Open for Innovation
KNIME

KNIME Workbench Guide

KNIME AG, Zurich, Switzerland
Version 4.2 (last updated on 2019-12-06)

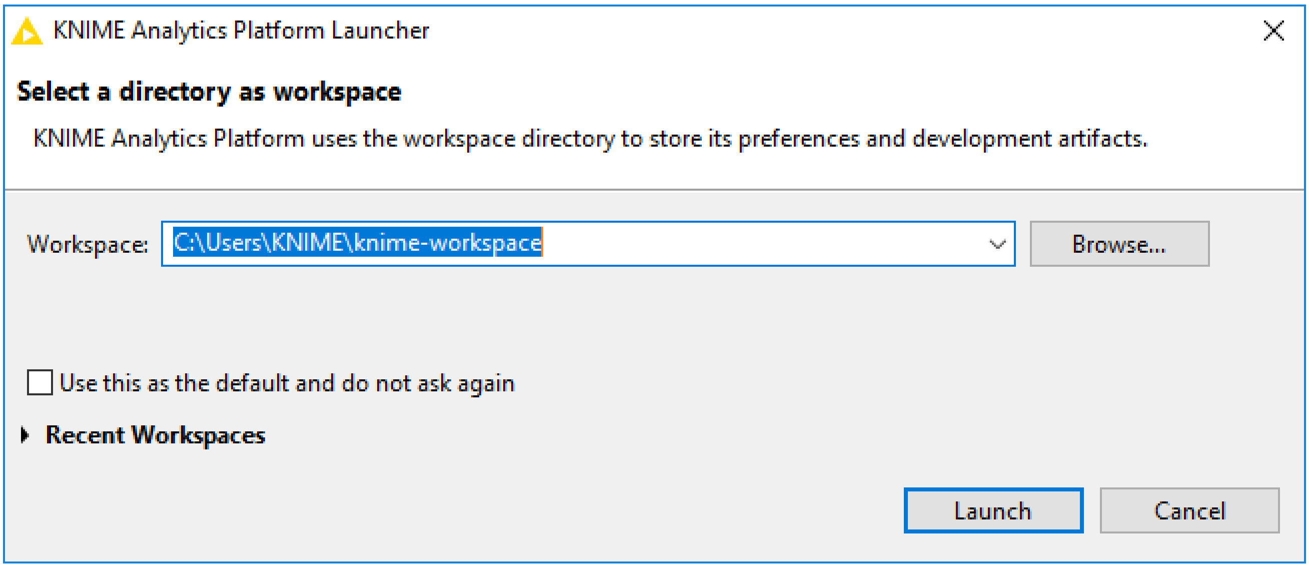
Table of Contents

In this section of the documentation we describe the first steps after starting KNIME Analytics Platform and all of the resources you have on the KNIME Workbench to build your workflows. This chapter also explains how to customize your workbench, configure KNIME to best suit your needs and finally explains data tables.

Workspaces

When you start KNIME Analytics Platform the KNIME Analytics Platform Launcher window appears and you are promoted to define the KNIME workspace, as shown in Figure 1.

The KNIME workspace is a folder on your local computer to store your KNIME workflows, node settings, and data produced by the workflow.



KNIME Analytics Platform Launcher

Select a directory as workspace

KNIME Analytics Platform uses the workspace directory to store its preferences and development artifacts.

Workspace: C:\Users\KNIME\knime-workspace

□ Use this as the default and do not ask again

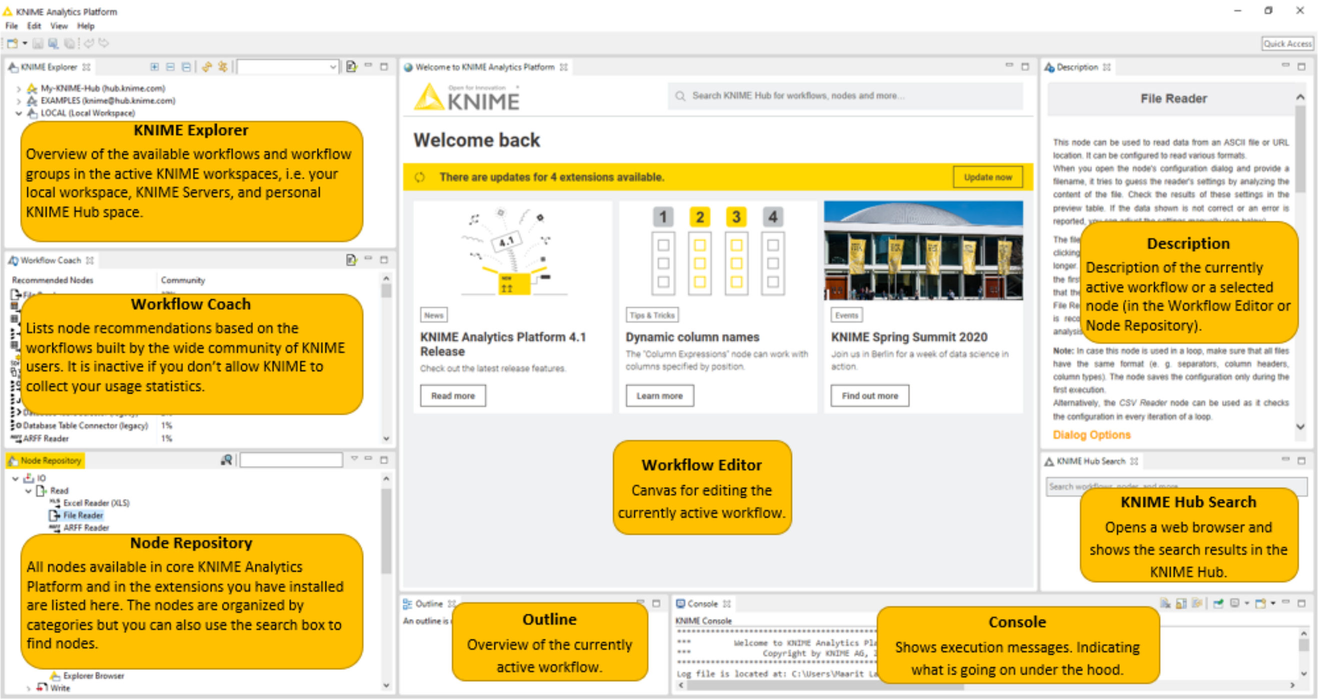
Figure 1. KNIME Analytics Platform Launcher

The workflows and data stored in your workspace are subsequently available through the KNIME Explorer in the upper left corner of the KNIME Workbench.

KNIME Workbench

After you have selected a workspace for your project, click *Launch*. The KNIME Analytics Platform user interface - the KNIME Workbench - opens.

It is typically organized as follows.



KNIME Explorer
Overview of the available workflows and workflow groups in the active KNIME workspaces, i.e. your local workspace, KNIME Servers, and personal KNIME Hub space.

Workflow Coach
Lists node recommendations based on the workflows built by the wide community of KNIME users. It is inactive if you don't allow KNIME to collect your usage statistics.

Node Repository
All nodes available in core KNIME Analytics Platform and in the extensions you have installed are listed here. The nodes are organized by categories but you can also use the search box to find nodes.

Workflow Editor
Canvas for editing the currently active workflow.

Description
Description of the currently active workflow or a selected node (in the Workflow Editor or Node Repository).

KNIME Hub Search
Opens a web browser and shows the search results in the KNIME Hub.

Outline
Overview of the currently active workflow.

Console
Shows execution messages. Indicating what is going on under the hood.

KNIME Analytics Platform
File Edit View Help
Quick Access
KNIME Explorer
My-KNIME-Hub (hub.knime.com)
EXAMPLES (knime@hub.knime.com)
LOCAL (Local Workspace)
Workflow Coach
Recommended Nodes
Community
Database Table Connector (legacy) 1%
ARFF Reader 1%
Node Repository
IO
Read
Excel Reader (XLS)
File Reader
ARFF Reader
Explorer Browser
Write
Welcome to KNIME Analytics Platform
KNIME
Search KNIME Hub for workflows, nodes and more...
Welcome back
There are updates for 4 extensions available.
Update now
News
KNIME Analytics Platform 4.1 Release
Check out the latest release features.
Read more
Tips & Tricks
Dynamic column names
The "Column Expressions" node can work with columns specified by position.
Learn more
Events
KNIME Spring Summit 2020
Join us in Berlin for a week of data science in action.
Find out more
Description
File Reader
Dialog Options
KNIME Hub Search
Search workflows, nodes and more...
Outline
Console
KNIME Console
Welcome to KNIME Analytics Pla
Copyright by KNIME AG,
Log file is located at: C:\Users\Maarit L

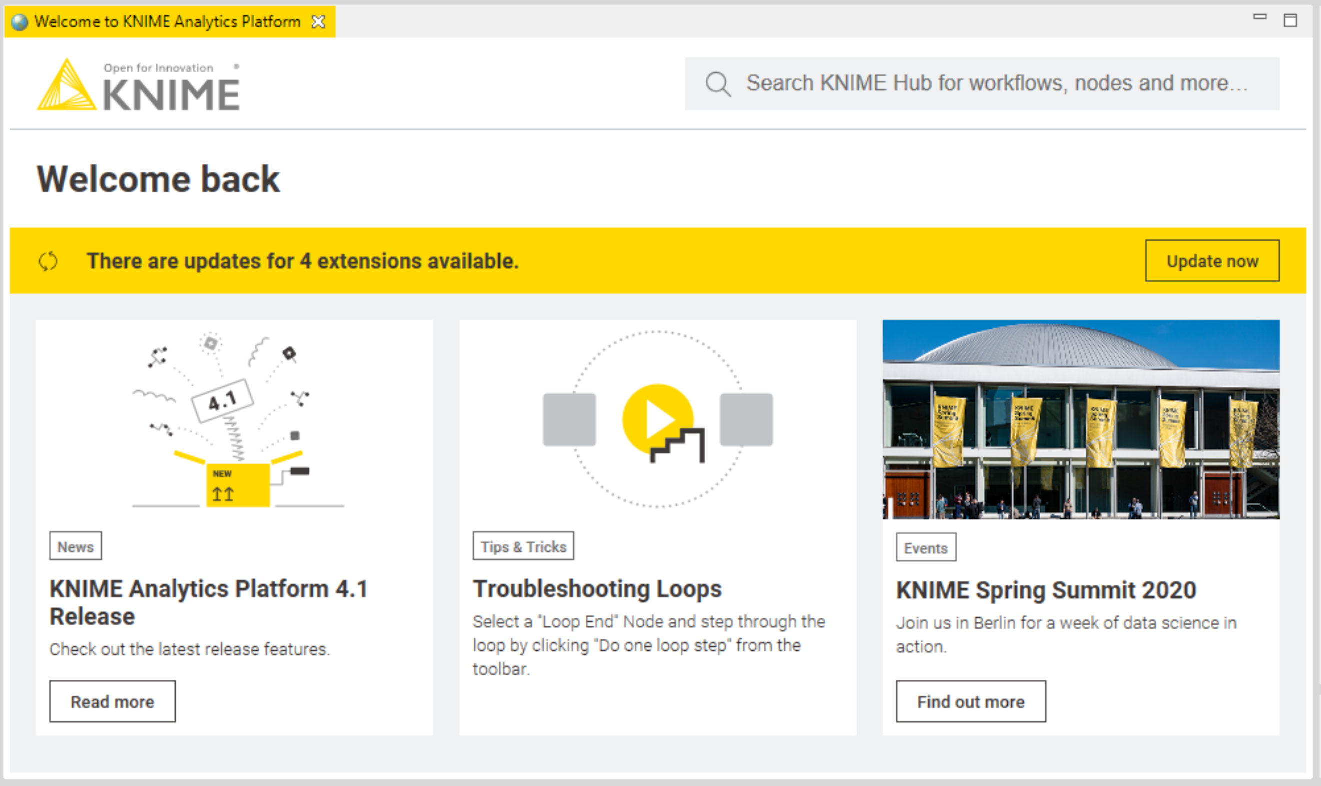
Figure 2. KNIME Workbench

In the next few sections we explain the functionality of and what you can do with these components of the workbench:

- Welcome Page
- Workflow Editor & Nodes
- KNIME Explorer
- Workflow Coach
- Node Repository
- KNIME Hub Search
- Description
- Outline
- Console

Welcome Page

In the middle of the KNIME workbench is the Welcome Page shown in Figure 3.



Welcome to KNIME Analytics Platform

Search KNIME Hub for workflows, nodes and more...

Welcome back

There are updates for 4 extensions available.

Update now

News

KNIME Analytics Platform 4.1 Release

Check out the latest release features.

Read more

Tips & Tricks

Troubleshooting Loops

Select a "Loop End" Node and step through the loop by clicking "Do one loop step" from the toolbar.

Events

KNIME Spring Summit 2020

Join us in Berlin for a week of data science in action.

Find out more

Figure 3. Welcome Page

This page links you to information - for example available updates and the latest KNIME news, upcoming events, and tips and tricks.

If you close the Welcome Page by clicking in the top right hand corner, you are left with an empty canvas. This is your KNIME Workflow Editor.

Workflow Editor & Nodes

The workflow editor is where workflows are assembled. Workflows are made up of individual tasks, represented by nodes.

You create a workflow by dragging nodes from the Node Repository to the workflow editor, then connecting, configuring and executing them.

Nodes

In KNIME Analytics Platform, individual tasks are represented by nodes. Nodes can perform all sorts of tasks, including reading/writing files, transforming data, training models, creating visualizations, and so on.

Facts about Nodes

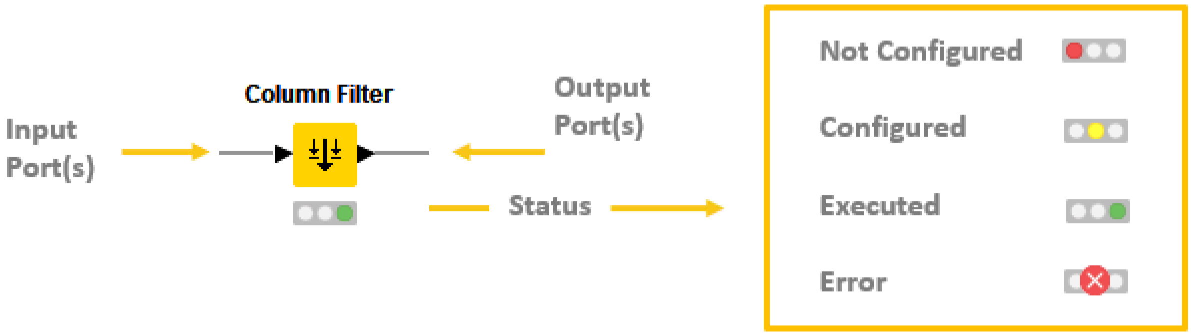


Figure 4. Node ports and node status

- Each node is displayed as a colored box with input and output ports, as well as a status, as shown in Figure 4
- The input port(s) hold the data that the node processes, and the output port(s) hold the resulting datasets of the operation
- The data is transferred over a connection from the output port of one to the input port of another node.

> For simplicity we refer to data when we refer to node input and output ports, but nodes can also have input and output ports that hold a model, a database query, or another type explained in Node Ports.

Changing the Status of a Node

To change the status of a node, you either configure, execute, or reset it. You can find all these options in the context menu of a node shown in Figure 5.

Open the context menu by right clicking a node. From the context menu you can also open output tables and views, as well as copy nodes, along with some more advanced node options.

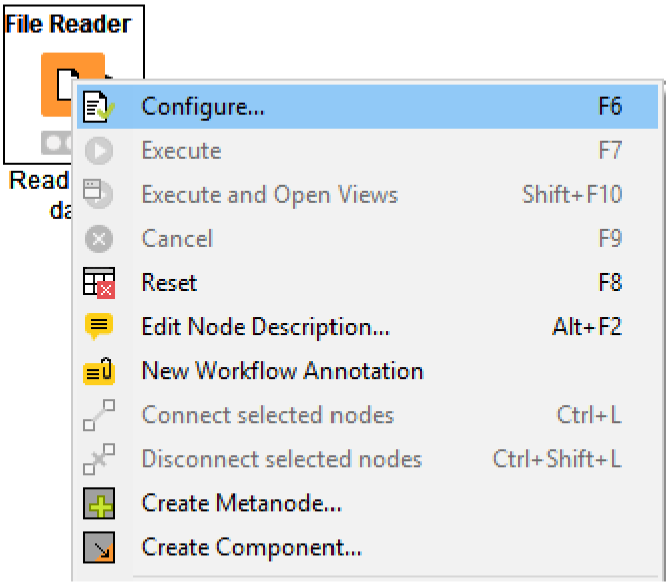

File Reader
Read
da
Configure... F6
Execute F7
Execute and Open Views Shift+F10
Cancel F9
Reset F8
Edit Node Description... Alt+F2
New Workflow Annotation
Connect selected nodes Ctrl+L
Disconnect selected nodes Ctrl+Shift+L
Create Metanode...
Create Component...

Figure 5. Context menu of a node

Identifying the Node Status

The traffic light below each node shows the status of the node. When you configure a node, the traffic light changes from red to yellow, i.e. from "not configured" to "configured".

When you add a new node to the Workflow Editor, its status is "not configured" - shown by the red traffic light below the node.

Configuring the Node

You can configure the node by adjusting the settings in its configuration dialog.

Open the configuration dialog of a node by either:

- Double clicking the node
- Right clicking a node and selecting *Configure…* in the context menu
- Or, selecting the node and pressing F6

In addition to the task specific settings, each configuration dialog has a:

- "Memory Policy"-tab: here you can define whether tables are attempted to be kept in memory, or if all tables are written to disk (see the section on In-Memory Caching for details).

- "Flow Variables"-tab: flow variables are explained in the Flow Control Guide

Executing the Node

Some nodes have the status "configured" already when they are created. These nodes are executable without adjusting any of the default settings.

To execute a node, you can either

- Right click the node and select *Execute*
- Or, select the node and press F7

If execution is successful, the node status becomes "executed", which you will see from the green traffic light. If the execution fails, you will see an error sign on the traffic light, and you will have to revise the node settings and the node's inputs and adjust them as necessary.

You can inspect the outputs, such as data tables, and views of an executed node by right clicking the node and selecting one of the last options in the menu. If the node produces an (interactive) view in its output, like all JavaScript based nodes, you can open it by selecting *(Interactive) View: …* in the middle of the context menu.

Canceling Execution of the Node

To cancel the execution of a node, right click it and select *Cancel* or select it and press F9.

Resetting the Node

To reset a node, right click it and select *Reset* or select it and press F8.

> ❗ Resetting a node also resets all of its subsequent nodes in the workflow. Now, the status of the node(s) turns from "executed" into "configured", the nodes' outputs are cleared.

Node Ports

A node may have multiple input ports and multiple output ports. A collection of interconnected nodes, using the input ports on the left and output ports on the right, constitutes a workflow. The input ports consume the data from the output ports of the predecessor nodes, and the output ports provide data to the successor nodes in the workflow.

Besides data tables, input and output ports can provide other types of inputs and outputs. For each type the pair of input and output port looks different, as shown in Figure 6.

You can only connect an output port to an input port of the same type - data to data, model to model, and so on.

Some input ports can be empty, like the data input port of the Decision Tree View node in Figure 6. This means that the input is optional, and the node can be executed without the input. The mandatory inputs, shown by filled input ports, have to be provided to execute the node.

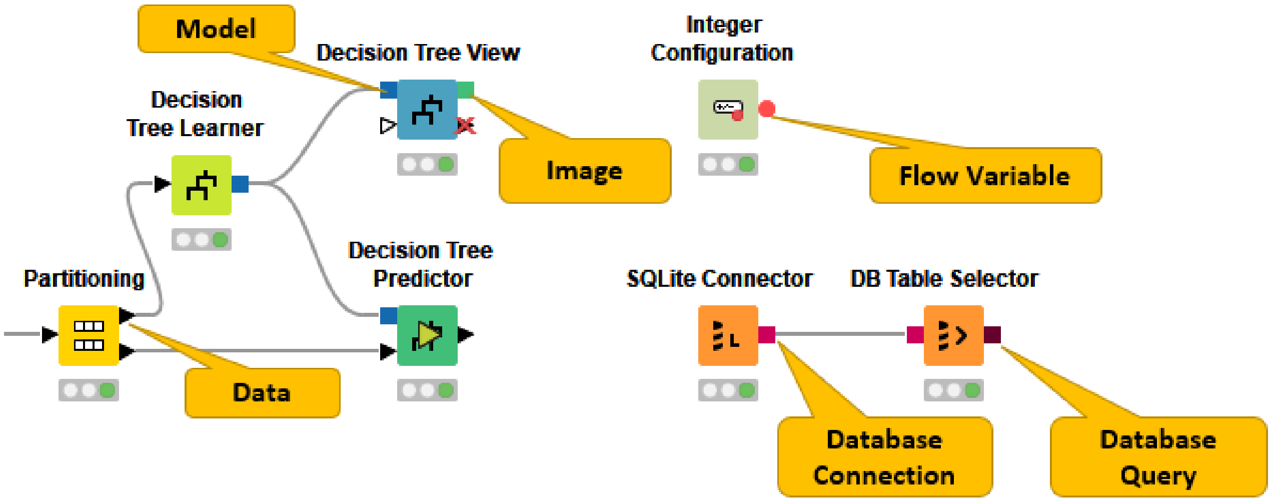


Figure 6. Common Port Types

A tooltip gives a short explanation of the input and output ports. If the node is executed, the dimensions of the outcoming data are shown in its data output port. You can find a more detailed explanation of the input and output ports in the node description.

How to select, move, copy, and replace nodes in a workflow

You can move nodes into the workflow editor by dragging and dropping them. To copy nodes between workflows, select the nodes you want to copy, right click the selection, and select *Copy* in the menu. In the destination workflow, right click the workflow editor, and select *Paste* in the menu.

To select a node in the workflow editor, click it once, and you will see a border around it. To select multiple nodes, either press Ctrl and select nodes by mouse click, or draw a rectangle over the nodes with the mouse.

You can replace a node by dragging a new node onto an existing node. Now the existing node will be covered with a colored box with an arrow and boxes inside as shown in Figure 7. Releasing the mouse replaces the node.

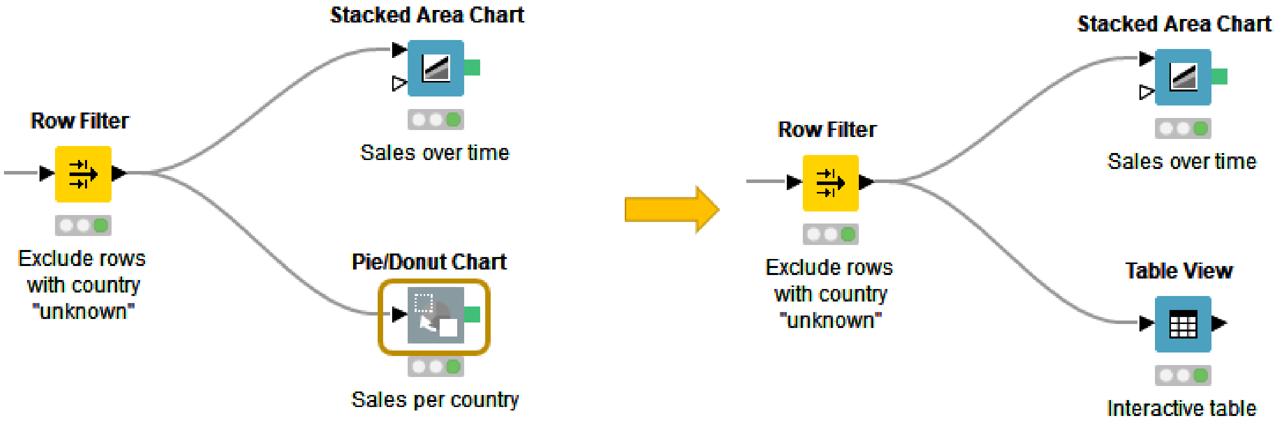


Figure 7. Replacing a node in a workflow

Comments and Annotations

You have two options to document your workflow (shown in Figure 8) in the workflow editor:

- Add a comment to an individual node by double clicking the text field below the node and editing the text.
- Add a general comment to the workflow, right click the workflow editor and select *New Workflow Annotation* in the menu. Now a yellow box will appear in the workflow editor.

To edit the workflow annotation box, you can:

- Move the workflow annotation box inside the workflow editor by first activating it from the top left corner, and then dragging the box.
- Resize the box by dragging any of its edges.
- Edit the text inside by double clicking the top left corner of the annotation box and typing new text in the text field.
- Change the properties of the text and the border by double clicking in the top left corner and then right clicking inside the box. A menu will open showing the available editing options.

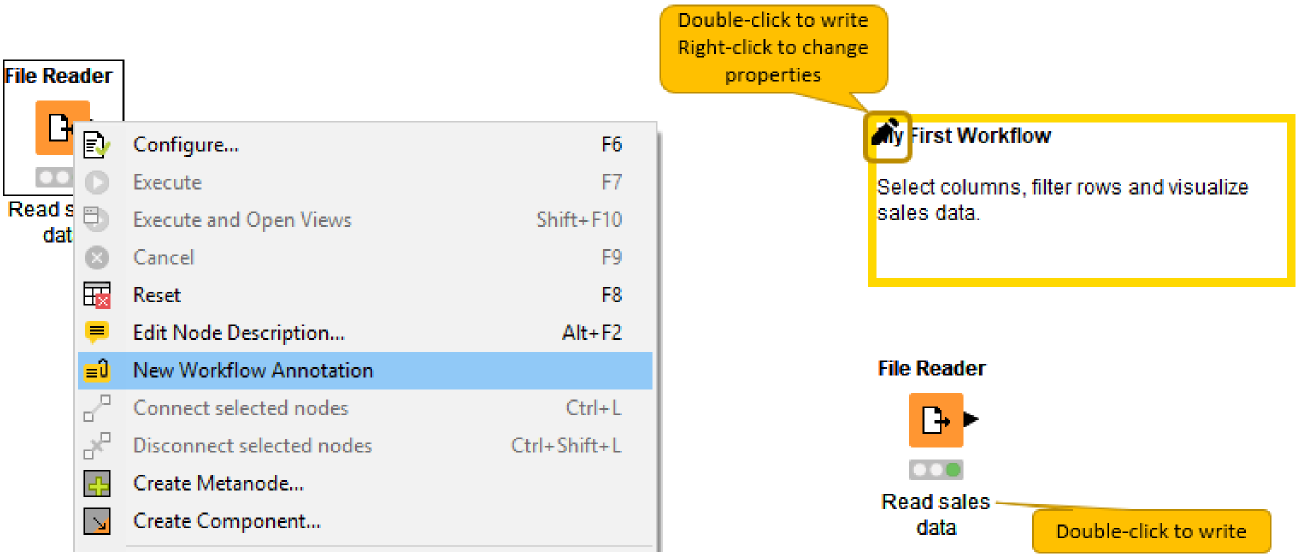


Figure 8. Writing a node comment and creating a workflow annotation

In the video *Annotations & Comments* we give you a few hints about how to document your workflow.

Workflow Editor Settings

You can change visual properties of the workflow editor by clicking the "Workflow Editor Settings" button on the toolbar shown in Figure 9.

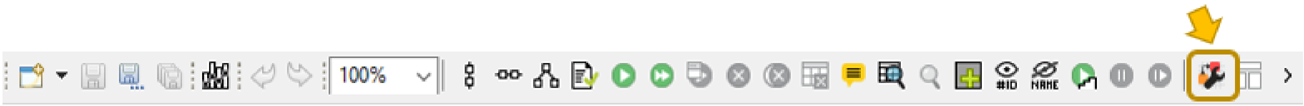


Figure 9. Changing visual properties of the workflow

In the dialog that opens, you can change the grid size, or remove the grid lines completely. You can also change the connection style from angular to curved, and make the connections thicker or narrower.

The changes will only apply to the currently active workflow editor. If you want to change the default workflow editor settings, go to *File* → *Preferences* → *KNIME* → *KNIME GUI* → *Workflow Editor*.

Keyboard Shortcuts

To view a full list of keyboard shortcuts, choose *Help* → *Show Active Keybindings*. Here you can view all the keybindings to commands, modify the bindings, and create your own shortcuts.

KNIME Explorer

The KNIME Explorer is where you can manage your workflows, workflow groups, and server connections.

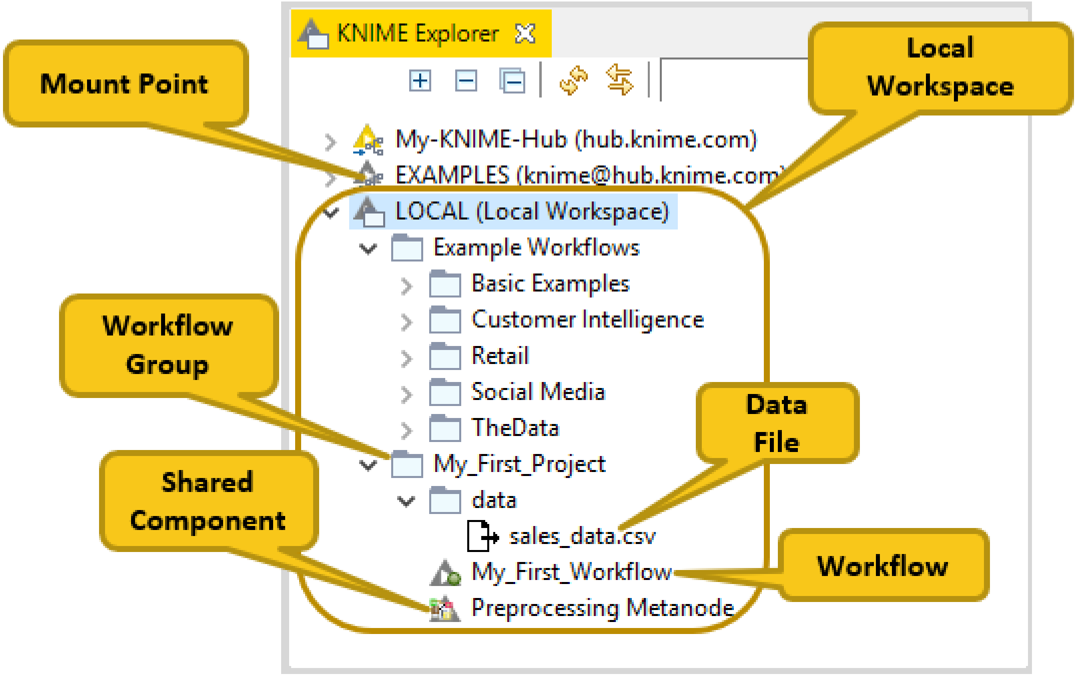


Figure 10. KNIME Explorer

Creating a New Workflow

To create an empty workflow, right click anywhere in your local workspace, and select *New KNIME Workflow…* in the menu, or use one of the options explained in Building Workflows.
Give the workflow a name, and define the destination of the new workflow.
Click *Finish*, and the new workflow will appear in the selected workflow group in the KNIME Explorer.
If you want to learn how to build a workflow, you can take a look at the next section Building Workflows, follow the steps in the Quickstart Guide, or check the video Workflows and Workflow Groups.

Building Workflows

To create a workflow, you need an empty workflow canvas. You can do any of these things:

- Navigate to *File* → *New…*, and select *New KNIME Workflow*.
- Click the leftmost icon in the toolbar
- Right click in the local workspace and select *New KNIME Workflow…*

A workflow is built by dragging nodes from the node repository to the workflow editor and connecting them. To add a node from the node repository or from the workflow coach to the workflow editor, you have two options shown in Figure 11:

- Drag and drop the node into the workflow editor
- Double click the node

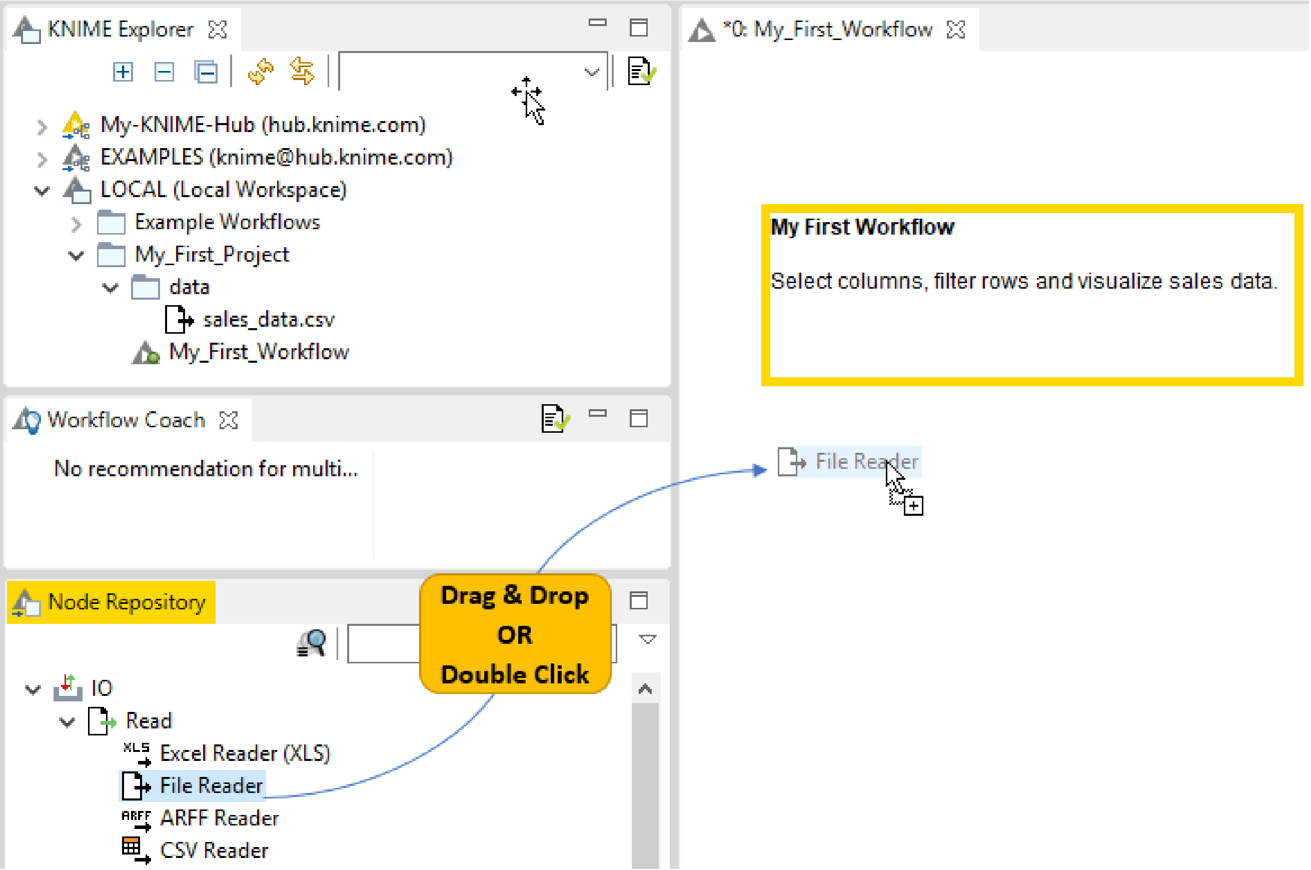


Figure 11. Adding a node into the workflow editor

Once you have added two nodes to the workflow editor, you probably want to connect them. There are three ways to connect nodes:

- Click the output port of the first node and release the mouse at the input port of the second node. Now, the nodes are connected.
- Select a node in the workflow editor, and then double click the next node in the node repository. This double click creates a new node, and connects it to the selected node in the workflow editor.
- Select the nodes you want to connect in the workflow editor and press "Ctrl + L".

If you want to add a node between two nodes in a workflow, you do not have to disconnect them. Just drag the node from the node repository, and release it on its place in the workflow when the connector has turned red, as shown in Figure 12. The red connection means that it is ready to accept the new node when you release the mouse.

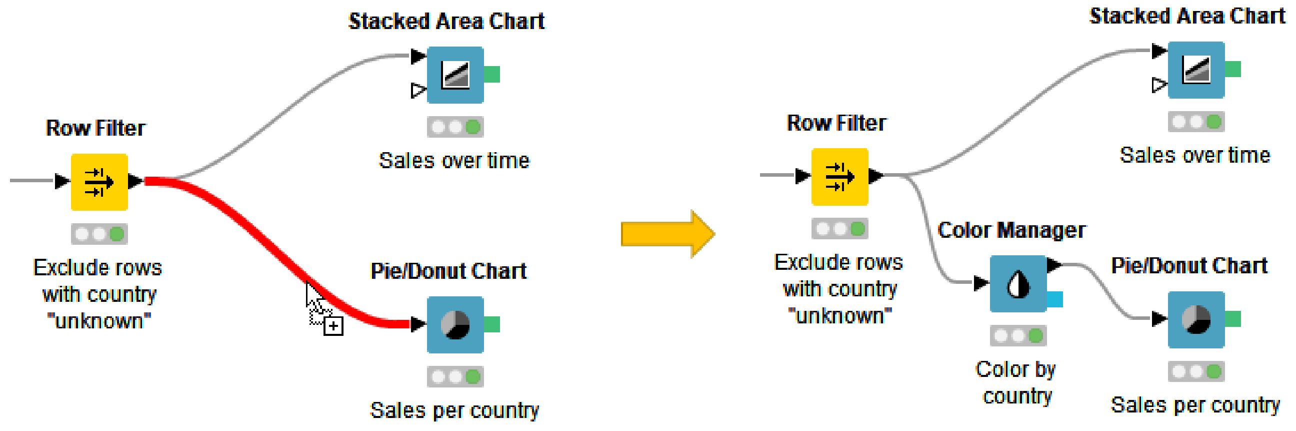


Figure 12. Add a node in the middle of a workflow

Mount Points

Mount points are workflow repositories that are accessible from KNIME Analytics Platform. They can be displayed as root directories in the KNIME Explorer view.

Each mount point consists of the location of the workflow repository, and a mount ID. For a local workflow repository, the location is the path to the folder, and for a server it is the address of the server. The mount ID is used to reference files and workflows under the mount point.

knime:// Protocol

First of all, `knime://` protocol is a protocol specific to KNIME that allows you to specify file paths relatively to the KNIME workspace or even the location of the currently executing workflow.

The first element in the file path after `knime://` is the base for the path. It is either the workflow itself, the current mount point or a specific mount point like `LOCAL` in the following example:

```
knime://LOCAL/My_First_Project/data/sales_2008-2011.csv
```

ℹ The portable file path options are explained in the subsections below and in this video: The knime:// Protocol.

Absolute Paths

Absolute paths are defined relative to a specific mount point. The following file path is defined using the absolute path to the file based on the mount point `LOCAL`:

```
knime://LOCAL/My_First_Project/data/sales_2008-2011.csv
```

The file path would now work on any system where the workflow is saved in the local workspace, and the file path inside the local workspace folder is the same.

Mountpoint-relative Paths

Because of the `LOCAL` term in the absolute path, accessing the file with the absolute path is not possible, if the workflow is deployed to a server.

To enable access to a data file both locally and on a server, you can define the path to the file relative to the currently active mount point.

You do this by changing the `LOCAL` term in the file path to `knime.mountpoint` as in this file path:

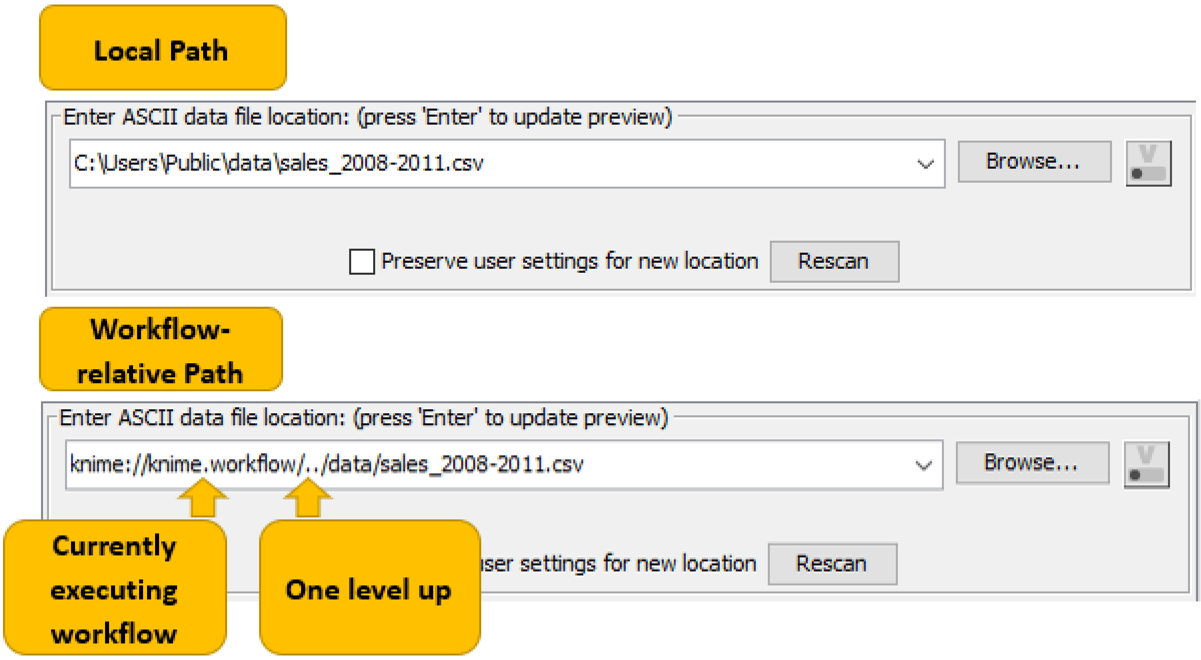
```
knime://knime.mountpoint/My_First_Project/data/sales_2008-2011.csv
```

In the mountpoint-relative file path, the `knime.mountpoint` refers to the uppermost folder level, which can be `LOCAL` or the mount ID of a server.

Workflow-relative Path

The most flexible portable file path is the workflow-relative path. A workflow-relative path defines the file path relative to the currently executing workflow. Using this file path you can access data files in workflows in local workspaces on different systems, or on a server, as long as the folder structure between the workflow and the data file is the same.

Compared to the absolute path and mountpoint-relative path, the name of the folder containing the workflow does not have to be the same in the different locations. That's because an upper folder level is denoted by `/../` instead of the name of the folder.


Local Path
Enter ASCII data file location: (press 'Enter' to update preview)
Browse...
Preserve user settings for new location
Rescan
Workflow-relative Path
Enter ASCII data file location: (press 'Enter' to update preview)
Browse...
ser settings for new location
Rescan
Currently executing workflow
One level up

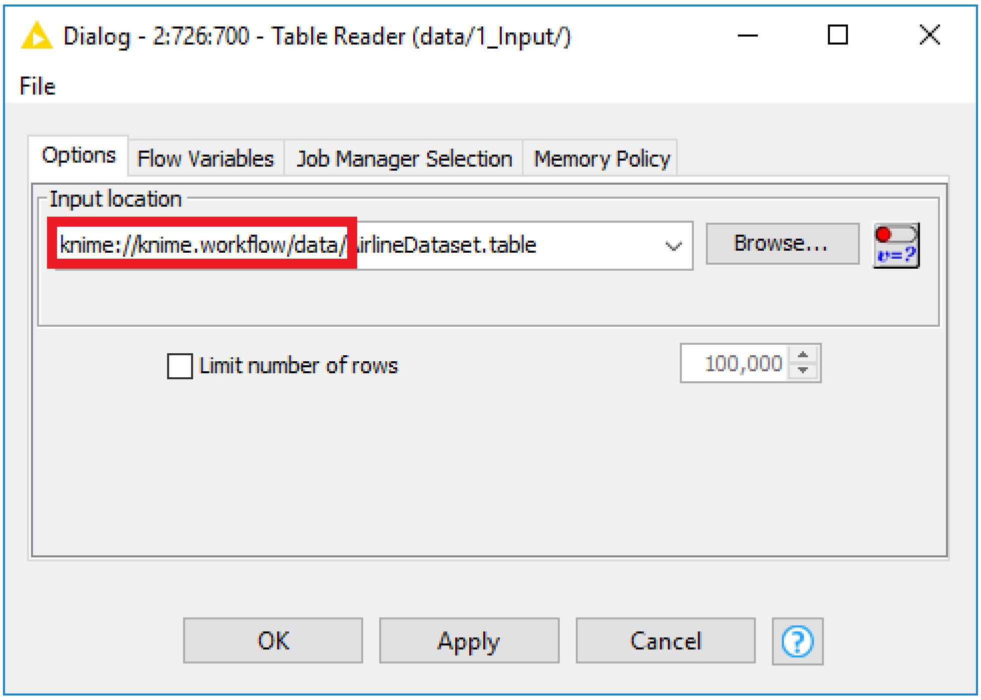
C:\Users\Public\data\sales_2008-2011.csv

knime://knime.workflow/../data/sales_2008-2011.csv

Figure 13. Workflow-relative file path

Save Workflows with Data

You can easily include data into your workflow by using the workflow-relative paths as described above. First, access the KNIME workflow in your knime-workspace from your operating system (it is just a folder), then manually create a folder called `data`, and place your data inside this folder. In this way you can easily reference your data within nodes using `knime://knime.workflow/data`, which makes sure that your data will remain with your workflow whenever you archive it, export it, or upload it to a KNIME Server or the KNIME Hub.



Input location: knime://knime.workflow/data/AirlineDataset.table

□ Limit number of rows 100,000

Figure 14. Workflow-relative file path

Workflow Groups

Multiple workflows can be organized into workflow groups. Workflow groups are folders in the KNIME workspace that can include multiple workflows, as well as associated datafiles, shared metanodes, and even other workflow groups.

The workflow groups in the currently active local workspace are shown under the `LOCAL` mount point in the KNIME Explorer.

There are three ways to create a new, empty workflow group:

- Right click in your local workspace in the KNIME Explorer, and select *New Workflow Group…* in the menu
- Click the arrow next to the leftmost icon in the toolbar and select *New KNIME Workflow Group*
- Navigate to *File* → *New…*, select *New KNIME Workflow Group* in the list, and click *Next*.

In the dialog that opens, give the folder a name, and define where in your local workspace you want to save the folder. Click *Finish*. Now the new folder will appear in the selected destination in the KNIME Explorer.

Import/Export Workflows

You have two options to export a workflow:

- You can export it as a file
- Or, you can deploy it to a server (requires a license)

In the same way, you can also import a workflow:

- Import a file containing a workflow into your local workspace
- Or, save a workflow on a server to your local workspace. Accessing the EXAMPLES Server does not require any credentials, and you can save the workflows there to your local workspace.

How to Import and Export a Workflow (or Workflow Group)

To import or export a workflow or a workflow group, you can:

- Right click anywhere in the local KNIME workspace, and select *Import (Export) KNIME Workflow…*, as shown in Figure 15.

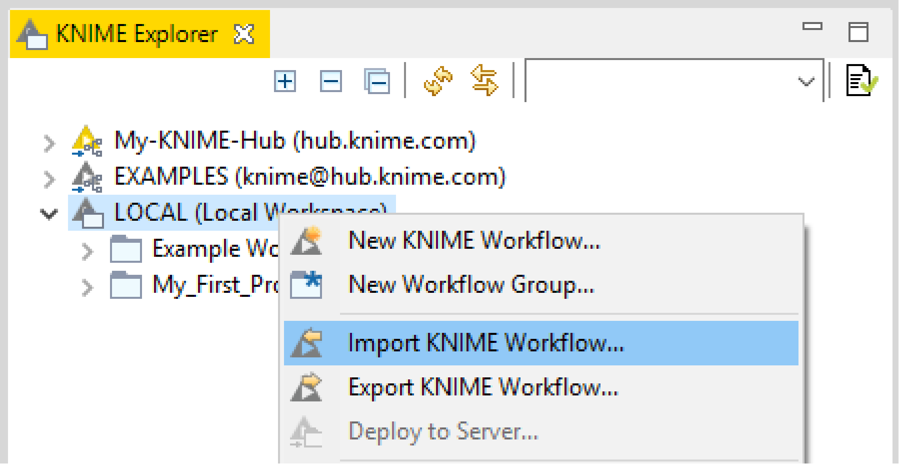


Figure 15. Importing and Exporting Workflow (Groups)

- Or, go to *File* menu and select *Import (Export) KNIME Workflow…*

The dialog shown in Figure 16 opens.

Importing a Workflow

In the upper part of the "Import" dialog, select the items to import, i.e define the file or directory path to import. In the "Destination" field underneath, define the destination folder in the KNIME workspace you want to import to.

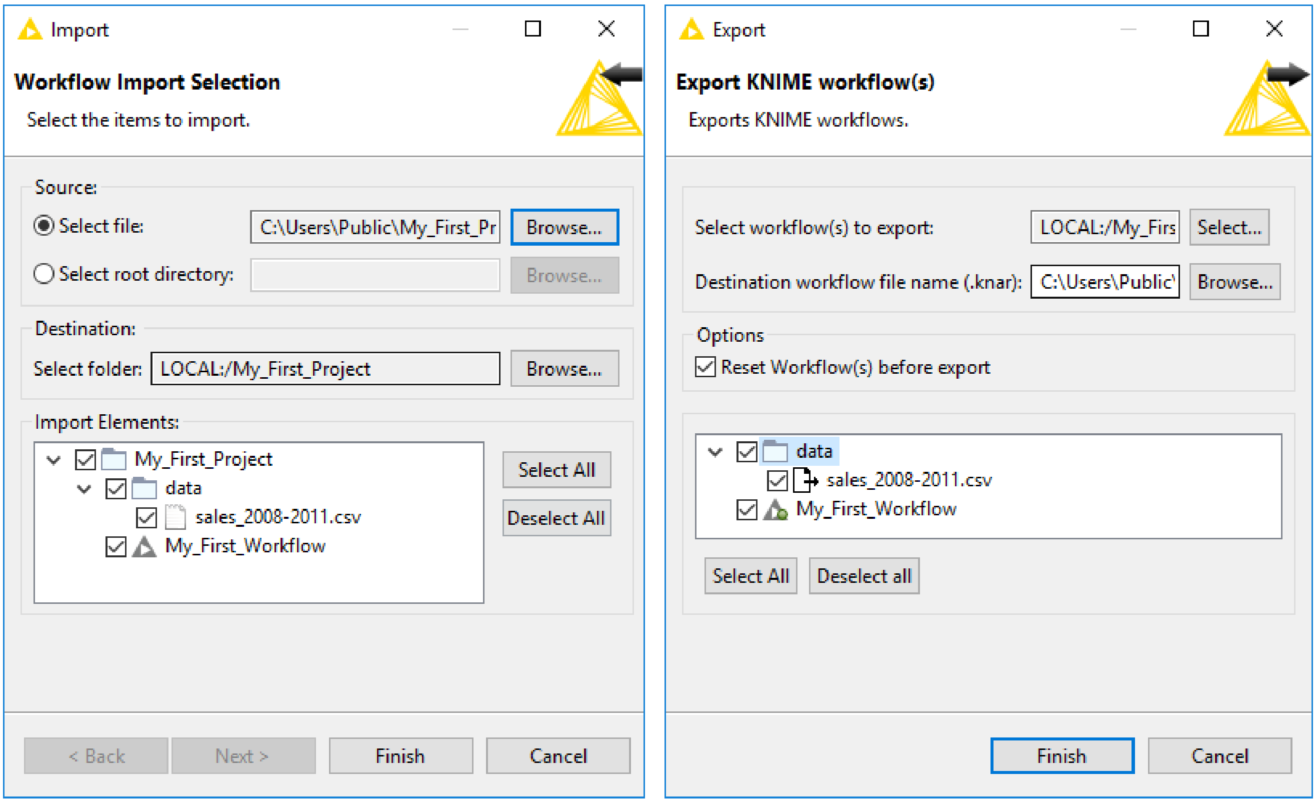
If you import a workflow group, you will see a list of elements inside the workflow group in the lower part of the dialog. Here you can select single elements to import.

Exporting a Workflow

In the upper part of the "Export" dialog, select the workflow (or group) you want to export. In the "Destination" field underneath, define the path to the destination folder on your system, and the name of the file.

In "Options" you can choose to reset the workflow(s) before exporting. When you reset a node, the node status changes from "executed" to "configured", and the output of the node will not be available any more. If you export a workflow in an executed state, the data used in the workflow will be exported as well. See the section on Reset and Logging for more information.

If you export a workflow group, you can select which elements the exported file will contain.



Import

Workflow Import Selection

Select the items to import.

Source:

● Select file: C:\Users\Public\My_First_Pr Browse...

○ Select root directory: Browse...

Destination:

Select folder: LOCAL:/My_First_Project Browse...

Import Elements:

- ☑ My_First_Project
  - ☑ data
    - ☑ sales_2008-2011.csv
  - ☑ My_First_Workflow

Select All | Deselect All

< Back | Next > | Finish | Cancel

Export

Export KNIME workflow(s)

Exports KNIME workflows.

Select workflow(s) to export: LOCAL:/My_Firs Select...

Destination workflow file name (.knar): C:\Users\Public\ Browse...

Options

☑ Reset Workflow(s) before export

- ☑ data
  - ☑ sales_2008-2011.csv
- ☑ My_First_Workflow

Select All | Deselect all

Finish | Cancel

Figure 16. Defining Settings for Importing and Exporting Workflow (Groups)

Importing and exporting workflows are also introduced in this video: *Import/Export Workflows*.

- The file extension for a KNIME workflow, is `.knwf` (KNIME workflow file)

- The file extension for a workflow group, is `.knar` (KNIME archive file)

EXAMPLES Server

You can explore example workflows - including real-world use cases - on the public EXAMPLES server.

Inspect the workflow groups for different categories by expanding the EXAMPLES mount point in the KNIME Explorer, and then double clicking the text below as shown in Figure 17.

To download an example workflow:

- Drag and drop
- Or, copy and paste

the workflow into your LOCAL workspace. Double click the downloaded copy of the example workflow to open and edit it like any other workflow.
Alternatively, double click the example workflow directly on the EXAMPLES server to open it in the workflow editor. Save it to your LOCAL workspace via "*File*" and then "*Save As…*".

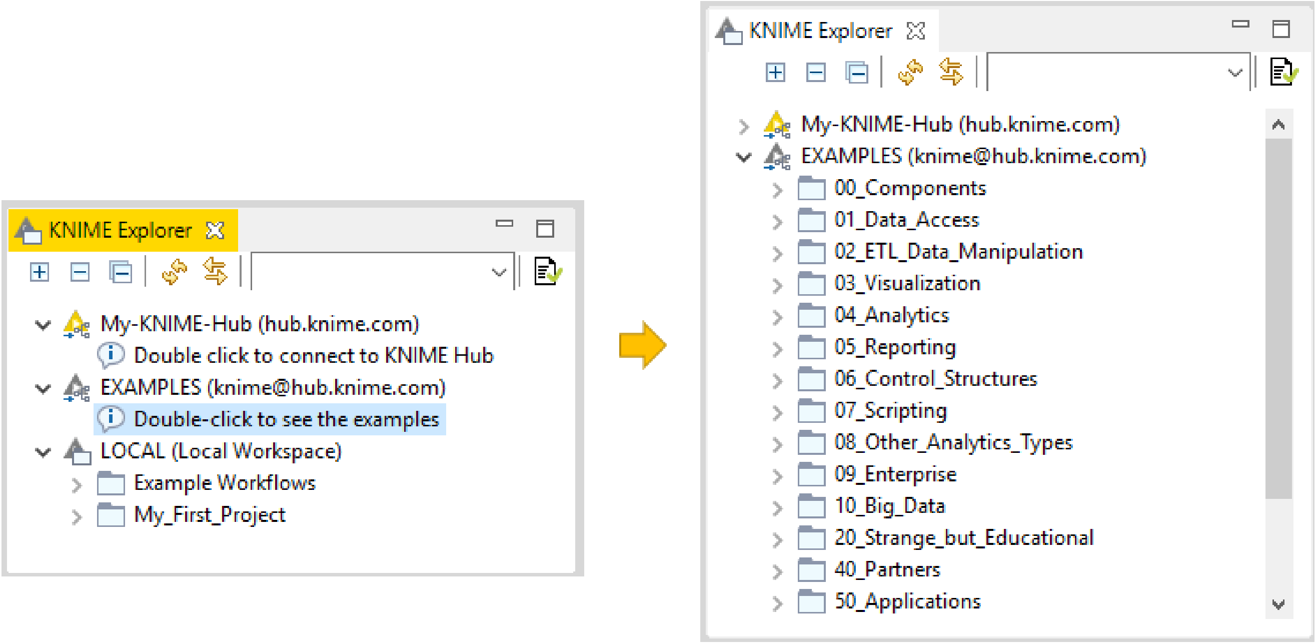


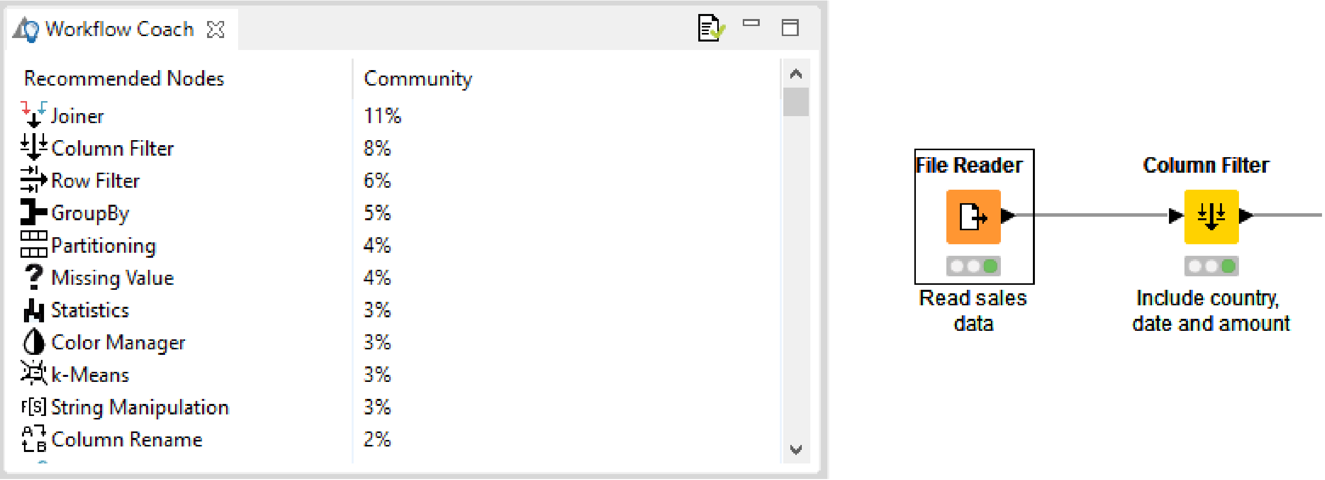
Figure 17. Example workflow available on the EXAMPLES Server

The video The EXAMPLES Server provides a more detailed introduction to the EXAMPLES server.

Workflow Coach

The workflow coach shown in Figure 18 provides node recommendations. If you have selected a node in the workflow editor, the workflow coach shows the most popular nodes to follow the selected node. If you have not selected any node, the recommendations represent the most popular nodes to start a workflow.

The recommendations are based on KNIME community usage statistics about workflows built in KNIME Analytics Platform. You can add nodes from the workflow coach to the workflow editor in the same way as you would from the node repository - by drag and drop, or by a double click.



Workflow Coach

Recommended Nodes	Community
Joiner	11%
Column Filter	8%
Row Filter	6%
GroupBy	5%
Partitioning	4%
Missing Value	4%
Statistics	3%
Color Manager	3%
k-Means	3%
String Manipulation	3%
Column Rename	2%

Figure 18. Workflow Coach

Note: start or stop sending anonymous usage data any time by checking the option *Yes, help improve KNIME.* in the "KNIME" dialog in Preferences.

Customizing node recommendations

Customize the node recommendations in the "Workflow Coach" dialog, which you find by navigating to *File → Preferences → KNIME → Workflow Coach*.
You have these three options:

- Add node recommendations based on workflows in the currently active local workspace by enabling the *Workspace Node Recommendations* option in the "Workspace Recommendations" dialog.
- Add node recommendations based on the workflows on a server by selecting the KNIME Server in the "Server Recommendations" dialog
- Disable the node recommendations by the community by unchecking the *Node Recommendations by the Community* option in the "Workflow Coach" dialog

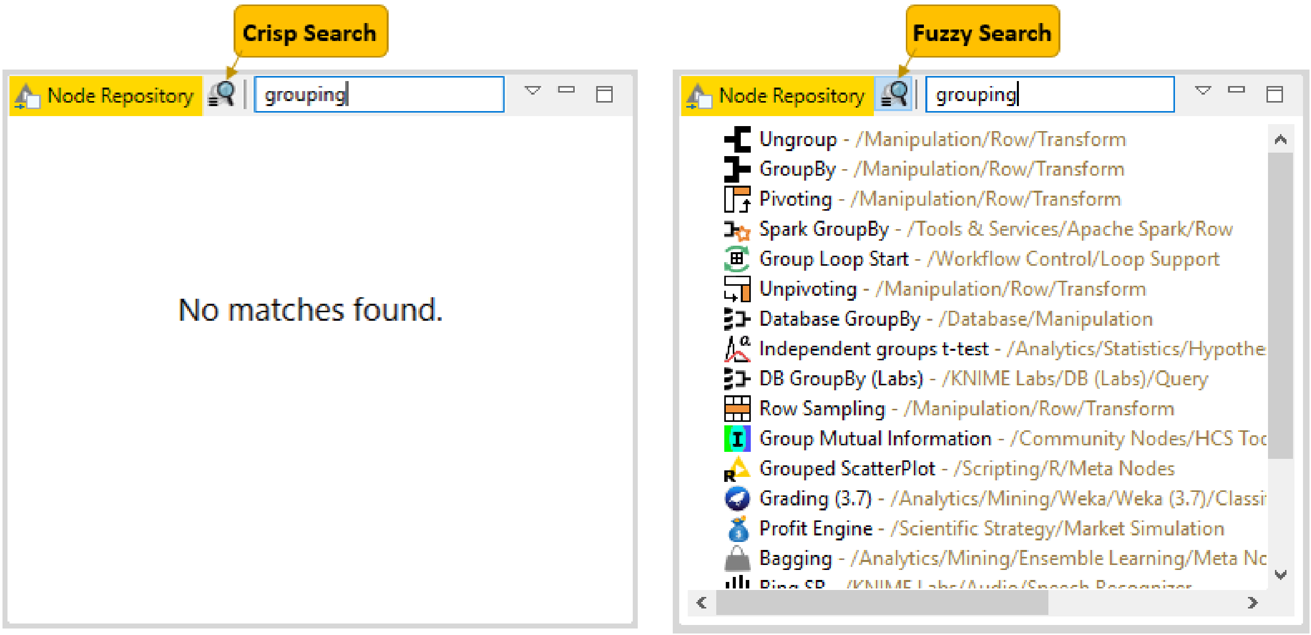
ℹ The video Workflow Coach: The Wisdom of the KNIME Crowd provides a more detailed introduction to node recommendations.

Node Repository

Currently installed nodes are available in the node repository where they are organized under different categories. You can add a node from the node repository into the workflow editor by drag and drop, or by a double click, as we explain in the section Building Workflows.

You can search for a node by expanding the categories or by typing a search term in the search field on top of the node repository, as shown in Figure 19. The default search mode is *crisp search*. Using this search mode, the interface will return all the nodes that either have the search term in their names, or they are in a subcategory whose name includes the search term.

You can switch the search mode to *fuzzy search* by clicking the icon next to the search field. Using this search mode, the interface will return all the nodes that are related to the search term.



No matches found.

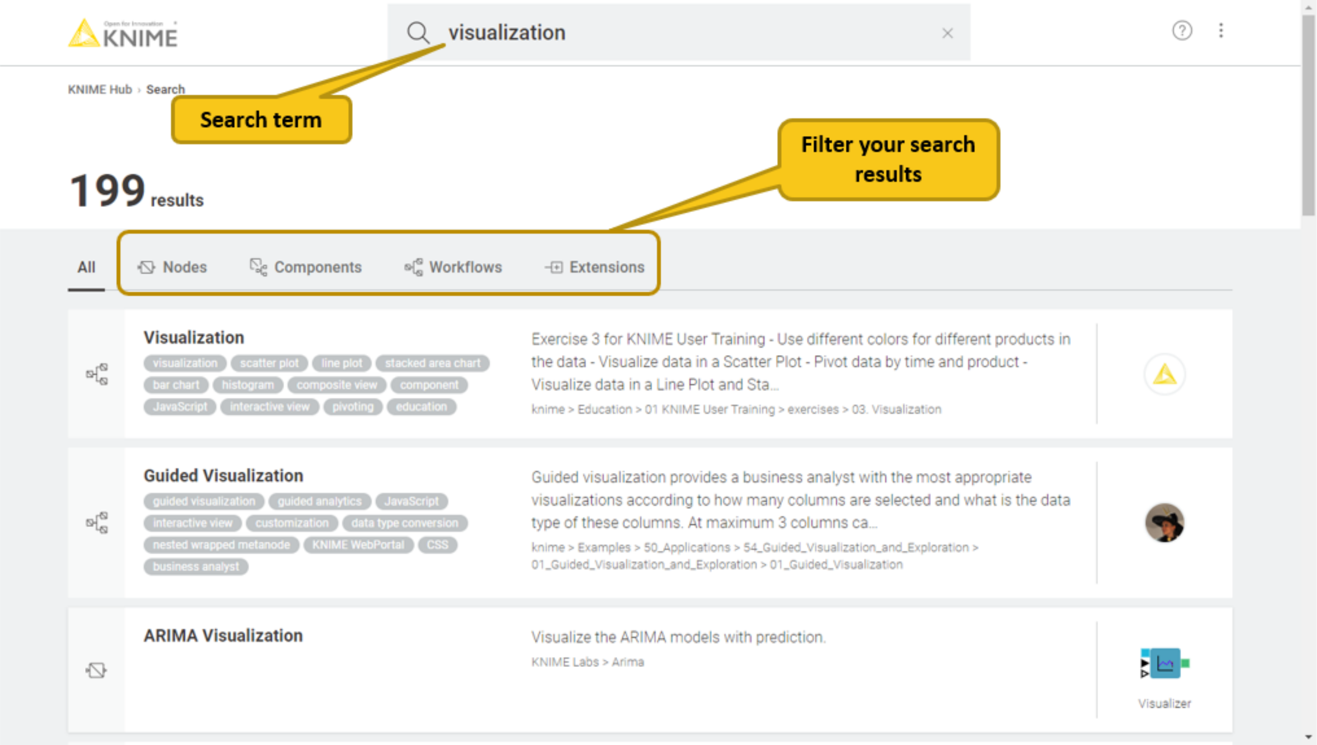
Ungroup - /Manipulation/Row/Transform
GroupBy - /Manipulation/Row/Transform
Pivoting - /Manipulation/Row/Transform
Spark GroupBy - /Tools & Services/Apache Spark/Row
Group Loop Start - /Workflow Control/Loop Support
Unpivoting - /Manipulation/Row/Transform
Database GroupBy - /Database/Manipulation
Independent groups t-test - /Analytics/Statistics/Hypothe
DB GroupBy (Labs) - /KNIME Labs/DB (Labs)/Query
Row Sampling - /Manipulation/Row/Transform
Group Mutual Information - /Community Nodes/HCS Too
Grouped ScatterPlot - /Scripting/R/Meta Nodes
Grading (3.7) - /Analytics/Mining/Weka/Weka (3.7)/Classi
Profit Engine - /Scientific Strategy/Market Simulation
Bagging - /Analytics/Mining/Ensemble Learning/Meta Nc

Figure 19. Node repository with two search modes

An introduction to the node repository is also available in the video Node Repository.

KNIME Hub Search

The search bar on the right of the KNIME Workbench shown in Figure 2 provides a convenient way to directly search the KNIME Hub from within KNIME Analytics Platform. After you entered a search term or sentence, press **Enter**. This will open a browser window and display the results of the search as show in Figure 20.



Search term

Filter your search results

199 results

Visualization
visualization, scatter plot, line plot, stacked area chart, bar chart, histogram, composite view, component, JavaScript, interactive view, pivoting, education
Exercise 3 for KNIME User Training - Use different colors for different products in the data - Visualize data in a Scatter Plot - Pivot data by time and product - Visualize data in a Line Plot and Sta...
knime > Education > 01 KNIME User Training > exercises > 03. Visualization

Guided Visualization
guided visualization, guided analytics, JavaScript, interactive view, customization, data type conversion, nested wrapped metanode, KNIME WebPortal, CSS, business analyst
Guided visualization provides a business analyst with the most appropriate visualizations according to how many columns are selected and what is the data type of these columns. At maximum 3 columns ca...
knime > Examples > 50_Applications > 54_Guided_Visualization_and_Exploration > 01_Guided_Visualization_and_Exploration > 01_Guided_Visualization

ARIMA Visualization
Visualize the ARIMA models with prediction.
KNIME Labs > Arima

Figure 20. Inspecting the KNIME Hub search results on a browser

From the KNIME Hub page, you can:

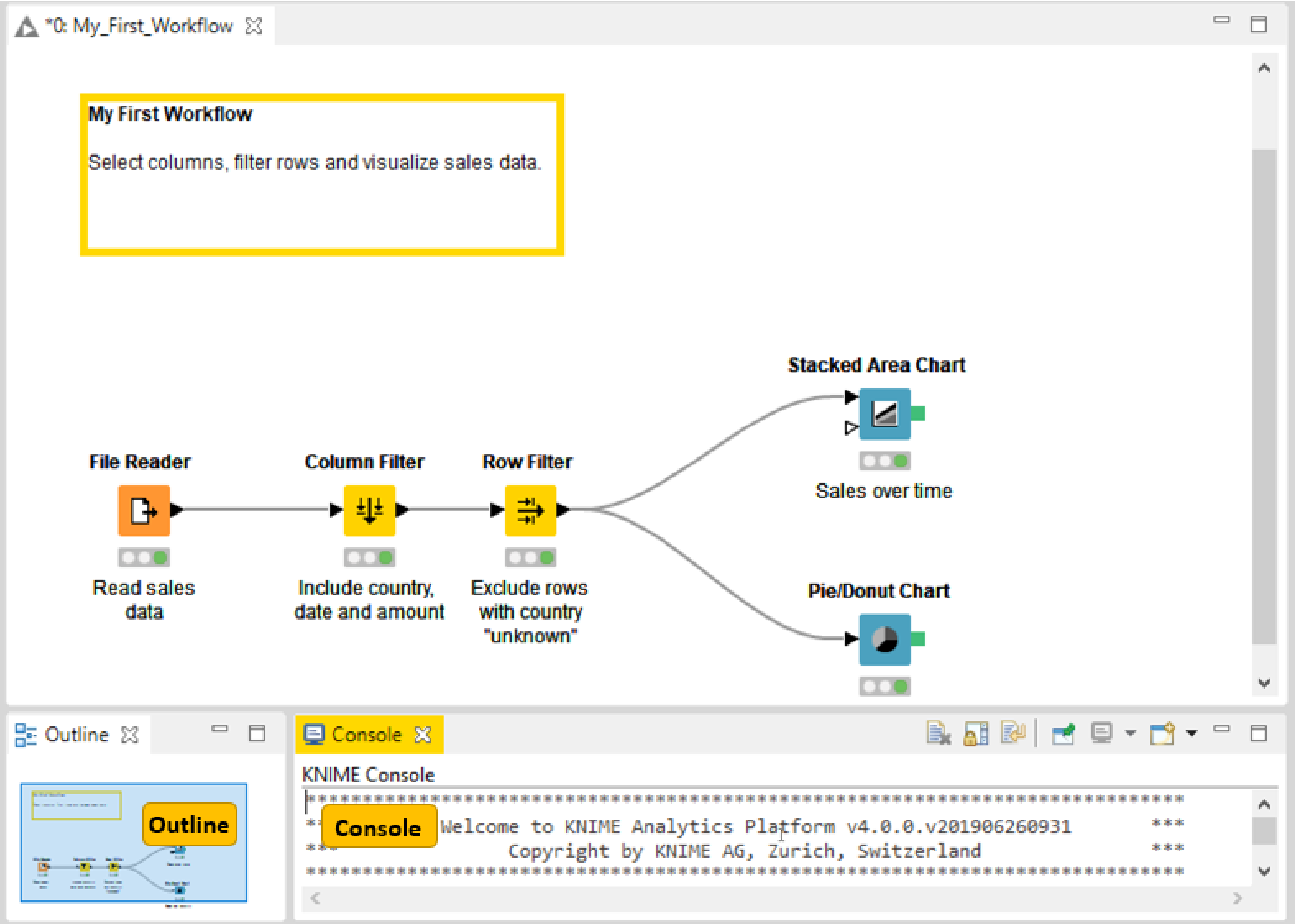
- Inspect, open and download workflows
- Add nodes and components into your workflow by drag and drop
- Install extensions by drag and drop

Description

The description panel on the right of the KNIME Workbench shown in Figure 2 provides a description of the currently active workflow, or a node selected in the node repository or workflow editor. For a workflow, the first part is a general description, followed by tags and links to other resources related to the workflow. For a node, the first part is a general description, followed by the available setting options, and finally a list of input and output ports.

Outline

In the outline on the bottom part of the KNIME Workbench shown in Figure 21, you see an overview of the currently active workflow. If the whole workflow does not fit in the workflow editor, you can change the active area by scrolling the blue, transparent rectangle.



```
****************************************************************************
**      Welcome to KNIME Analytics Platform v4.0.0.v201906260931         ***
***            Copyright by KNIME AG, Zurich, Switzerland                ***
****************************************************************************
```

Figure 21. Outline and console

Console

The console on the bottom part of the KNIME Workbench shown in Figure 21 shows all warning and error messages related to the workflow execution - indicating what is going on under the hood. If you want debug and log information messages to be reported in the console, you can change the console log level in *File* → *Preferences* → *KNIME* → *KNIME GUI*.

Customizing the KNIME Workbench

Node Monitor

If you want to inspect intermediate output tables in your workflow, you can add a Node Monitor panel into your KNIME workbench. Go to *View* → *Other* → *KNIME Views*, and you will find the *Node Monitor* item in the list of available views, as shown in Figure 22.

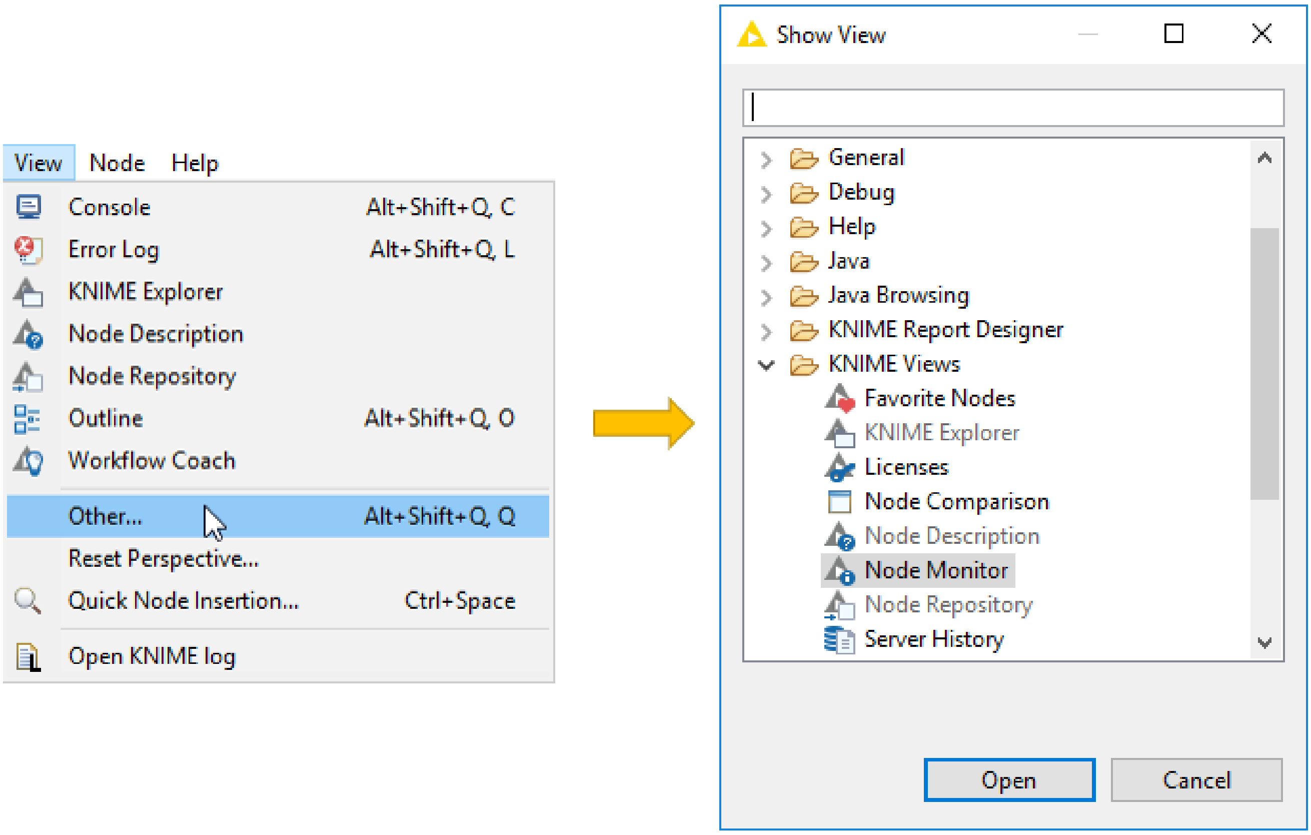
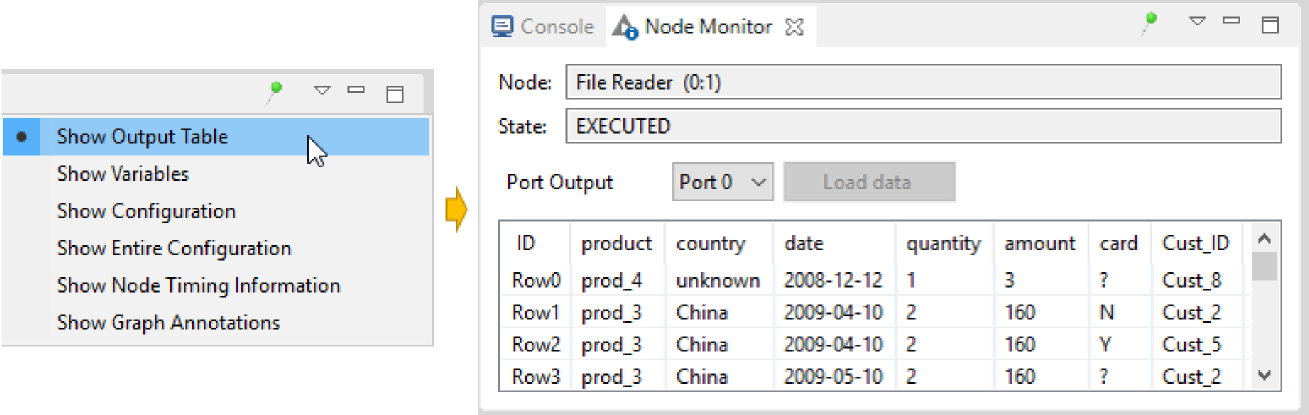


Figure 22. Adding node monitor to the KNIME Workbench

After adding the panel to the workbench, select *Show Output Table* in the menu in the upper right corner of the node monitor panel, as shown in Figure 23. Now, this panel will show the output table of the node you have selected in the workflow editor.



Node: File Reader (0:1)

State: EXECUTED

ID	product	country	date	quantity	amount	card	Cust_ID
Row0	prod_4	unknown	2008-12-12	1	3	?	Cust_8
Row1	prod_3	China	2009-04-10	2	160	N	Cust_2
Row2	prod_3	China	2009-04-10	2	160	Y	Cust_5
Row3	prod_3	China	2009-05-10	2	160	?	Cust_2

Figure 23. Showing output table in the node monitor in the KNIME Workbench

Besides the output table, you can also have the node monitor panel to show the available flow variables in the node output, or the execution time of the node. Or, you can pin the output of one node. This means that the output of the pinned node is shown independently of the selection in the workflow editor.

Reset and Logging

When you reset a node, the node status changes from "executed" to "configured", and the output of the node will not be available any more. If you save a workflow in an "executed" state, the data used in the workflow will be saved as well. That is, the larger the dataset, the larger the file size. Therefore, resetting workflows before saving them is recommended if you can access the dataset without any restrictions.

A reset workflow only saves the node configurations, and not any results. However, resetting a node does not undo the operation executed before. All operations done during creation, configuration, and execution of a workflow are reported in the `knime.log` file.

You can inspect the `knime.log` file by going to *View* → *Open KNIME log*. The log file opens in the workflow editor. The `knime.log` file has a limited size, and after reaching it the rows will be overwritten from the top.

You can also find the `knime.log` file in the `knime`-folder inside the `.metadata`-folder, which you will find in the KNIME workspace folder you defined when launching KNIME Analytics Platform.

Show Heap Status

The heap status panel shows the memory usage during the execution of a workflow, and helps you to monitor memory usage for your project. To add the heap status panel to the workbench, go to *File* → *Preferences*. In the dialog that opens, click *General*, select *Show heap status*, and click *Apply and Close*.

A heap status bar showing the memory usage appears in the bottom right part of the status bar, directly below the console panel. Next to the heap status bar is the "Run Garbage Collector" button, which you can click to manually allocate and free up memory.

Configuring KNIME Analytics Platform

Preferences

You can adjust the default settings in KNIME Analytics Platform in Preferences. Go to *File* → *Preferences*, and in the dialog that opens, you will find a list of subcategories. Each category contains a separate dialog for specific settings like database drivers, available update sites, and appearance.

KNIME

Select *KNIME* in the list of subcategories, and you can define the log file log level. By default it is set to DEBUG. This log level helps developers to find reasons for any unexpected behavior.

Directly below, you can define the maximum number of threads for all nodes. Separate branches of the workflow are distributed to several threads to optimize the overall execution time. By default the number of threads is set to twice the number of CPUs on your machine.

In the same dialog, you can also define the directory for temporary files.

By checking the last option *Yes, help improve KNIME.*, you agree to sending us anonymous usage data. Your agreement activates the node recommendations by community in the Workflow Coach.

KNIME GUI

If you expand the *KNIME* category, you will find a subcategory *KNIME GUI*. In this dialog, you can define the console view log level. By default it is set to "WARN", because more detailed information is only useful for diagnosis purposes.

Further below, you can select which confirmation dialogs are shown when you use KNIME Analytics Platform. Choose from the following:

- Confirmation after resetting a node
- Deleting a node or connection
- Replacing a connection
- Saving and executing workflow
- Loading workflows created with a nightly build

In the same dialog, you can define what happens if an operation requires executing the previous nodes in the workflow. You have these three options:

- Nodes are executed automatically
- The node execution is always rejected
- Show a dialog to execute or not

The following options allow you to define if workflows are saved automatically and after which time interval and if linked metanodes and components are automatically updated, among some visual properties like the border width of the workflow annotations.

Master Key

If you use credentials in your workflow, you can encrypt them using a Master Key. Once you enter for example your credentials for different database connections in a workflow, you do not need to save them together with the workflow, nor do you need to enter them every time you open the workflow. Instead, you just provide the Master Key.

Setting up knime.ini

When installing KNIME Analytics Platform, configuration options are set to their defaults. The configuration options, i.e. options used by KNIME Analytics Platform, range from memory settings to system properties required by some extensions.

The default settings can be changed in the `knime.ini` file. You can find the `knime.ini` file in the installation folder of KNIME Analytics Platform.

> To locate the `knime.ini` file on MacOS, open Finder and navigate to your installed Applications.
> Next, right click the KNIME application, select *Show Package Contents* in the menu, and navigate to *Contents*, and open *Eclipse*.

The `knime.ini` file can be edited with any plaintext editor, such as Notepad (Windows), TextEdit (MacOS) or gedit (Linux).

The entry `-Xmx1024m` in the `knime.ini` file specifies how much memory KNIME Analytics Platform is allowed to use. The setting for this value will depend on how much memory is available in your machine. KNIME recommends setting it to approximately one half of your available memory, but you can modify the value based on your needs. For example, if your computer has 16GB of memory, you might set the entry to `-Xmx8G`.

Besides the memory available, many other settings can be defined in the `knime.ini` file. Table 1 provides an overview of some of the most common settings, and here you can access a complete list of the configuration options.

Table 1. Common configuration settings in knime.ini file

Setting	Explanation
`-Xmx` • default value: `1024m` • example: `-Xmx16G`	Sets the maximum amount of memory available for KNIME Analytics Platform.
`-Dknime.compress.io` • default value: `SNAPPY` • possible values: `[SNAPPY|GZIP|NONE]` • example: `-Dknime.compress.io=SNAPPY`	Determines which compression algorithm (if any) to use when writing temporary tables to disk.
`-Dorg.knime.container.cellsinmemory` • default value: 5,000 • possible values: any value between 0 and 2,147,483,647 • example: `-Dorg.knime.container.cellsinmemory=100,000`	This setting defines the size of a "small table". Small tables are attempted to be kept in memory, independent of the Table Caching strategy. By increasing the size of a small table, you can limit the number of swaps to the disk, which comes at the cost of reducing memory space available for other operations.
`-Dknime.table.cache` • default value: `LRU` • possible values: `[LRU|SMALL]` • example: `-Dknime.table.cache=SMALL`	Determines whether to attempt to cache large tables (i.e., tables that are not considered to be "small"; see setting `-Dorg.knime.container.cellsinmemory`) in memory. If set to `LRU`, large tables are evicted from memory in least-recently used (LRU) order or when memory becomes scarce. If set to `SMALL`, large tables are always flushed to disk.

Setting	Explanation
`-Dknime.url.timeout` • default value: 1,000 ms • example: `-Dknime.url.timeout=100`	When trying to connect or read data from an URL, this value defines a timeout for the request. Increase the value if a reader node fails. A too high timeout value may lead to slow websites blocking dialogs in KNIME Analytics Platform.

KNIME Tables

Data Table

Very common input and output ports of nodes are data input ports and data output ports, which you can recognize from the black triangles in Figure 24.

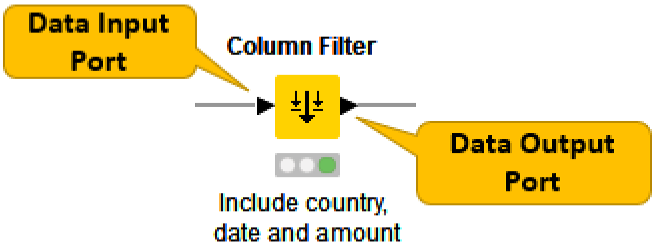
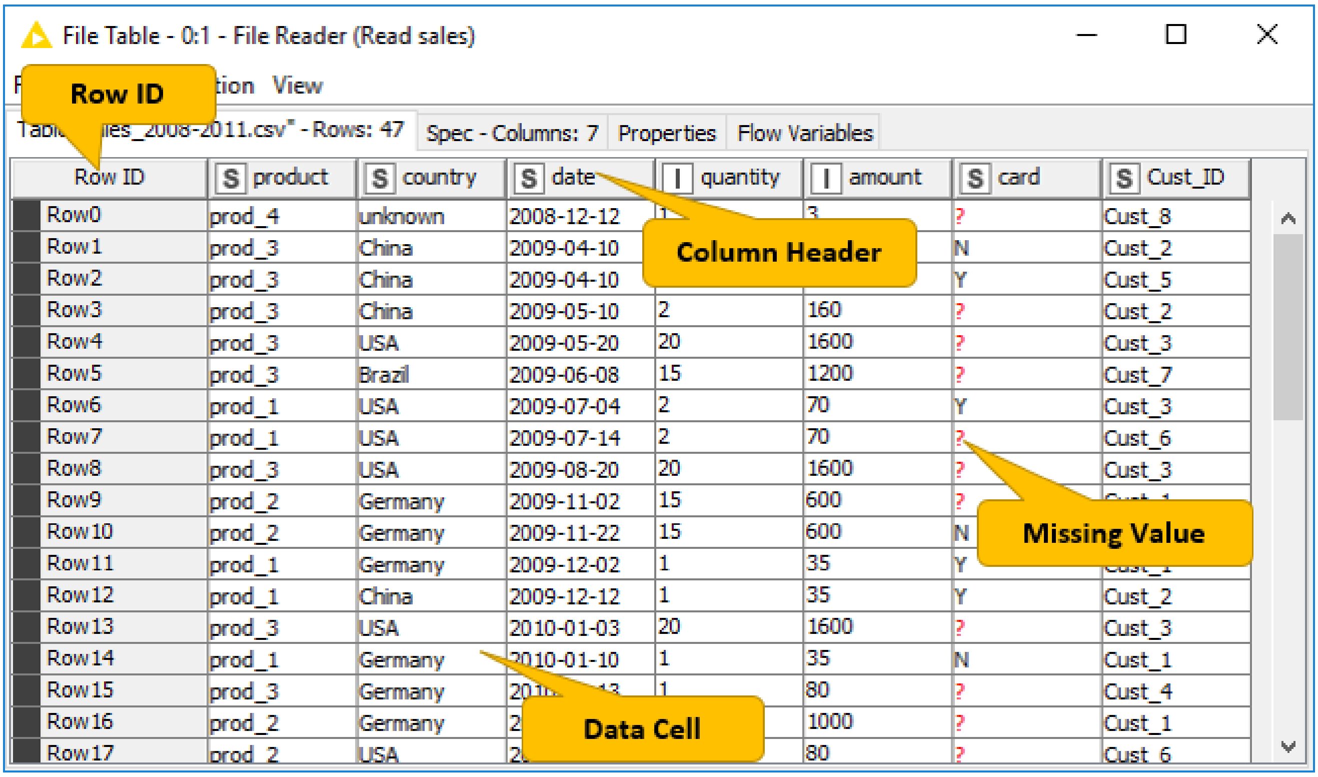


Figure 24. Data input and output port

A data table is organized by columns and rows, and it contains a number of equal-length rows. Elements in each column must have the same data type.

The data table shown in Figure 25 is produced by the File Reader node, which is one of the many nodes with a black triangle output port for data output. To open the table, right click the node and select the last item *File Table* in the menu. The output table has unique row IDs and column headers. The row IDs are automatically created by the reader node, but they can also be defined manually. The row IDs and the column headers can therefore be used to identify each data cell in the table. Missing values in the data are shown by a question mark.

Besides the data table, the node output contains the default "Table" tab, "Spec" tab, "Properties" tab, and "Flow Variables" tab. The "Table" tab shows the contents of the table. The "Spec" tab shows the meta information of the table, including the column name, column type, and optional properties like the domain of the values in the column. In the "Properties" tab, you can see possible metadata related to some columns, for example the width of the histogram in the "Histogram" column produced by the Statistics node. The "Flow Variables" tab shows the available flow variables in the node output and their current values.



Row ID	S product	S country	S date	I quantity	I amount	S card	S Cust_ID
Row0	prod_4	unknown	2008-12-12	1	3	?	Cust_8
Row1	prod_3	China	2009-04-10			N	Cust_2
Row2	prod_3	China	2009-04-10			Y	Cust_5
Row3	prod_3	China	2009-05-10	2	160	?	Cust_2
Row4	prod_3	USA	2009-05-20	20	1600	?	Cust_3
Row5	prod_3	Brazil	2009-06-08	15	1200	?	Cust_7
Row6	prod_1	USA	2009-07-04	2	70	Y	Cust_3
Row7	prod_1	USA	2009-07-14	2	70	?	Cust_6
Row8	prod_3	USA	2009-08-20	20	1600	?	Cust_3
Row9	prod_2	Germany	2009-11-02	15	600	?	
Row10	prod_2	Germany	2009-11-22	15	600	N	
Row11	prod_1	Germany	2009-12-02	1	35	Y	
Row12	prod_1	China	2009-12-12	1	35	Y	Cust_2
Row13	prod_3	USA	2010-01-03	20	1600	?	Cust_3
Row14	prod_1	Germany	2010-01-10	1	35	N	Cust_1
Row15	prod_3	Germany		1	80	?	Cust_4
Row16	prod_2	Germany			1000	?	Cust_1
Row17	prod_2	USA			80	?	Cust_6

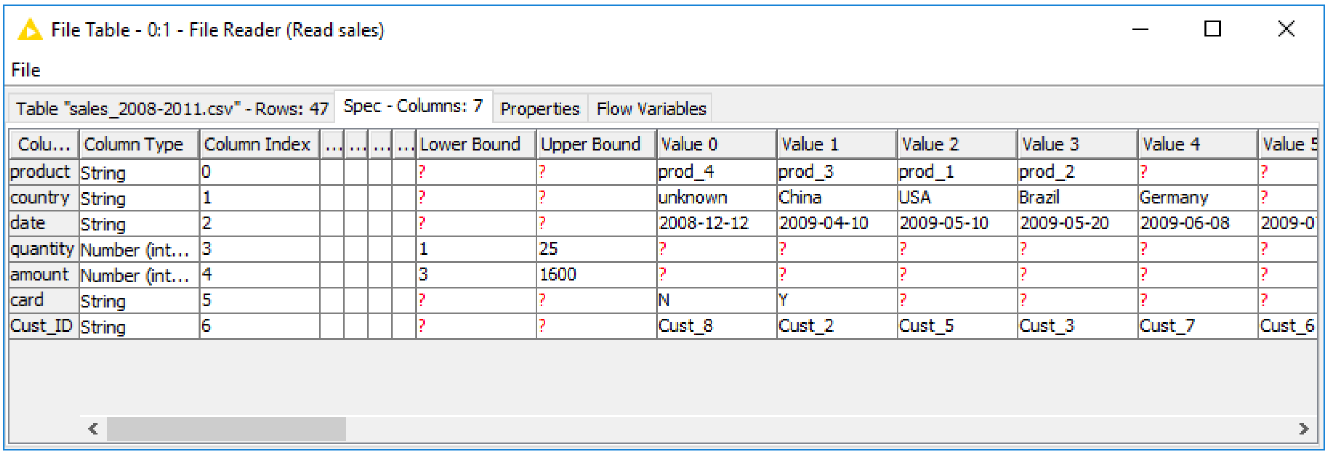
Figure 25. Data Output in KNIME Analytics Platform

In the video Data Table Structure we introduce the data organization and data representation in KNIME Analytics Platform in more detail.

Column Types

The basic data types in KNIME Analytics Platform are `Integer`, `Double`, and `String`, along with other supported data types such as `Long`, `Boolean` value, `JSON`, `URI`, `Document`, `Date&Time`, `Bit vector`, `Image`, and `Blob`. KNIME Analytics Platform also supports customized data types - for example, a representation of a molecule.

If you click on the "Spec" tab in an output table, you will see the data types of the columns in the data table, as well as the domain of the values in the columns, as shown in Figure 26. For numerical values you will see the range of the values in the data. For string values, you will see the different values appearing in the data.



File Table - 0:1 - File Reader (Read sales)

File

Table "sales_2008-2011.csv" - Rows: 47 | Spec - Columns: 7 | Properties | Flow Variables

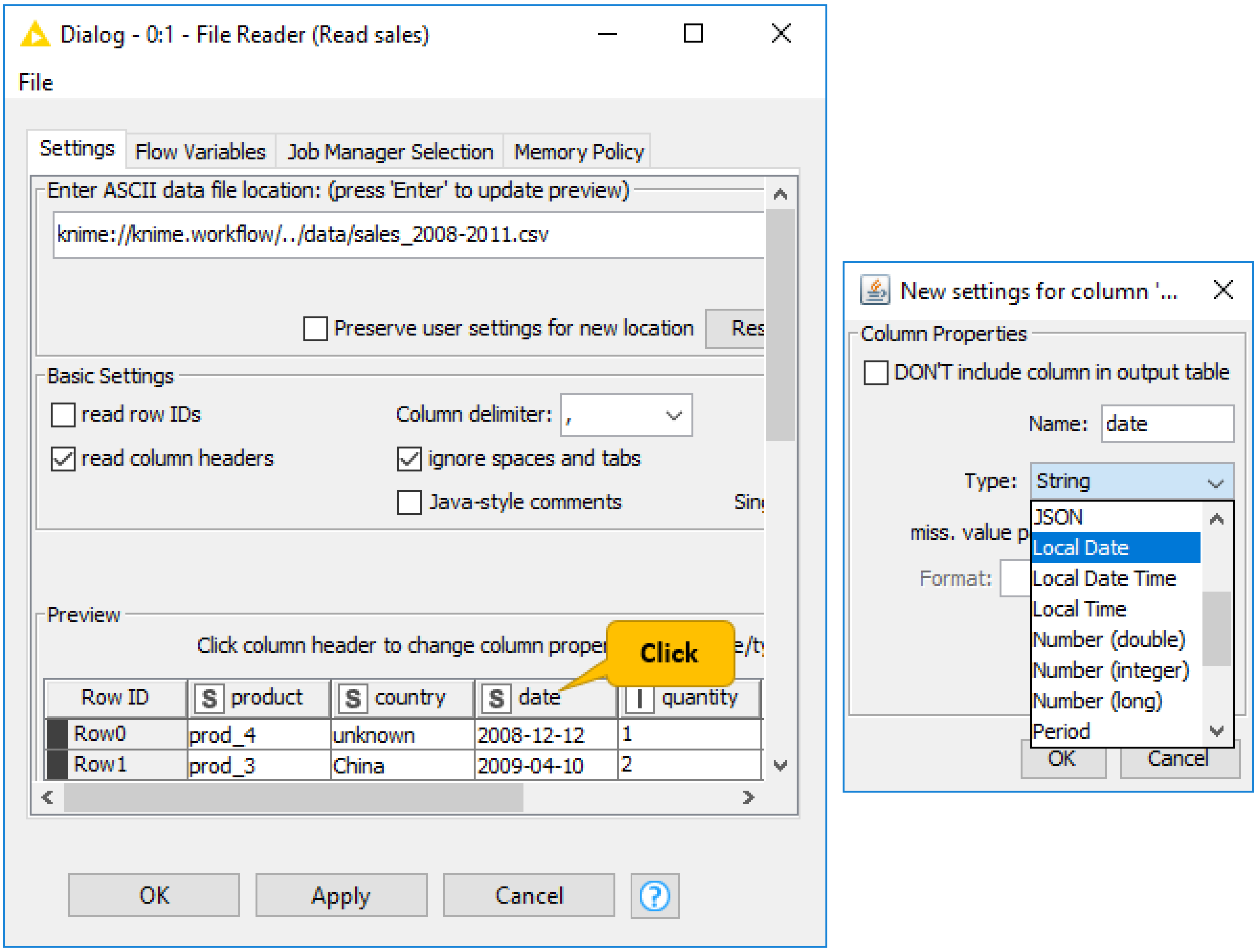
Colu…	Column Type	Column Index	…	…	…	…	Lower Bound	Upper Bound	Value 0	Value 1	Value 2	Value 3	Value 4	Value 5
product	String	0					?	?	prod_4	prod_3	prod_1	prod_2	?	?
country	String	1					?	?	unknown	China	USA	Brazil	Germany	?
date	String	2					?	?	2008-12-12	2009-04-10	2009-05-10	2009-05-20	2009-06-08	2009-0
quantity	Number (int…	3					1	25	?	?	?	?	?	?
amount	Number (int…	4					3	1600	?	?	?	?	?	?
card	String	5					?	?	N	Y	?	?	?	?
Cust_ID	String	6					?	?	Cust_8	Cust_2	Cust_5	Cust_3	Cust_7	Cust_6

Figure 26. Data types and data domain in Spec tab

The reader nodes in KNIME Analytics Platform assign a data type to each column based on their interpretation of the content. If the correct data type of a column is not recognized by the reader node, you can convert the data type afterwards. The nodes to convert data types are for example String to Number, Number to String, Double to Int, String to Date&Time, String to JSON, and String to URI.

Many of the special data types are recognized as `String` by the reader nodes. To convert these `String` columns to their correct data types, you can use the Column Type Auto Cast node.

If you use the File Reader node to read a file, you can convert the column types directly in the configuration dialog. You do this by double clicking a column header in the preview and changing the column type in the dialog that opens, as shown in Figure 27.



Dialog - 0:1 - File Reader (Read sales)

File

Enter ASCII data file location: (press 'Enter' to update preview)

knime://knime.workflow/../data/sales_2008-2011.csv

☐ Preserve user settings for new location

Basic Settings

☐ read row IDs

Column delimiter: ,

☑ read column headers

☑ ignore spaces and tabs

☐ Java-style comments

Preview

Click column header to change column prope

Row ID	S product	S country	S date	I quantity
Row0	prod_4	unknown	2008-12-12	1
Row1	prod_3	China	2009-04-10	2

New settings for column '...

Column Properties

☐ DON'T include column in output table

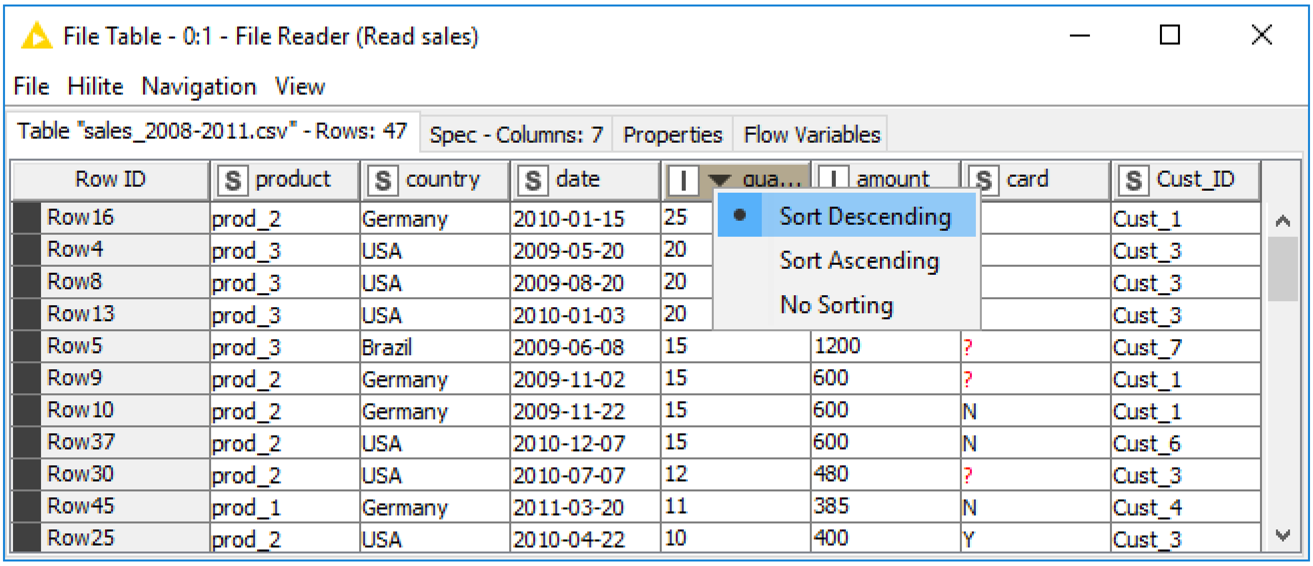
Name: date

Type: String

Figure 27. Change column type in File Reader node

Sorting

You can sort rows in the table view output by values in one column by clicking the column header and selecting *Sort Descending* or *Sort Ascending* as shown in Figure 28. Note that this sorting only affects the current output view, and has no effect on the node output.



File Table - 0:1 - File Reader (Read sales)

File Hilite Navigation View

Table "sales_2008-2011.csv" - Rows: 47 | Spec - Columns: 7 | Properties | Flow Variables

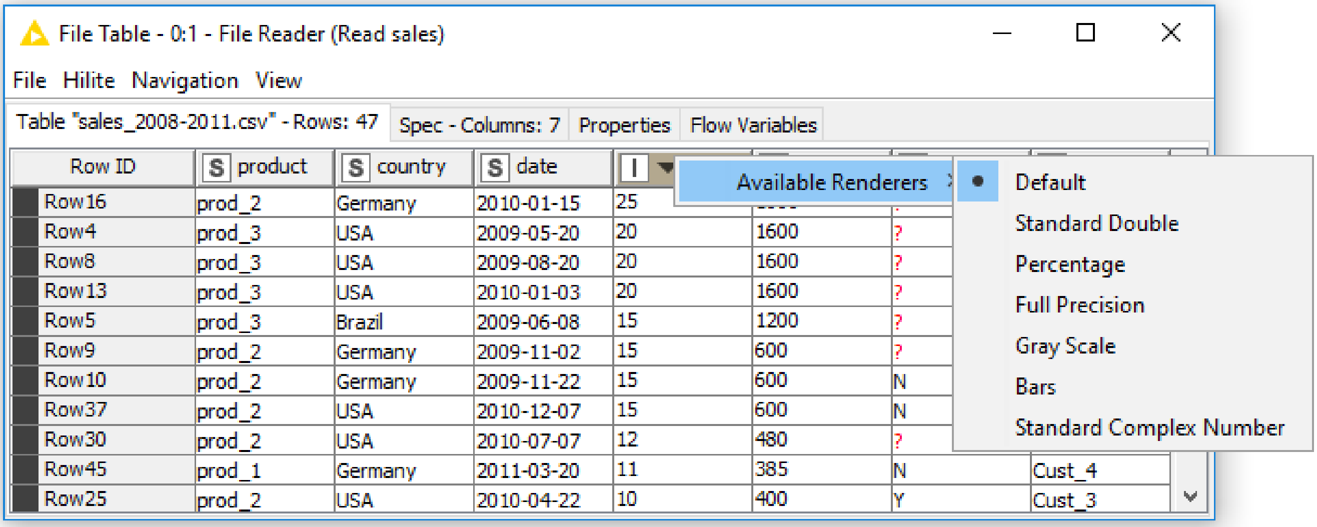
Row ID	S product	S country	S date	I qua...	I amount	S card	S Cust_ID
Row16	prod_2	Germany	2010-01-15	25			Cust_1
Row4	prod_3	USA	2009-05-20	20			Cust_3
Row8	prod_3	USA	2009-08-20	20			Cust_3
Row13	prod_3	USA	2010-01-03	20			Cust_3
Row5	prod_3	Brazil	2009-06-08	15	1200	?	Cust_7
Row9	prod_2	Germany	2009-11-02	15	600	?	Cust_1
Row10	prod_2	Germany	2009-11-22	15	600	N	Cust_1
Row37	prod_2	USA	2010-12-07	15	600	N	Cust_6
Row30	prod_2	USA	2010-07-07	12	480	?	Cust_3
Row45	prod_1	Germany	2011-03-20	11	385	N	Cust_4
Row25	prod_2	USA	2010-04-22	10	400	Y	Cust_3

Figure 28. Sorting Data in Table View

To sort rows in an output table permanently, you can use the Sorter node. With the Column Resorter node you can reorder columns.

Column Rendering

In a table view output, you can change how numeric values are displayed in a data table. For example, it is possible to display numeric values as percentages, or with full precision. You can even replace digits by a color scale or bars. To see these and other rendering options for a column, right click the column header, and select *Available Renderers* as shown in Figure 29. Note that these changes are temporary, and have no effect on the node output.



File Table - 0:1 - File Reader (Read sales)

File Hilite Navigation View

Table "sales_2008-2011.csv" - Rows: 47 | Spec - Columns: 7 | Properties | Flow Variables

Row ID	S product	S country	S date	I			
Row16	prod_2	Germany	2010-01-15	25			
Row4	prod_3	USA	2009-05-20	20	1600	?	
Row8	prod_3	USA	2009-08-20	20	1600	?	
Row13	prod_3	USA	2010-01-03	20	1600	?	
Row5	prod_3	Brazil	2009-06-08	15	1200	?	
Row9	prod_2	Germany	2009-11-02	15	600	?	
Row10	prod_2	Germany	2009-11-22	15	600	N	
Row37	prod_2	USA	2010-12-07	15	600	N	
Row30	prod_2	USA	2010-07-07	12	480	?	
Row45	prod_1	Germany	2011-03-20	11	385	N	Cust_4
Row25	prod_2	USA	2010-04-22	10	400	Y	Cust_3

Figure 29. Rendering Data in Table View

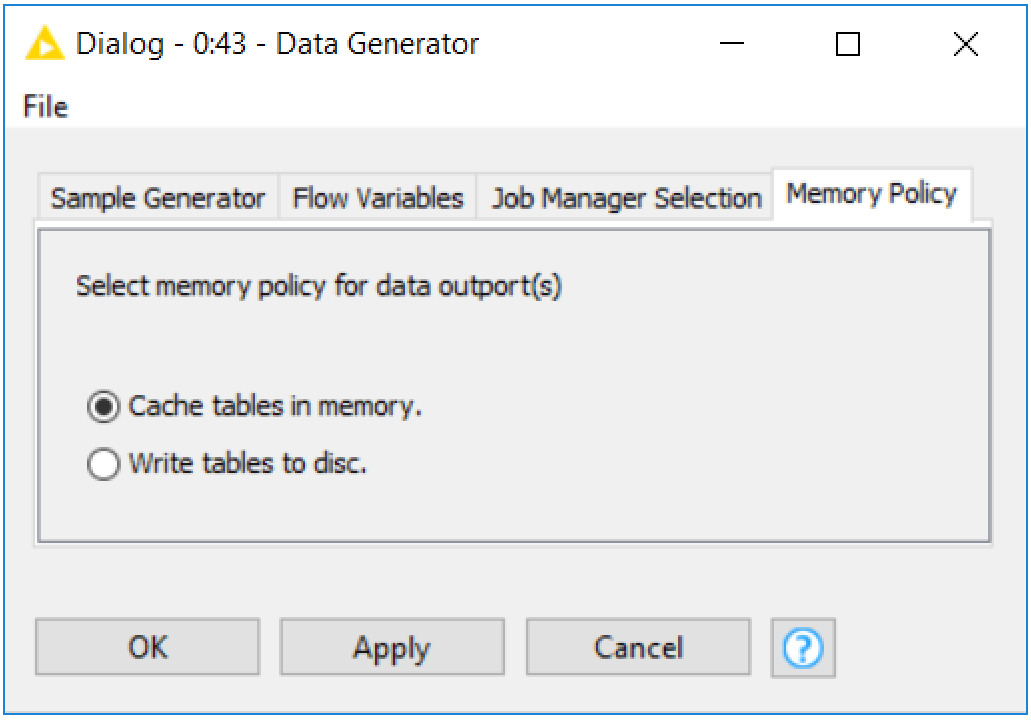
Table Storage

Many KNIME nodes, when executed, generate and provide access to tabular data at their output ports. These tables might be small or large and, therefore, might fit into the executing machine's main memory or not. Several options are available for configuring which tables to hold in memory as well as when and how to write tables to disk. These options are outlined in this section.

In-Memory Caching

KNIME differentiates between small and large tables. Tables are considered to be small (large) when they are composed of up to (more than) 5,000 cells. This threshold of 5,000 cells can be adjusted via the `-Dorg.knime.container.cellsinmemory` parameter in the `knime.ini` file. KNIME always attempts to hold small tables in memory, flushing them to disk only when memory becomes scarce.

In addition, KNIME attempts to keep recently used large tables in memory while sufficient memory is available. However, it writes these tables asynchronously to disk in the background, such that they can be dropped from memory when they have not been accessed for some time or when memory becomes scarce. If you are concerned about the memory consumption of a give node, you can configure that node to never attempt to hold its tables in memory and, instead, write them to disk on execution. This can be helpful if you know in advance that some node will generate a table that can't be held in memory or if you want to reduce a node's memory footprint.



Dialog - 0:43 - Data Generator

Select memory policy for data outport(s)

● Cache tables in memory.

○ Write tables to disc.

Figure 30. Configuring a node's memory policy

Alternatively, by putting the line `-Dknime.table.cache=SMALL` into the `knime.ini` file, you can globally configure KNIME to use a less memory-consuming, albeit much slower caching strategy. This strategy only ever keeps small tables in memory.

Disk Storage

KNIME compresses tables written to disk to reduce the amount of occupied disk space. By default, KNIME uses the Snappy compression algorithm to compress its tables. However, KNIME can be configured to use GZIP compression or no compression scheme at all via the `-Dknime.compress.io` parameter in the `knime.ini` file.

KNIME also supports columnar storage of tables using the Apache Parquet format. The columnar table storage format provides much faster access to individual sections of a table and can therefore speed up execution of certain nodes. To install the columnar data storage, in the KNIME Analytics Platform, go to *File* → *Install KNIME Extensions…* and search for *KNIME Column Storage (based on Apache Parquet)*. To enable the columnar table storage, navigate to *File* → *Preferences* → *KNIME* → *Data Storage*.

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