableExtension("factory-class");  
// ...  
}
```



Pitfalls

- Implementing classes need public constructor with no arguments
- Include schema.exsd into the binary build



Pitfalls

org.knime.workbench.repository

Build Configuration

Custom Build

Runtime Information

Define the libraries, specify the order in which they should be built, and list the source folders that should be compiled into each selected library.

knime-workbench-repository.jar

Add Library... Add Folder...

Up Down

Binary Build

Select the folders and files to include in the binary build.

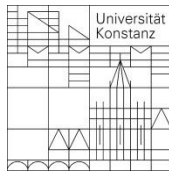
- build.xml
- icons
- lib
- plugin.xml
- schema
 - Category.exsd
 - Node.exsd
 - metanode.exsd
 - nodesets.exsd
 - registeredFileExtensions.exsd

Source Build

Select the folders and files to include in the source build.

- META-INF
- bin
- build.properties
- build.xml
- icons
- lib
- plugin.xml
- schema
- src
- test

Overview Dependencies Runtime Extensions Extension Points **Build** MANIFEST.MF plugin.xml build.properties



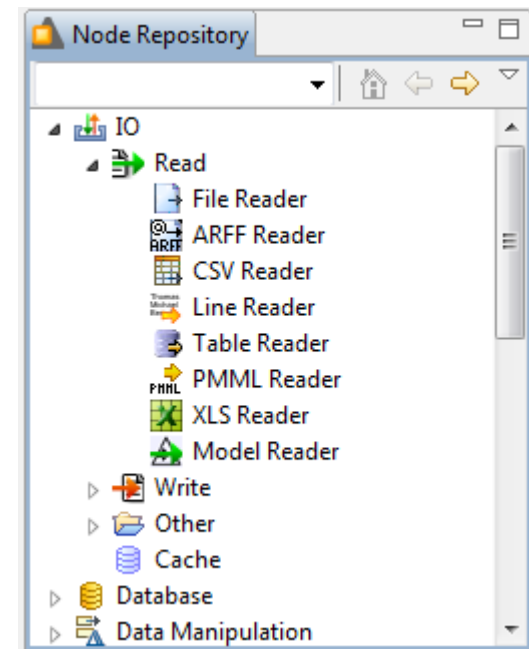
KNIME Extension Points

- `org.knime.workbench.repository:`
 - Node
 - Category
 - Meta node
 - Node sets
 - Registered file extensions
- `org.knime.product`
 - Splash extension



KNIME Extension Points

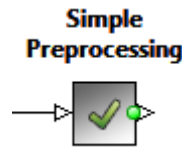
- `org.knime.workbench.repository`:
 - Node
 - Category
 - Meta node
 - Node sets
 - Registered file extensions
- `org.knime.product`
 - Splash extension





KNIME Extension Points

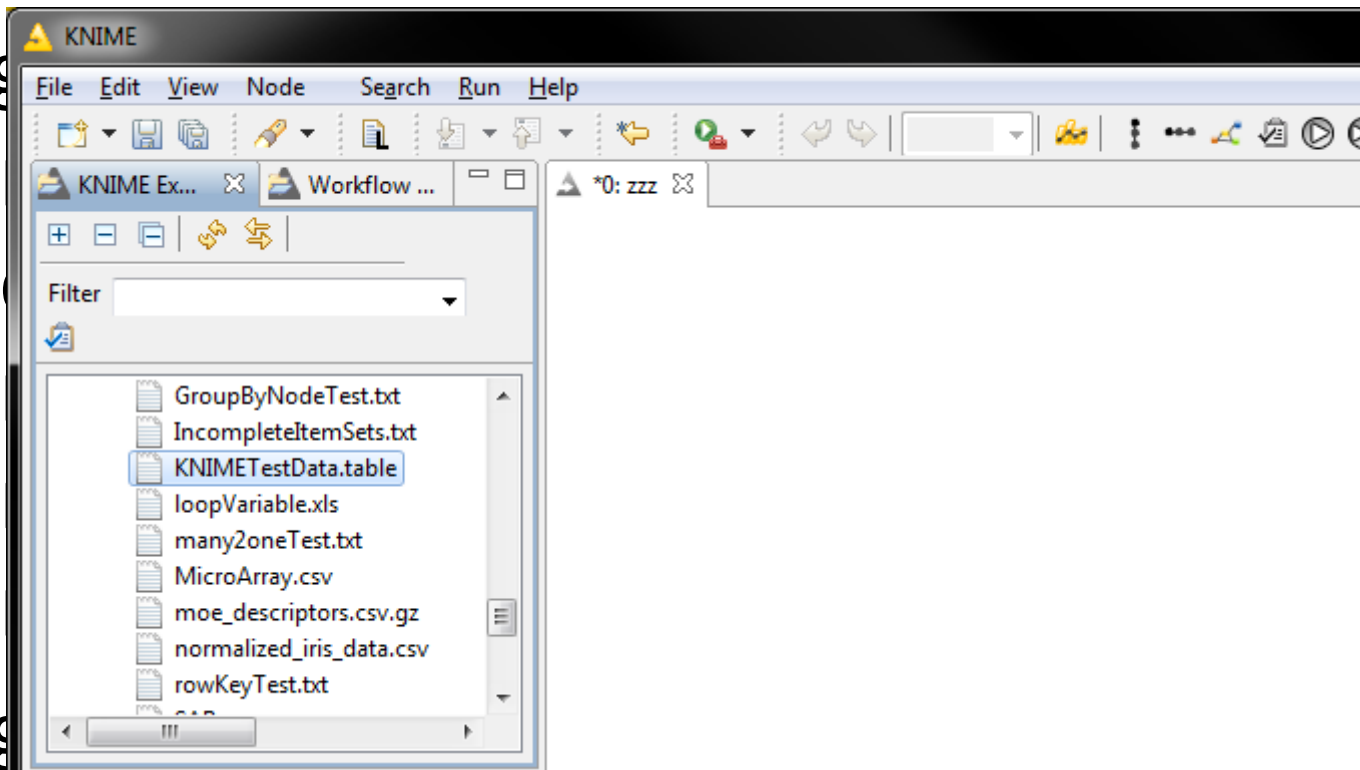
- `org.knime.workbench.repository:`
 - Node
 - Category
 - Meta node
 - Node sets
 - Registered file extensions
- `org.knime.product`
 - Splash extension





KNIME Extension Points

- org



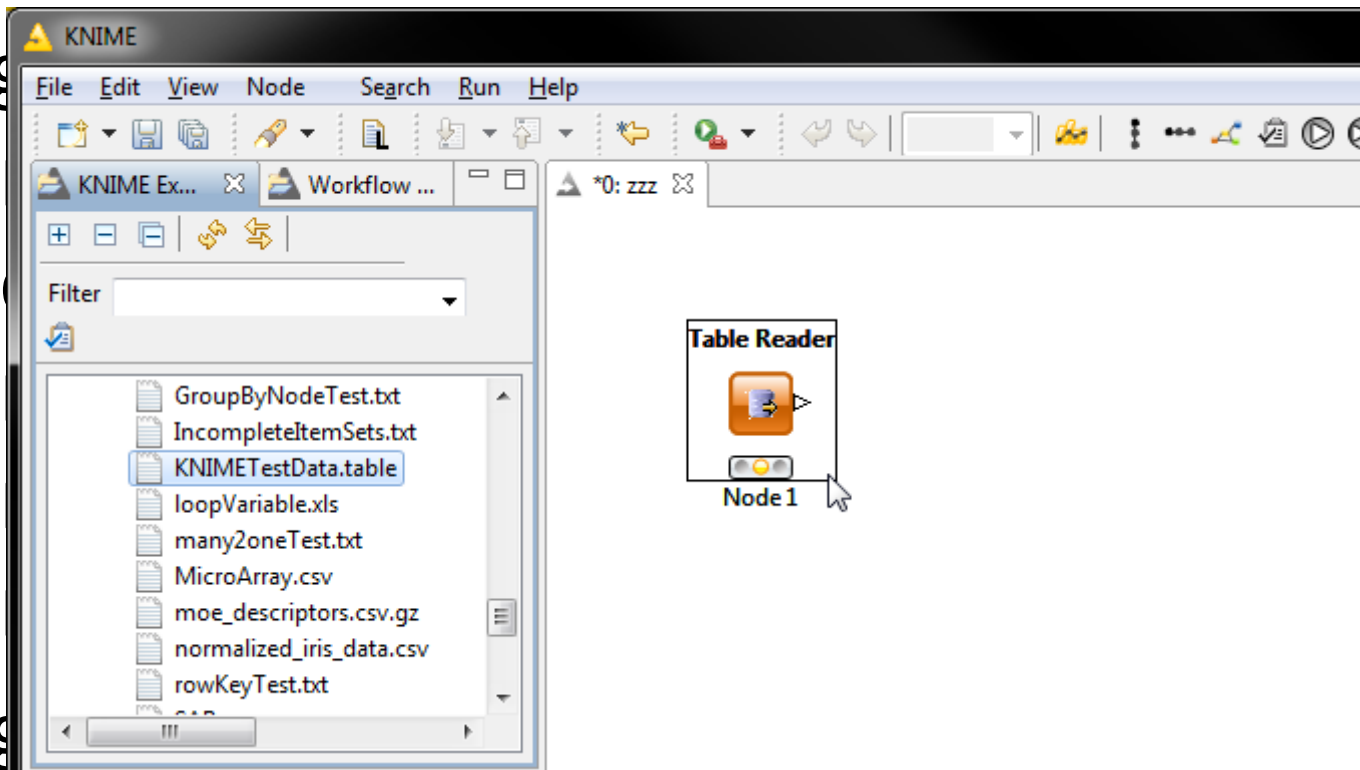
- org

- Splash extension



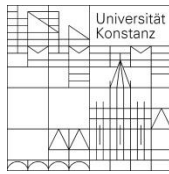
KNIME Extension Points

- org



- org

- Splash extension



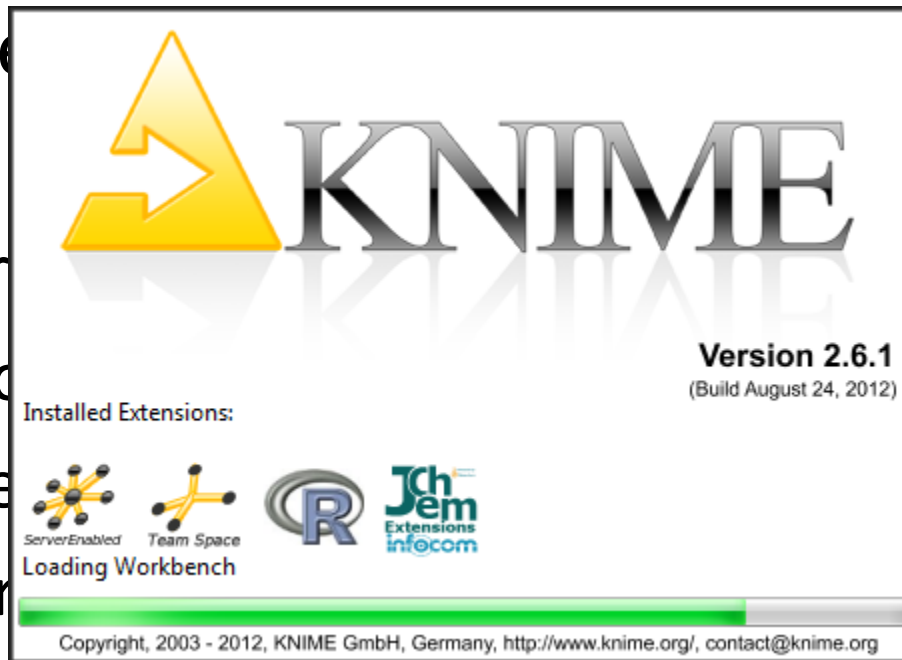
KNIME Extension Points

- `org.knime.workbench.repository:`
 - Node
 - Category
 - Meta node
 - Node sets
 - Registered file extensions
- `org.knime.product`
 - Splash extension



KNIME Extension Points

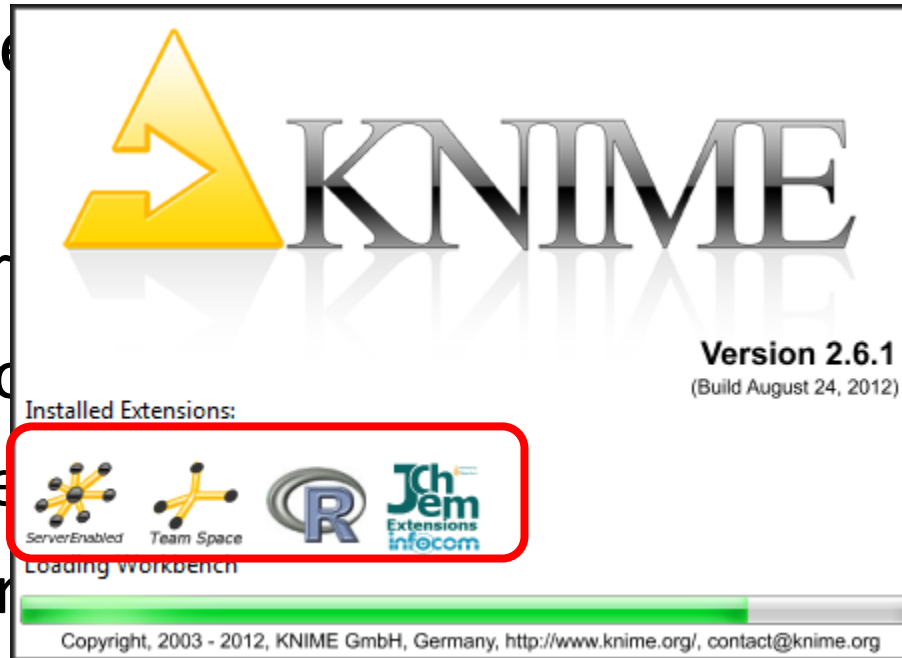
- org.knime
 - Node
 - Category
 - Meta node
 - Node selector
 - Register
-
- org.knime.product
 - Splash extension





KNIME Extension Points

- org.knime
 - Node
 - Category
 - Meta node
 - Node set
 - Register
- org.knime.product
 - Splash extension





KNIME Extension Points

- `org.knime.base`
 - Aggregation operator
- `org.knime.distmatrix`
 - Distance function
- `org.knime.ext.lucene`
 - Lucene type
- `org.knime.ext.textprocessing`
 - Tag set

GroupBy



Column Aggregator



**Distance Matrix
Calculate**



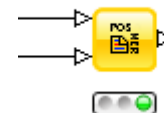
Table Indexer



Index Query



Dictionary tagger





KNIME Extension Points

- 0
- 0
- 0
- 0
- 0

Dialog - 0:2 - GroupBy

File

Settings Description Flow Variables Memory Policy

Groups Options

Aggregation settings

Available columns

- Universe_0_0
- Universe_0_1
- Universe_1_0
- Universe_1_1**
- Cluster Membership

Select

add >>

add all >>

<< remove

<< remove all

To change multiple columns use right mouse click for context menu.

Column	Aggregation (click to change)	Missing
Universe_1_1	Mean	<input type="checkbox"/>

Mean

Standard deviation

Variance

Median

Sum

Product

Range

Geometric mean

Advanced settings

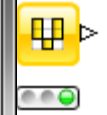
Maximum unique values per group: 10.000

Column naming: Aggregation method (column name)

Enable hiliting Value delimiter: , Process in memory Retain row order

OK - Execute Apply Cancel ?

Aggregator



SQL Query





KNIME Extension Points

- `org.knime.base`
 - Aggregation operator
- `org.knime.distmatrix`
 - Distance function
- `org.knime.ext.lucene`
 - Lucene type
- `org.knime.ext.textprocessing`
 - Tag set

GroupBy



Column Aggregator



**Distance Matrix
Calculate**



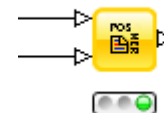
Table Indexer



Index Query



Dictionary tagger





KNIME Extension Points

- or
- or
- or
- or

Dialog - 0:3 - Distance Matrix Calculate

File

Distance Calculate | Flow Variables | Memory Policy

Distance Function: Euclidean

Exclude

Column(s):

Select all search hits

Select

add >>

add all >>

<< remove

<< remove all

Include

Column(s): Search

Select all search hits

- Universe_0_0
- Universe_0_1
- Universe_1_0
- Universe_1_1

Always include all columns

Append Column Name:

Chunk Size:

OK - Execute | Apply | Cancel | ?

Column Aggregator



Index Query





KNIME Extension Points

- `org.knime.base`
 - Aggregation operator
- `org.knime.distmatrix`
 - Distance function
- `org.knime.ext.lucene`
 - Lucene type
- `org.knime.ext.textprocessing`
 - Tag set

GroupBy



Column Aggregator



**Distance Matrix
Calculate**



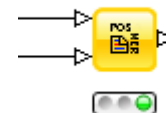
Table Indexer



Index Query



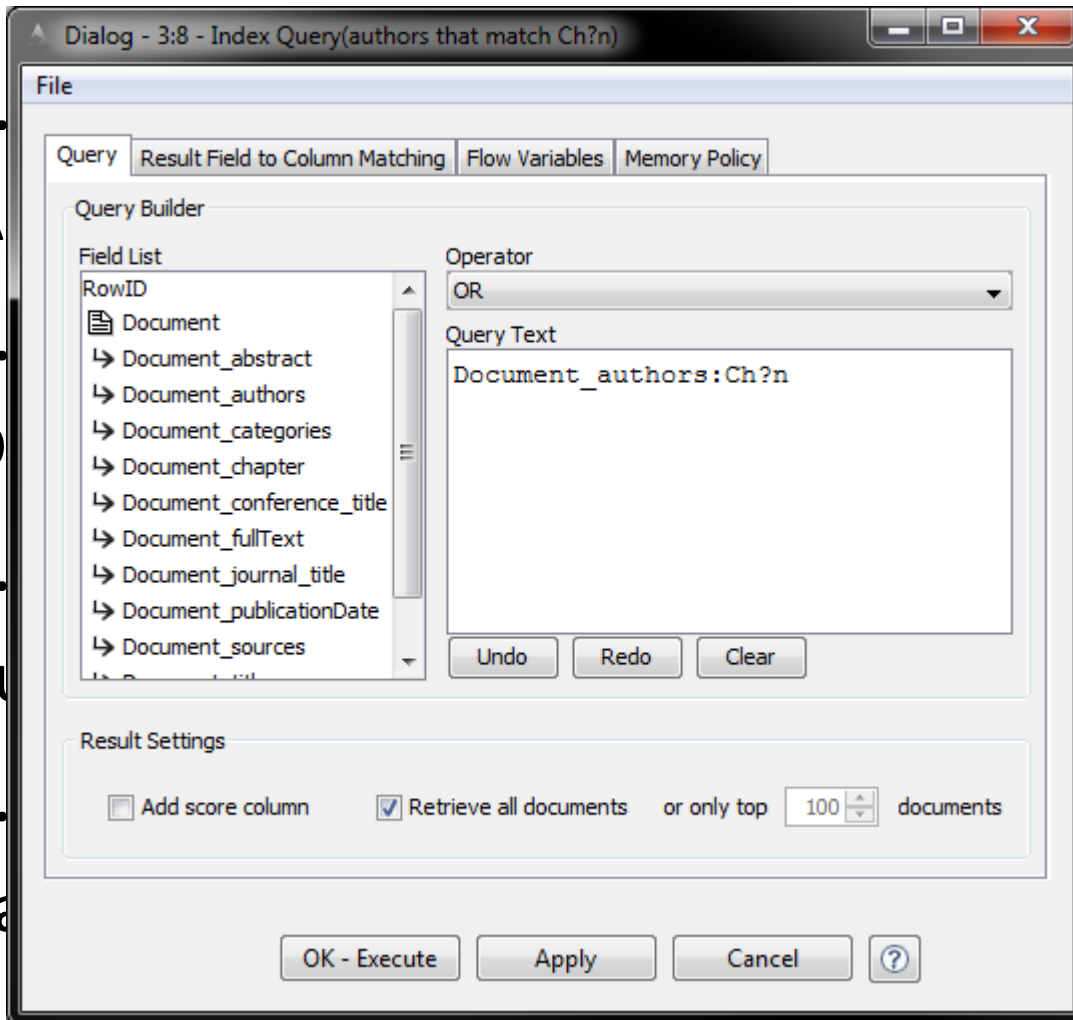
Dictionary tagger





KNIME Extension Points

- org.knime...
- A...
- org.knime...
- D...
- org.knime...
- L...
- org.knime...
- T...



GroupBy

Matrix
Calculate

Indexer

Tagger

Column Aggregator

Index Query



KNIME Extension Points

- `org.knime.base`
 - Aggregation operator
- `org.knime.distmatrix`
 - Distance function
- `org.knime.ext.lucene`
 - Lucene type
- `org.knime.ext.textprocessing`
 - Tag set

GroupBy



Column Aggregator



**Distance Matrix
Calculate**



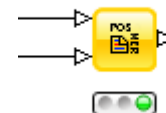
Table Indexer



Index Query



Dictionary tagger





KNIME Extension Points

- `org.knime.jsnippets`
 - Template repository
- `org.knime.network.base`
 - Analyzer type
 - Feature type
 - Graph file format
- `org.knime.network.base`
 - Jung graph layout

Java Snippet



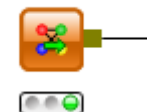
Network Analyzer



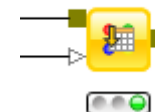
Multi Feature Inserter



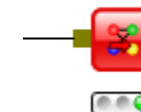
Network Reader



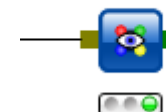
Feature Inserter



Network Writer



Network Viewer





Dialog - 0:4 - Java Snippet

File

Java Snippet | Additional Libraries | **Templates** | Flow Variables | Memory Policy

Category: KNIME

Title: Line Total

Description: Computes the sum over all numeric

Apply Remove

Java Snippet | Additional Libraries

C:\DEVELOPMENT\workspaces\KNIME-workspace_latest_branch\plugins\org.knime.jsnippets\jsnip...

Column List

- ROWID
- ROWINDEX

Flow Variable List

- knime.workspace

```
1 // system imports
12 // Your custom imports:
13
14 // system variables
21 // Your custom variables:
22
23 // expression start
25 // Enter your code here:
26
27 // The field out_lineTotal is defined below
```

Input

Column / Flow variable	Java Type	Java Field
------------------------	-----------	------------

Add Remove

Output

Fi...	...	Column / Fl...	Output Type	...	Java Type	Java Field
Col...	<input type="checkbox"/>	line total	<input checked="" type="checkbox"/> DoubleCell	<input type="checkbox"/>	Double	out_lineTotal

Add Remove

OK Apply Cancel ?

- O
- O
- O

File Inserter

Work Writer



KNIME Extension Points

- `org.knime.jsnippets`
 - Template repository
- `org.knime.network.base`
 - Analyzer type
 - Feature type
 - Graph file format
- `org.knime.network.base`
 - Jung graph layout

Java Snippet



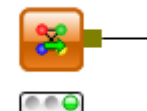
Network Analyzer



Multi Feature Inserter



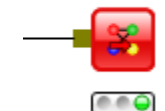
Network Reader



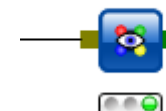
Feature Inserter



Network Writer



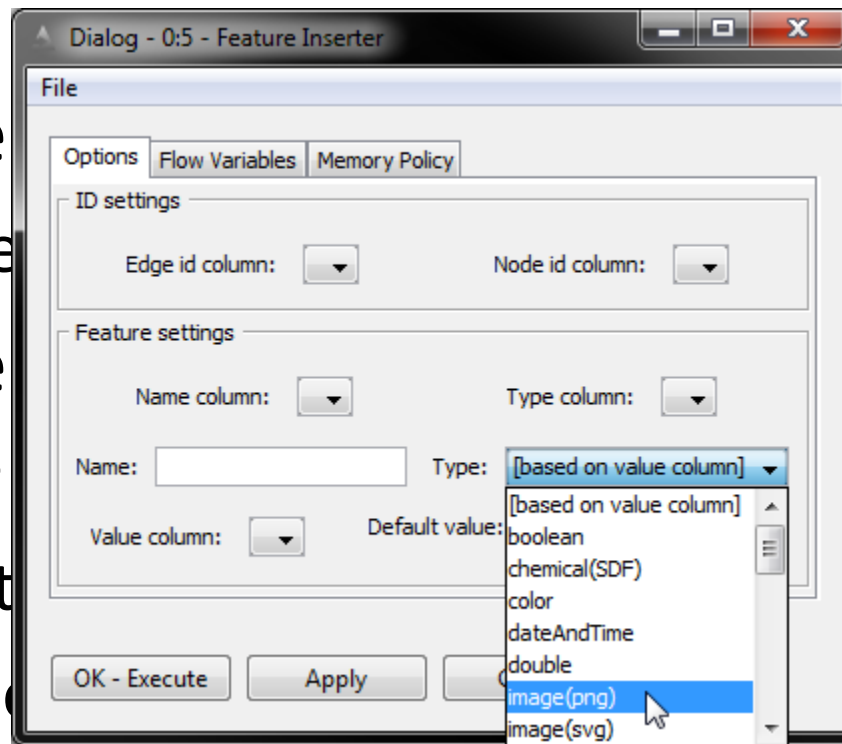
Network Viewer





KNIME Extension Points

- org.knime
– Template
- org.knime
– Analyzer
– Feature transformer
– Graph file
- org.knime.network.base
– Jung graph layout



Snippet

Network Analyzer

Multi Feature Inserter

Network Reader

Feature Inserter

Network Writer

Network Viewer



KNIME Extension Points

- `org.knime.jsnippets`
 - Template repository
- `org.knime.network.base`
 - Analyzer type
 - Feature type
 - Graph file format
- `org.knime.network.base`
 - Jung graph layout

Java Snippet



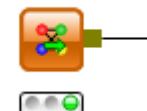
Network Analyzer



Multi Feature Inserter



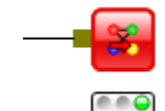
Network Reader



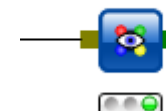
Feature Inserter



Network Writer



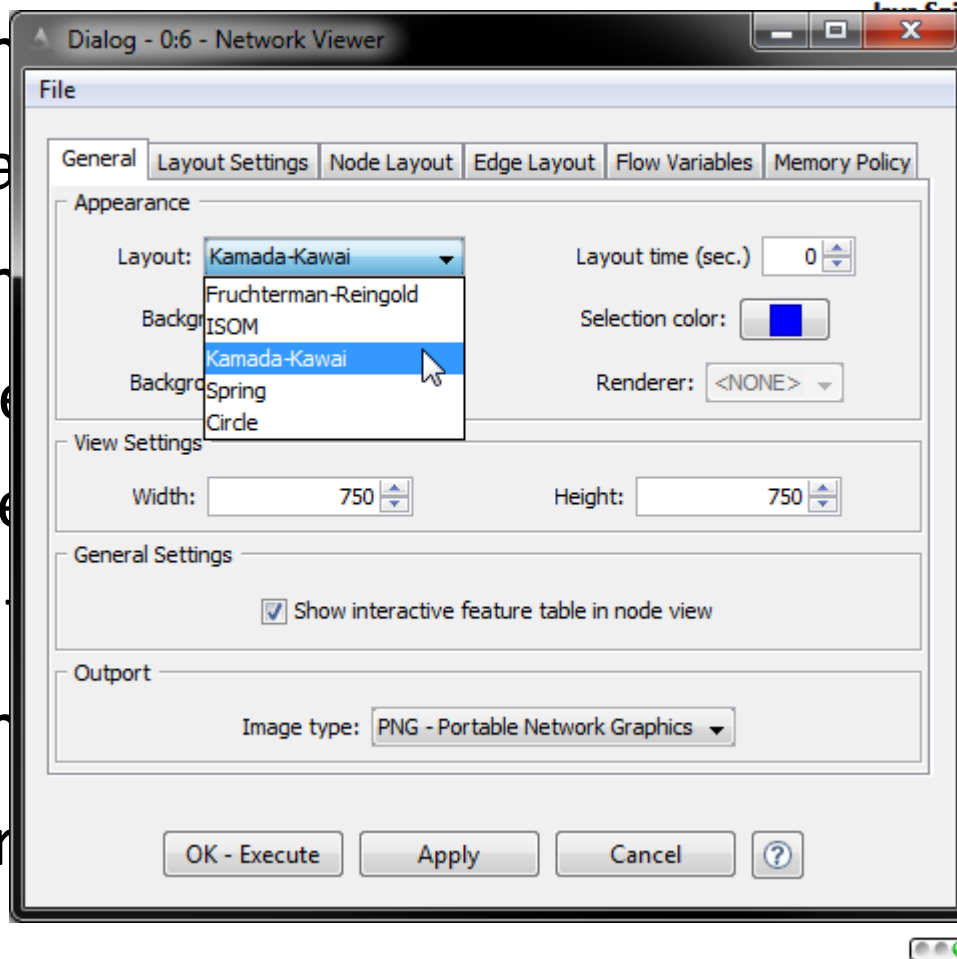
Network Viewer





KNIME Extension Points

- org.knime
- Template
- org.knime
- Analyzer
- Feature
- Graph
- org.knime
- Jung



Feature Inserter



Network Writer





KNIME Extension Points

- `org.knime.jsnippets`
 - Template repository
- `org.knime.network.base`
 - Analyzer type
 - Feature type
 - Graph file format
- `org.knime.network.base`
 - Jung graph layout

Java Snippet



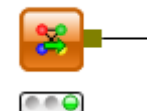
Network Analyzer



Multi Feature Inserter



Network Reader



Feature Inserter



Network Writer



Network Viewer

