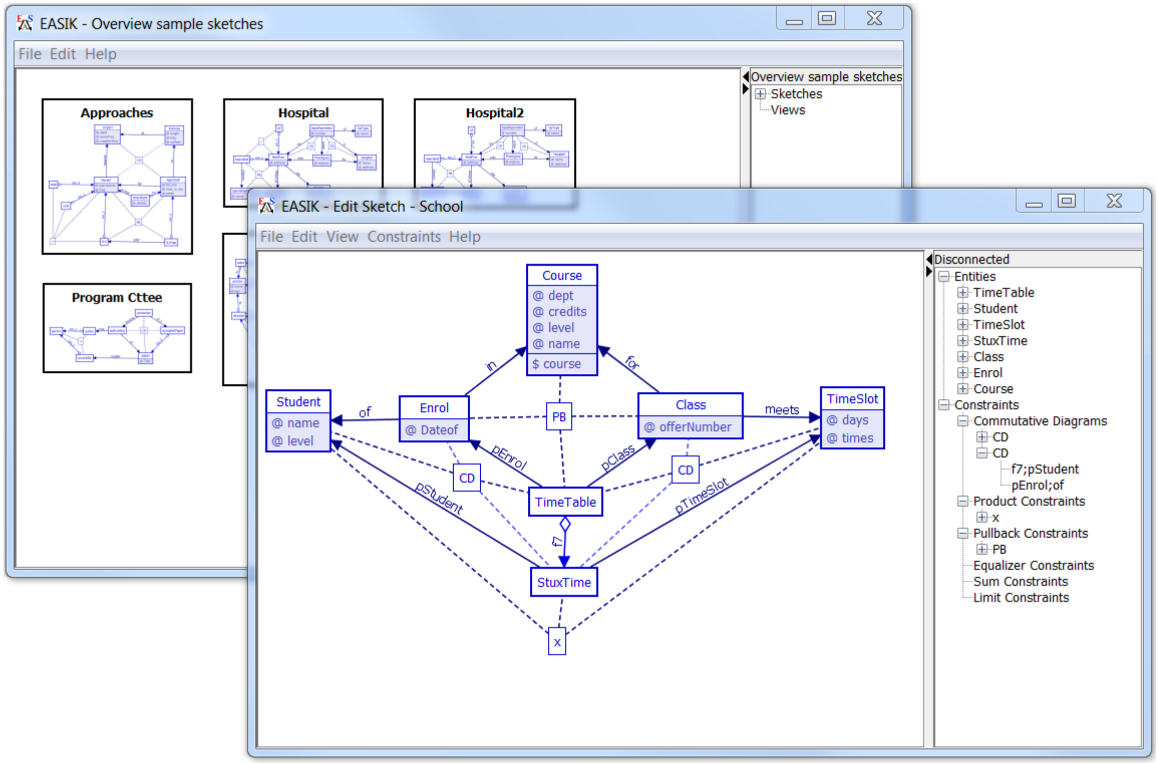
1 Introduction to EASIK

EASIK is a Java based development tool for database schemas based on EA sketches. EASIK allows graphical modeling of EA sketches and views. Sketches and their views can be converted to SQL code and then exported directly to a MySQL database schema or saved as a text file, EASIK supports interaction with the exported database schema and data entry and manipulation allowing the user to experiment with design decisions.



Suggestions to make EASIK a better product should be directed to rrosebrugh@mta.ca

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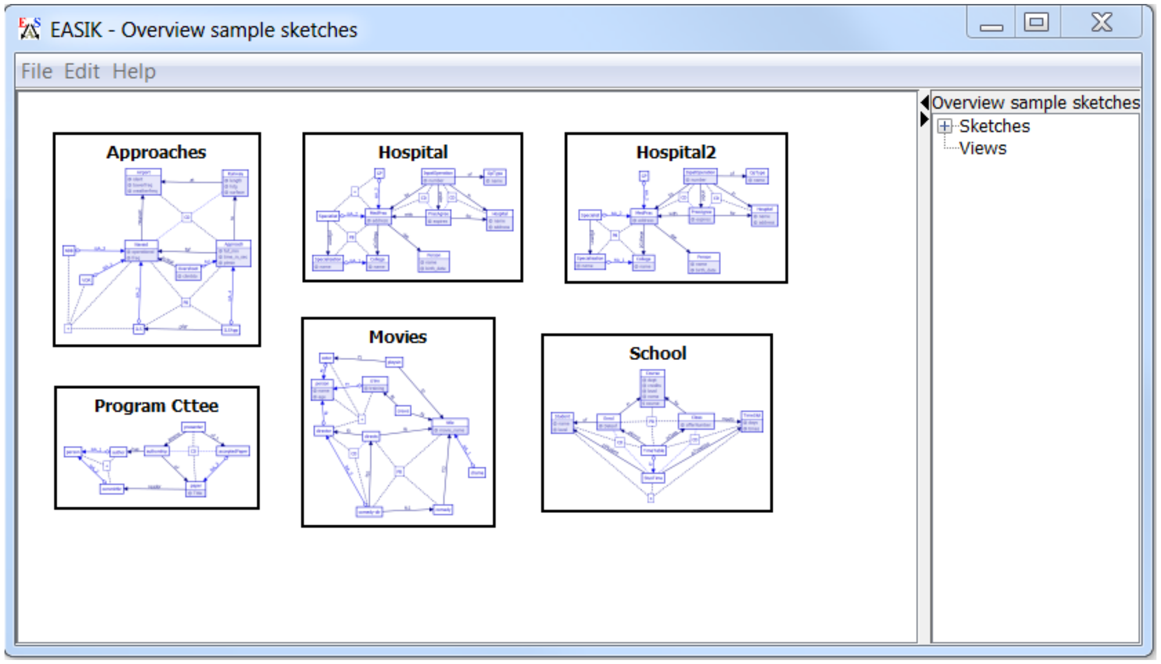
3 THE EASIK OVERVIEW WINDOW

The overview window opens when EASIK is started and remains open throughout. The overview window allows the user to have multiple sketches open for editing and allows for the definition of sketches as well as views of these sketches.



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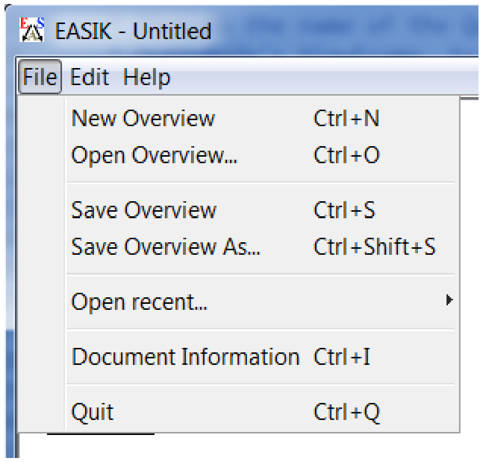
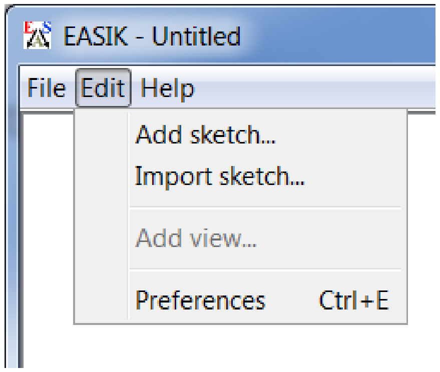
3.1 Editing The Overview

The actions available when working with the overview:



File Menu:

- **New Overview** (File | New Overview): Creates a fresh canvas containing no sketches or views. Any unsaved work will be lost.
- **Save Overview** (File | Save Overview): Saves the current overview to an XML file. Note: overview files are saved with a .easik extension.
- **Open Overview** (File | Open Overview): Opens an overview from a .easik file. Any unsaved work will be lost.

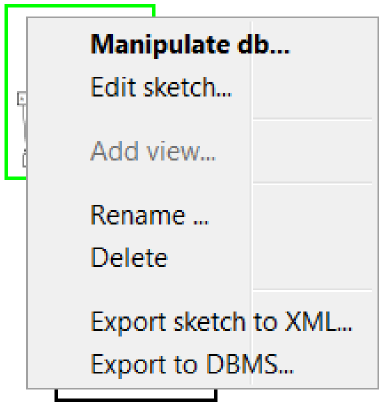


3.1.1.1.1 Edit Menu:

- **Add Sketch** (Edit | Add Sketch): Adds a new empty sketch to the overview canvas.
- **Import Sketch** (Edit | Import Sketch):
- To import a sketch (and its views) from an XML file, right click on the overview and select *Import sketch* from the popup menu. (The action is also available through the Edit menu.) Select the XML file and click OK to add it to the overview.
- **Add View** (Edit | Add View): Creates a new empty View of the selected sketch.
- **Preferences** (Edit | Preferences): Opens the Preferences window.

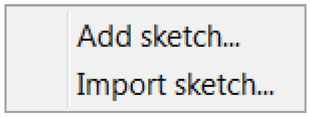
Canvas or Entity Click

- **Edit sketch** (Right click on desired sketch → Edit sketch): See Opening a Sketch in Edit Mode
- **Manipulate database** (Right click on desired sketch → Manipulate database): See Database Manipulation.



- **Export Sketch to XML** (Right click on sketch → Export sketch to XML): See Exporting a Sketch to XML.
- **Export Sketch to DBMS**: See Exporting a Sketch to DBMS
- **Add View** (Right click on sketch → Add view): Creates a new empty View of the selected sketch.
- **Rename** (Right click on sketch or view → Rename): Prompts the user for the new name of the selection.
- **Delete** (Right click with sketches and/or views selected → Delete): Deletes the current selection.
- **Add Sketch** (Right click → Add sketch): Adds a new empty sketch to the overview canvas.

- **Import Sketch** (Right click → Import sketch): To import a sketch (and its views) from an XML file, right click on the overview and select *Import sketch* from the popup menu. (The action is also available through the Edit menu.) Select the XML file and click OK to add it to the overview.



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3.2 Opening a Sketch in Edit Mode

To open a sketch for editing, it must exist as a sketch node in the overview. Right clicking on the sketch node and selecting *Edit sketch* from the popup menu will open the sketch for editing. If there is currently no active connection to an SQL server, a double click will also enter edit-mode. If there is an active connection to a database, a double-click will open the sketch in data manipulation mode.

Note: A sketch cannot be edited if it has been connected to an SQL server. If the user wishes to make edits to the sketch, they must first agree that edits will break the sketch/database synchronization.

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3.3 Opening a Sketch in Data Manipulation Mode

To open a sketch in data manipulation mode, right-click over the sketch's representation in the overview and select *Manipulate database* from the popup menu. If a valid SQL connection currently exists, EASIK will immediately enter data manipulation mode on the selected sketch. If there is no such connection, the user is prompted for connection information, and a connection attempt is made. Should a connection establish successfully, data manipulation mode will be entered. See database manipulation.

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3.4 Opening a View

From the overview, a view can be opened to edit by either right clicking over it and selecting *Open view* from the popup menu, or double clicking over it. A view is dependent on the sketch to which it is connected by an arrow. Therefore the view will be in the same mode (edit/data manipulation) as the sketch it depends on. If you would like to edit a view which is currently connected to a database you will have to break the sync from the sketch before being allowed to enter the view in edit mode. If you would like to manipulate a view which is in edit mode you will have to export the sketch and then open the view. See Data Manipulation in a View for available actions.

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4 Sketches

4.1 Editing A Sketch

4.1.1 Sketch Editing Actions

This section outlines the actions available when editing a sketch. (See Editing A Sketch) Note that any action in a popup menu is also be found in the EASIK Edit menu. If the action requires information about position on the sketch (such as adding an entity), a random position is used.

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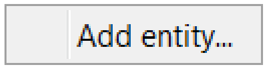
Edit Sketch - Popup Menus

4.1.1.1 Add Entity

Right-click at the position on the canvas where the new entity should be placed. Select *Add entity*... from the popup menu.

An entity translates to a table of the database schema.



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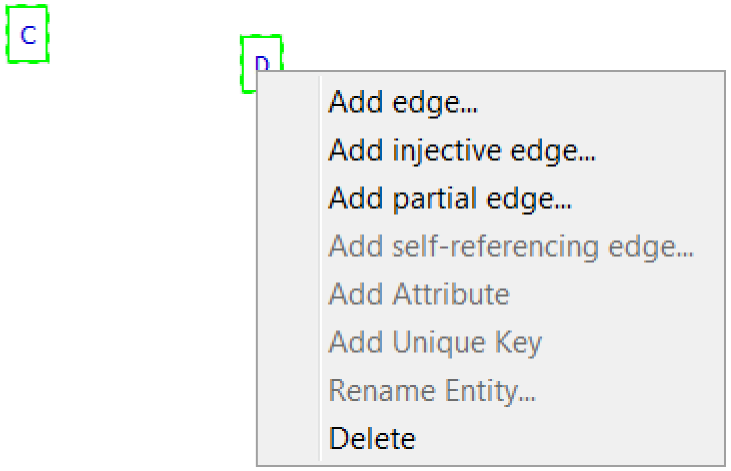
4.1.1.2 *Add Edge*



EASIK supports four types of edges:Normal edges, Injective edges, Partial edges, and Self-referencing partial edges. An edge is represented by a foreign key in the database schema: an edge from entity A to entity B signifies that one column of A matches the primary key of B. To add an edge to the sketch, highlight the desired entities and select *Add <edge-type>* from the popup menu. Note that self-referencing edges require only one entity, while the others require two. A dialog appears prompting for the edge's name and Edge cascading behaviour.

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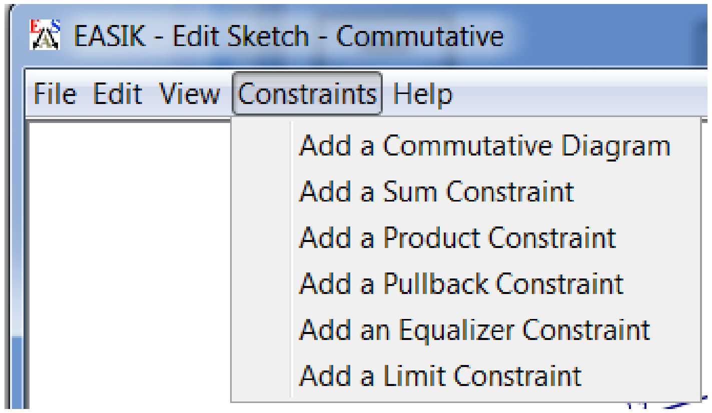
4.1.1.3 Add Constraint


EASIK - Edit Sketch - Commutative
File
Edit
View
Constraints
Help
Add a Commutative Diagram
Add a Sum Constraint
Add a Product Constraint
Add a Pullback Constraint
Add an Equalizer Constraint
Add a Limit Constraint

EASIK supports five types of constraints: Commutative Diagram, Sum Constraint, Product Constraint, Pullback Constraint, and Equalizer Constraint. Select *Add <constraint type>* from the Constraint menu of EASIK to add the constraint to the sketch. See notes on each constraint type for details on adding them to a sketch.

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4.1.1.4 Add Attribute

Right click on an entity and select *Add Attribute* from the popup menu. A dialog pops up prompting for the new attribute's name and Data Type. An attribute corresponds to a column of a table of the database schema

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4.1.1.5 Add Unique Key

Right click on an entity that has at least one attribute or at least one non-injective edge and select *Add Unique Key* from the popup menu. A dialog pops up prompting for the key's name, attributes and edges. Control-click to select multiple attributes/edges.

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4.1.1.6 Edit Attribute

Right click on the attribute in the information tree located at the right of the sketch window and select *Edit Attribute* from the popup menu. The selected attribute can then be renamed, and its type redefined.

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4.1.1.7 Rename Entity
Right click on an entity and select *Rename Entity* from the popup menu. A dialog popup prompting for the entity's new name.

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4.1.1.8 Delete
Right click with any combination of entities and edges highlighted. Choosing *Delete* from the popup menu will remove the highlighted selection from the sketch.

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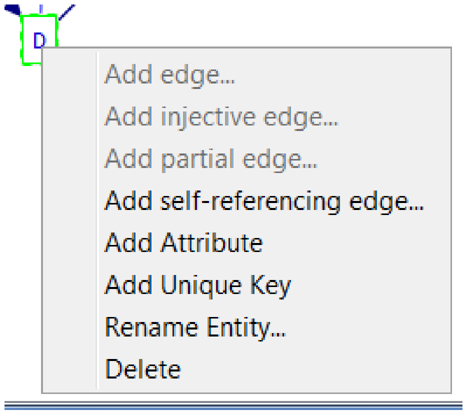
4.1.1.9 Delete Attribute
Right click on the attribute in the information tree located at the right of the sketch window and select *Delete Attribute* from the popup menu. The selected attribute will then be deleted from its entity.



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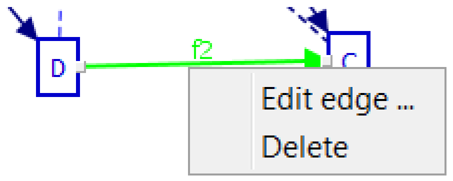
4.1.1.10 Edit Edge
Right click on an edge and select *Edit edge* from the popup menu. A dialog pops up allowing the edge to be renamed and its *cascade* behaviour specified.

- **Restrict**: Causes attempted deletions of referenced rows to fail.
- **Cascade**: Cause deletions in this table to trigger deletions of any rows in other tables that reference the row(s) being deleted.
- **Set null**: Causes references to be set to NULL when the targeted row is deleted (only available on partial edges.)



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4.1.2 Edge Types

This section describes the four types of edges available within EASIK. See Add Edge for details on adding an edge. The edge types are distinguished graphically as seen in the picture below.

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4.1.2.1 Normal edges

The normal edge type in EASIK is a non-nullable reference to a row of another entity. This represents a many-to-one relationship between entities.

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4.1.2.2 Injective edges

Injective edges are non-nullable, unique references to a row of another entity. Because the reference must be unique, this represents a one-to-one relationship between entities, and corresponds to the ERA "is-a" relationships between entities.

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4.1.2.3 Partial edges

Partial edges are like normal edges, but may have null references; that is, there may not be a referenced tuple in the target entity.

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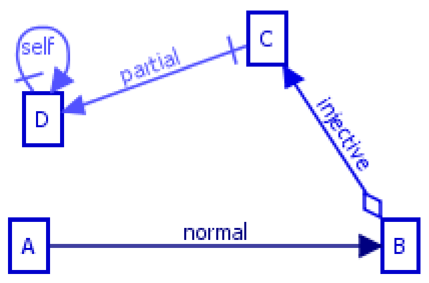
4.1.2.4 Self-referencing partial edges

Self-referencing edges allow tuples of an entity to refer to other tuples of the same entity. These edges must be partial: it would not be possible to insert the first tuple of a table if a null value for the reference value was not permitted. Self-referencing edges can be useful for representing tree or graph structures within a database.



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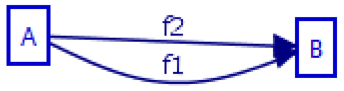
4.1.3 Edge warnings

In the event that adding an edge creates a strongly connected fully defined component (SCFDC)of the sketch, that is, a portion of the sketch where every entity can reach every other entity through a non nullable path of edges, the user will be warned. The warning is used because in a SCFDC it will be impossible to perform an initial insert. This is because every table needs a non nullable foreign key to another entity which in turn needs a non nullable foreign key to the next table, eventually reaching the first table where you tried to insert.

The user will also be warned if inserting an edge causes the creation of parallel paths, with at least one path being fully cascade and at least one other path not being fully cascade. Parallel paths with different deletion policies can cause unexpected results. For example in the simple diagram below where f1 is *on delete cascade* and f2 is *on delete restrict*. Suppose one row has been created in B and one row, with both foreign keys pointing to the one available row in B, has been created in A. If the user deletes the row in B what will happen? The user may expect the row to not be deleted because of the restrict clause or they may expect the row to delete and then cascade to delete in A as well. In this case the row cascades and both rows are eliminated.



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4.2 Constraints

There are several EA constraints that can be implemented and represented graphically using EASIK. These constraints include Commutative Diagram, Sum Constraint, Product Constraint, Pullback Constraint, and Equalizer Constraint. Defining constraints requires selecting paths in the sketch. This is done by successive ctrl-clicks on composable edges and then clicking *Next* or *Finish* as described below. Note: By definition, some entities involved in constraints have rows that are automatically generated. EASIK restricts insertion and deletion on such entities.

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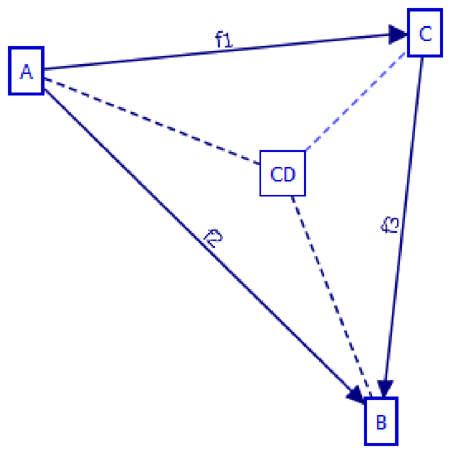
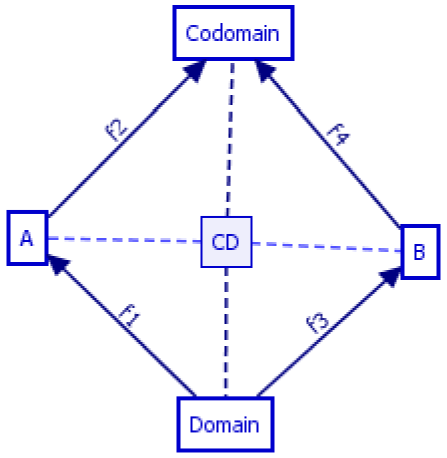
4.2.1 Commutative Diagram

A commutative diagram is a number of paths each of which has the same source entity and the same target entity. A commutative diagram constraint is satisfied if, for every row in the table of the source entity, the value is the same row in the target entity regardless of which path is followed.

Example Commutative Diagrams:





To add a commutative diagram constraint, select *Add a Commutative Diagram* from the *Constraints* menu.

Select the first path in the commutative diagram. This path should begin with the source entity of the commutative diagram and should terminate at the target entity. Once the path is selected, click *Next*.

After selecting the first path, the user will then be prompted to select the second path. Once the second path is selected, the user may then choose *Next* or *Finish* depending on whether more paths are involved in the commutative diagram constraint, or whether all paths are accounted for. The user will continue to be prompted to add more paths to the commutative diagram until the *Finish* or *Cancel* button is pressed. There is no upper bound to to the number of paths in a commutative diagram.

Should the commutative diagram requirements be violated, an error will be produced and no path will be built.

After it is created, new paths can be added to the constraint by right clicking over it in the sketch and selecting *Add path(s) to constraint*. Path selection works as described above.

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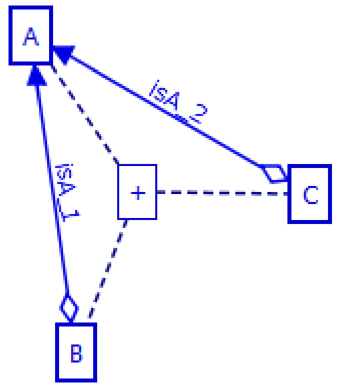
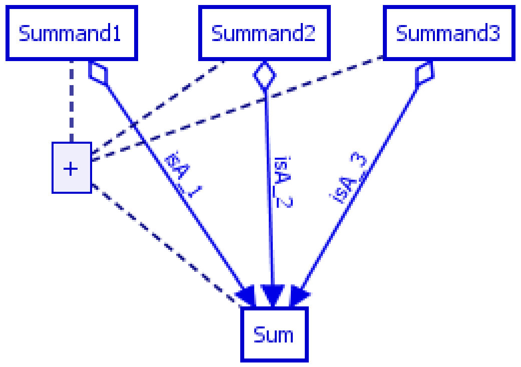
4.2.2 Sum Constraint

A sum constraint consists of two or more summand entities, a sum entity and a path (beginning with an injective edge) from each summand to the sum. The sum constraint is satisfied if the sum entity rows are isomorphic to the disjoint sum of the rows of the summands.

Example Sum Constraints:





To add a sum constraint to the sketch, select *Add Sum Constraint* from the Constraints menu. Select the first path involved in the constraint. This path should begin at a summand and end at the sum. Confirm this path by pressing the *Next* button at the bottom of the window.

After selecting the first path, the user will then be prompted to select the second path. Once the second path is selected, the user may then choose *Next* or *Finish* depending on whether or not more paths are involved in the sum constraint. The user will continue to be prompted to add more paths until the *Finish* or *Cancel* button is pressed. There is no upper bound to the number of paths in a sum constraint.

There are several conditions that must be observed for the successful creation of a sum constraint:

- All paths involved must have the same target entity
- All paths involved must have the first edge in the path an injective edge
- At least two paths must be selected

Should these conditions not be met, an error message will appear, and the constraint will not be created.

After it is created, new paths can be added to the constraint by right clicking over it in the sketch and selecting *Add path(s) to constraint*. Path selection works as described above.

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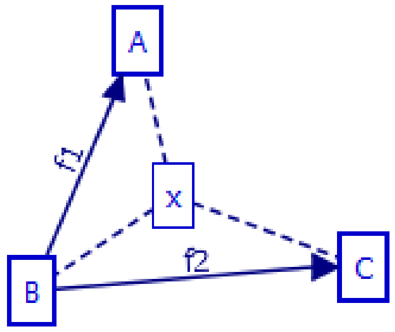
4.2.3 Product Constraint

A product constraint consists of two or more factor entities, a product entity and a path from each factor to the product. A product constraint is satisfied when the rows of the product entity are isomorphic to the cross product of the rows of the other (factor) entities involved in the constraint via the paths from the product entity to the factors.

Example Product Constraint:



To add a product constraint to the sketch, select *Add Product Constraint* from the *Constraints* menu. The user will then be prompted to select the first path involved in the constraint, and confirm this path by pressing the *Next* button at the bottom of the window.

After selecting the first path, the user will then be prompted to select the second path. Once the second path is selected, the user may then choose *Next* or *Finish* depending on whether or not more paths are involved. The user will continue to be prompted to add more paths to the product constraint until the *Finish* or *Cancel* button is pressed. There is no upper bound to how many paths can be involved in a product constraint.

There are several conditions that must be observed for the successful addition of a product constraint:

- All paths must have the same source entity
- At least two paths must be selected
- All projections must be fully defined and normal edges

Should these conditions not be met, an error message will appear.

After it is created, new paths can be added to the constraint by right clicking over it in the sketch and selecting *Add path(s) to constraint*. Path selection works as described above.

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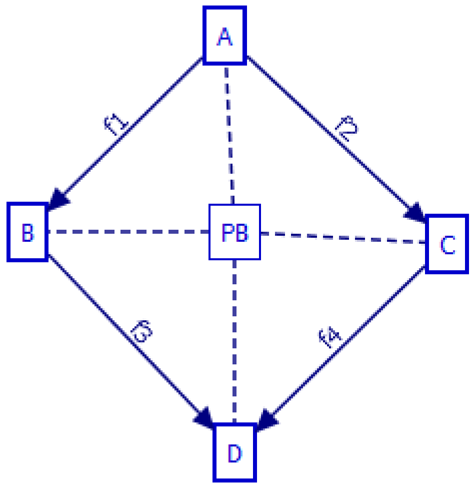
4.2.4 Pullback Constraint

A pullback is very similar to a database join. It requires a two (or more) defining paths with a common target and two (or more) “projection” paths with a common source, the pullback entity, one for each defining path and whose target is the source of the corresponding defining path. A pullback constraint is satisfied if there is exactly one tuple in the pullback entity for each list of tuples from the source entities of the defining paths which are sent to the same value in their common target.

Example Pullback Constraint (the defining paths are f3 and f4, the pullback entity is A and the projection paths are f1, f2):



To add a pullback constraint to the sketch, select *Add a Pullback Constraint* from the *Constraints* menu. The user then defines the paths involved in the pullback constraint. The paths must be selected in the correct order.

For a pullback of width n, the first n paths must have a common target - the target of the pullback. The n+1st path must have the pullback entity as its source and its target must be the *source* of the *first* selected path. The n+2nd path has the pullback entity as its source and its target must be the target of the *second* selected path. After the last path is selected, click *Finish*.

There are several conditions that must be observed for the successful addition of a pullback constraint:

- The first to nth paths must have a common target
- The next n paths must have a common source and be fully defined
- The target of n+1st path must be the source of the first; the target of the n+2nd path must be the source of the second and so on

Should these conditions not be met, an error message will appear, and the constraint will not be created.

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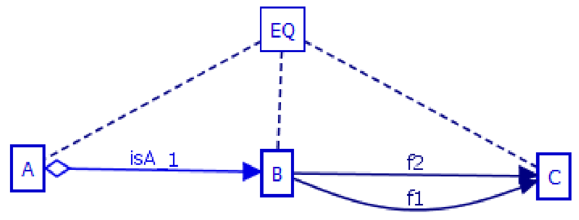
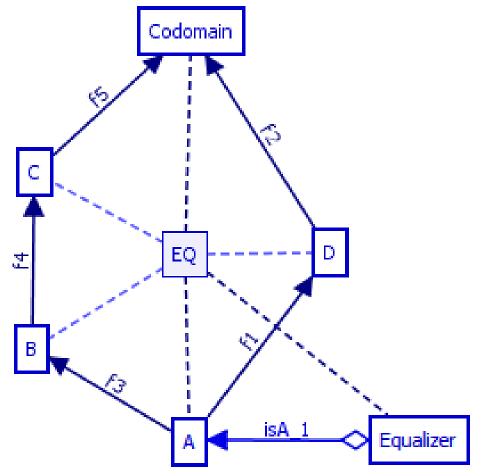
4.2.5 Equalizer Constraint

An equalizer constraint has an equalizer entity with a path (whose first edge is injective) to an entity which is the source of two (or more) parallel paths to a common target. An equalizer constraint is satisfied when the rows of the equalizer entity are exactly those rows of the source entity of the parallel paths whose values match under the action of the two (or more) paths to their common target.

Example equalizer constraints:





To add an equalizer constraint to the sketch, select *Add Equalizer Constraint* from the Constraints menu. The user will then be prompted to select the first path, the projection, involved in the constraint. This path must begin with an injective edge that has the equalizer entity as its source. Confirm this selection by pressing the *Next* button at the bottom of the window.

After selecting the first path, the user will then be prompted to select the second path. Its source must be the target of the first path. A third path with the same source and target as the second path must be selected, and the user may then choose *Next* or *Finish* depending on whether or not more paths are involved. The user will continue to be prompted to add more paths to the equalizer constraint until the *Finish* or *Cancel* button is pressed. There is no upper bound to how many paths can be involved in an equalizer constraint.

There are several conditions that must be observed for the successful addition of an equalizer constraint:

- The first path must begin with an injective edge
- All paths (excluding the first) have as their source the target entity of the first edge
- All paths (excluding the first) must have the same entity as their target

Should these conditions not be met, an error message will appear, and the constraint will

not be created.

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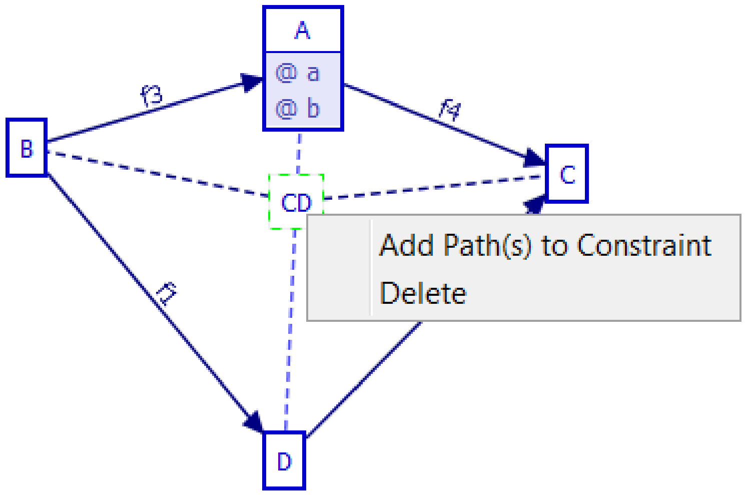
4.2.6 Adding Paths

Some constraints support path addition after their creation. These include Commutative Diagram, Sum Constraint, and Product Constraint. To add one or more paths to a constraint, right click on its entity and select *Add path(s) to constraint* from the popup menu. Paths can then be selected by successive ctrl-clicks on composable edges and clicking either *next* to select another path, or *finish* to add the selected paths to the constraint.



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5 DATABASE INTERACTION

5.1 DATABASE CONNECTION

EASIK requires an active connection to an SQL server for some functionality, such as exporting a sketch to database and manipulating a database which is defined by an EASIK sketch. When EASIK determines that a connection is needed, if a one has not previously been established, the user has the option to make a connection.

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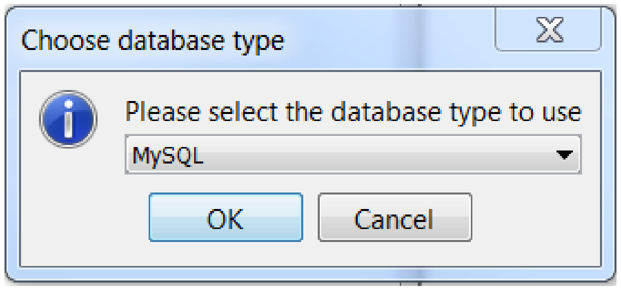
5.1.1 Establishing a connection

1. Select an SQL dialect (MySQL).

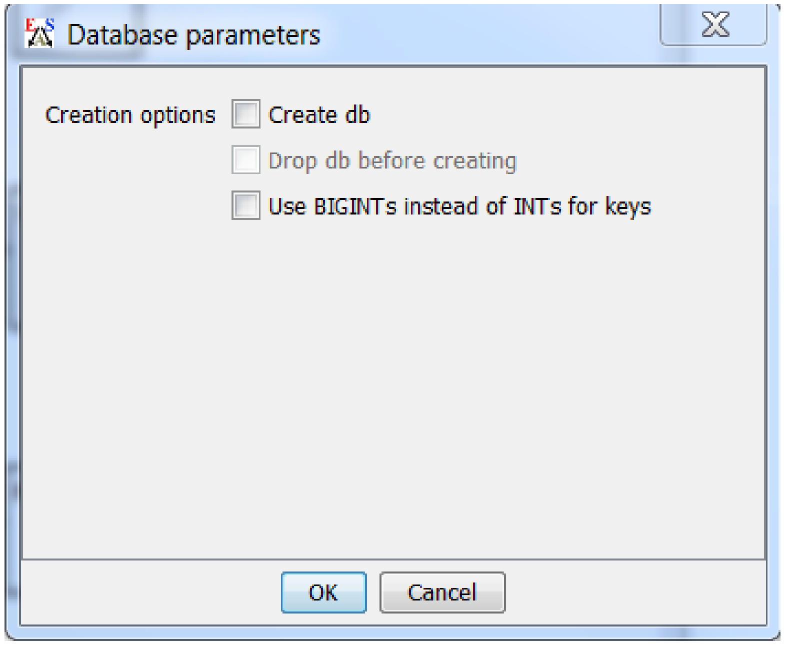


Choose database type

Please select the database type to use

MySQL

2. Select database parameters.

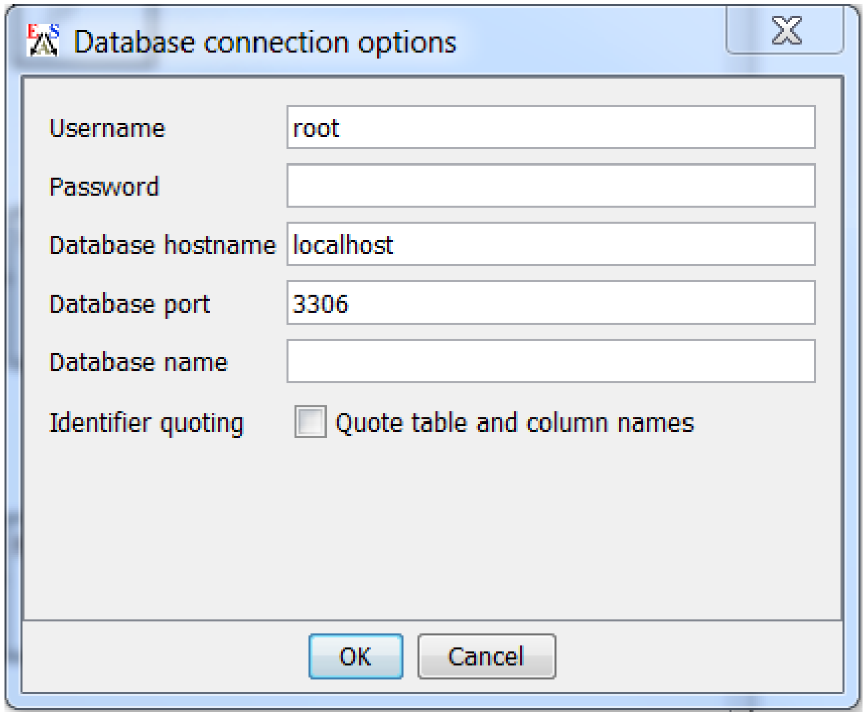


Database parameters

Creation options
- [ ] Create db
- [ ] Drop db before creating
- [ ] Use BIGINTs instead of INTs for keys

If exporting, the user is prompted for database parameters.

3. Enter database connection options:



Username	root
Password	
Database hostname	localhost
Database port	3306
Database name	
Identifier quoting	☐ Quote table and column names

- **Username**: The username on the database server.
- **Password**: <Username>'s password on the database server.
- **Database hostname**: Location of the database server.
- **Database port**: The port on which to attempt the connection. Defaults are used when this field is left blank.
- **Database name**: The name of the database that is defined by the current sketch. If exporting the sketch, this is the name that will be given to the new database. If connecting to a database, this must be the name with which the sketch had been exported.
- **Identifier quoting**: If enabled, this setting will make EASIK use SQL identifier quoting when interacting with the database. When enabled, this allows you to use non-alphanumeric values in entity, edge, and attribute names, which will be preserved in the generated SQL tables. Note, however, that if quoting is used, it must be used continually, including other tools accessing the database (for MySQL, this means using \`identifier\`).

  When disabled, non-alphanumeric characters will be converted to underscores.

  This setting defaults to off.

  Also note that when an entity or attribute conflicts with a built-in SQL keyword for the driver being used, quoting of the identifier will be forced, even if this setting is disabled.

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5.2 Sketch Exporting

This describes the various ways of exporting an EASIK sketch.

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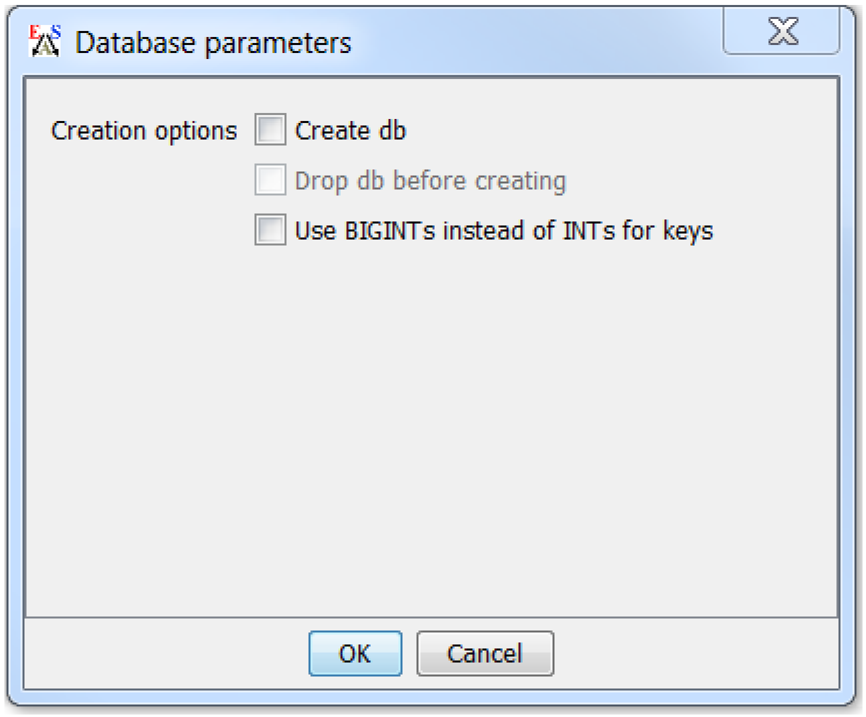
5.2.1 Exporting a Sketch to DBMS

This action is started by right clicking on the desired sketch from the overview and selecting *Export to DBMS* from the popup menu. If there is currently no active connection to a database, the user is prompted for connection information and *database parameters*. The following is a list of the database parameters.


Database parameters

Creation options
- [ ] Create db
- [ ] Drop db before creating
- [ ] Use BIGINTs instead of INTs for keys

5.2.1.1.1 Database Parameters

- **Create database**: Set database definition to create a new database.

- **Drop database before creating**: Available if *Create database* enabled. Sets database definition to drop an existing database in the event of a naming conflict.
- **Use BIGINTs instead of INTs for keys**: Enabling this option changes the type of foreign key columns and the primary key columns to which they point from the default of int(11) to bigint(20).

Once a connection is established, the sketch (and its views) are converted to SQL code and sent to the server. The database is created and the sketch is opened in data manipulation mode. The user can now interact with the new database. Note that this export action can also be found in the file menu of the sketch window - File | Export to | SQL server.

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5.2.2 Exporting a Sketch to XML

EASIK can create an XML file which defines the graphical layout of a sketch and information about its constraints. This is the file which is loaded when a sketch is imported. To export a sketch to an XML file, right click on its representation in the overview and select *Export sketch to XML* from the popup menu. The action can also be fired through the menu bar in the sketch window - File | Export to | XML. Select where the XML is to be saved and click OK. Note that all views of this sketch are automatically exported. Note also that these XML files are given a .sketch extension. See Import Sketch for details on importing.

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5.2.3 Exporting a sketch to an SQL Text File

This provides a text file containing the SQL data definition code sent to the server by the Export to DBMS action. This export can be selected from the File menu of the sketch window - File | Export to | SQL text file. The following steps are then taken to export the sketch to an SQL text file.

1. Select SQL dialect (MySQL).
2. Select database parameters.
3. Enter database connection options
    - **Database name**: The name used for the new database.
    - **Identifier quoting**: See identifier quoting for details.
4. Select where the SQL text file is to be saved and click OK.

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5.2.4 Export a Sketch to Image File

This action can be selected from the File menu in the sketch window - File | Export to | Image. Select where to save the image file and click OK. The default image type is png. The image type is specified by including its extension in the filename. Supported image types are png, jpeg, gif, and bmp.

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5.3 Data Types

EASIK supports many SQL data types for attributes, and allows you to specify any additional data type supported by your database. Note that the main data types listed here may be slightly different, depending on the SQL dialect in use (for example, the TEXT type becomes a LONGTEXT when exporting to MySQL).

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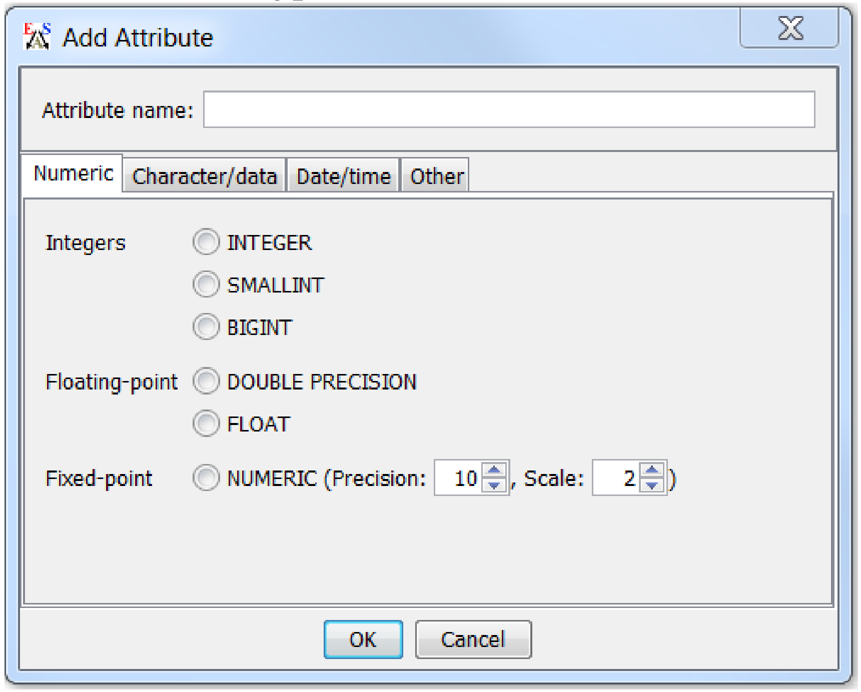
5.3.1 Numeric Types



The following numeric types are available:

Numeric Types

- **INTEGER**: An integer value field (usually a 32-bit int) that stores integer values from -2147483648 to 2147483647"
- **SMALLINT**: An integer value field (usually a 16-bit int) that stores integer values from (at least) -32768 to 32767
- **BIGINT**: An integer value field (usually a 64-bit int) that stores integer values from -9223372036854775808 to 9223372036854775807

- **DOUBLE PRECISION**: A floating point value with at least 15 digits of precision (typically a standard 64-bit floating-point value with 53 bits of precision)
- **FLOAT**: A floating-point value with at least 6 digits of precision (typically a standard 32-bit floating-point value with 24 bits of precision). This is sometimes known as a REAL, but a REAL is also sometimes an alias for a DOUBLE PRECISION
- **NUMERIC**: A fixed-point numeric type. Also known as DECIMAL. This type is substantially slower than integer and floating-point types, but guarantees precision for the range of values it supports. The precision value is the total number of digits storable, and the scale is the number of digits stored after the decimal point. "12345.67" has precision 7 and scale 2.

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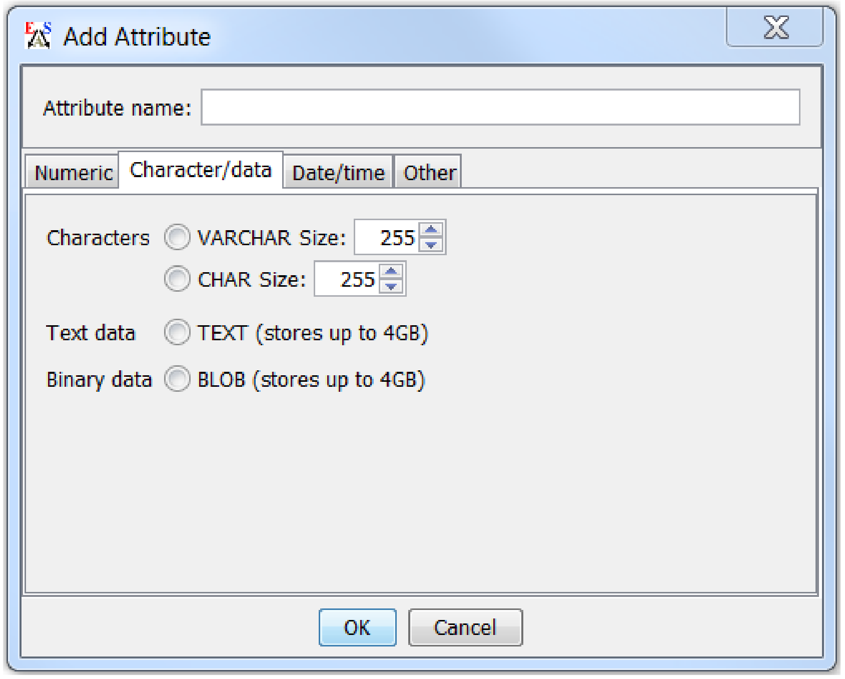
5.3.2 Character/Data Types


Add Attribute

Attribute name:

Numeric | Character/data | Date/time | Other

Characters ○ VARCHAR Size: 255
○ CHAR Size: 255

Text data ○ TEXT (stores up to 4GB)

Binary data ○ BLOB (stores up to 4GB)

OK Cancel

The following character and data types are available:

- **VARCHAR(n)**: Stores a string of characters of up to size n. Unlike a CHAR, a VARCHAR column is typically stored using the minimum storage space required, while a CHAR field pads shorter strings to always store values of size n.
- **CHAR(n)**: Stores a string of characters of up to size n. Unlike a VARCHAR, a CHAR column is typically padded up to the specified size to make it a fixed-width column (the padding is removed on retrieval). Note that some implementations implicitly convert CHAR columns to VARCHAR if other variable-size columns exist in the table.
- **TEXT**: Stores large amounts of text data. Also sometimes known as a CLOB.

- **BLOB**: Stores large amounts of binary data (bytes).

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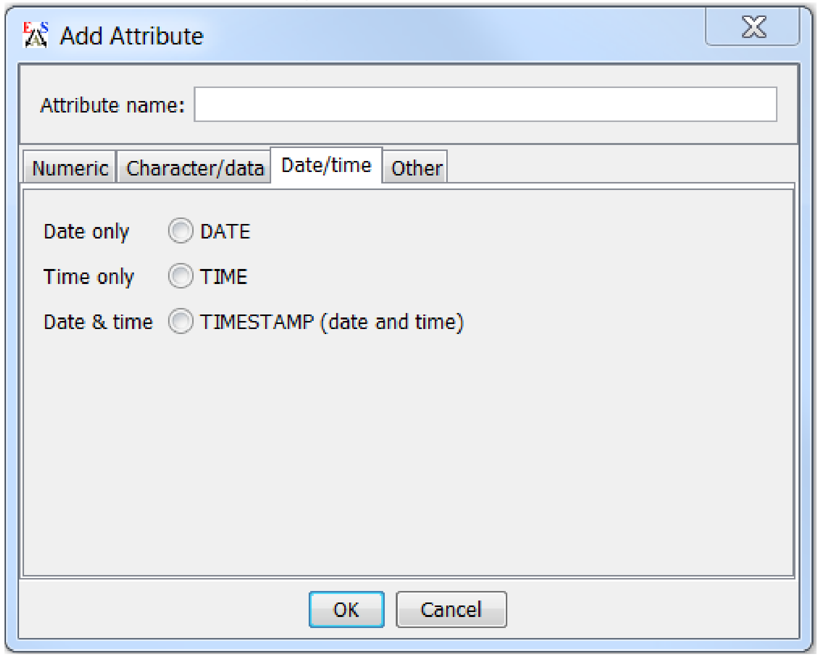
5.3.3 Date/Time Types



The following date/time types are available:

- **DATE**: A date field that does not include a time, such as "2008/07/14".
- **TIME**: A field that stores just a time (e.g. "12:13:14").
- **TIMESTAMP**: A field that stores a date and time (e.g. "2008/07/14 12:13:14"). Note that this is converted to a DATETIME when using MySQL.

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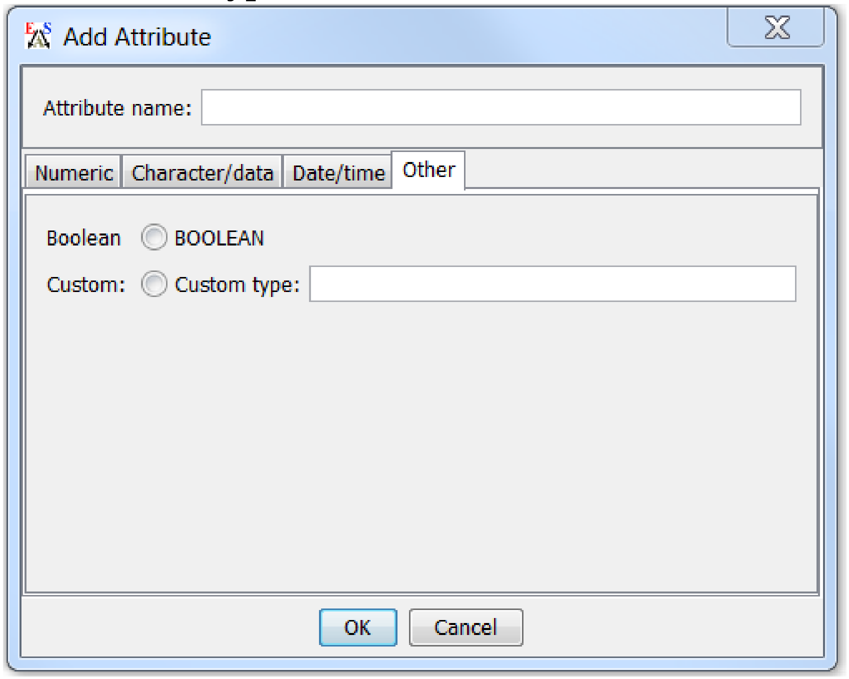
5.3.4 Other Types



The following other types are supported:

- **BOOLEAN**: A column that stores true/false values. Note that this type may be converted to a small integer type by databases (such as MySQL) that do not fully support BOOLEAN data types.
- **Custom Data Type**: This allows you to specify any data type supported by your database. Note that the type you enter here will not be checked for correctness: ensure that the provided type is valid for the SQL type(s) you intend to use.

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5.4 Database Manipulation

5.4.1 Setup

In order to manipulate a database that has been created through EASIK, the following conditions must be met:

- The sketch that defines the database must exist as a sketch node in the overview. (See importing/exporting a sketch)
- An active connection to a *compatible* database on an SQL server must exist. (See connect to an SQL database)

By a *compatible* database, we mean a database onto which our sketch maps (entities to tables, attributes to columns, edges to foreign keys, constraints to triggers and unique keys to unique indexes.) There is currently no utility to automatically detect compatibility between database and sketch. If an export was triggered from within EASIK and no editing has been done to the sketch since, we trust that the user has not connected to the server by other means and altered the database. We therefore assume the database is compatible. If, however, our sketch has no knowledge of a database synchronization (e.g. it was created by an EASIK-generated SQL text file), the user is prompted to verify that they are indeed connecting to an appropriate database.

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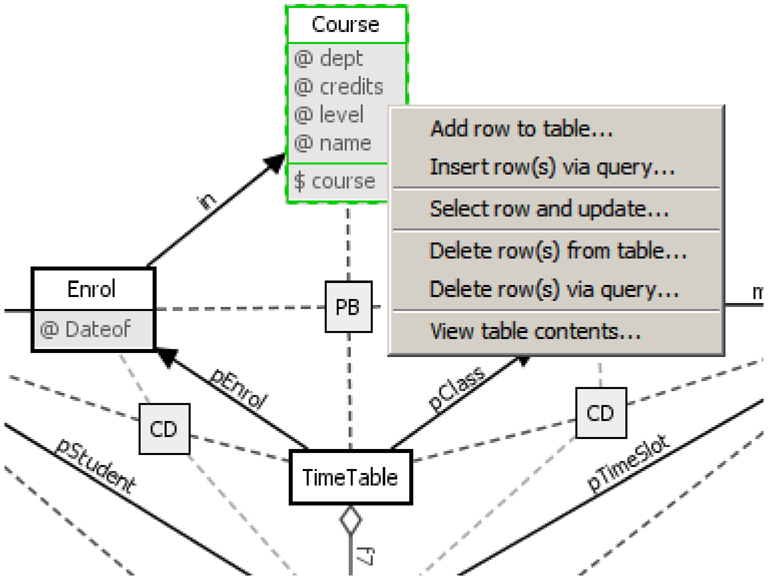
5.4.2 Database Manipulation Actions

The section outlines the actions available by right clicking on an entity while in a sketch that is open in data manipulation mode. See Data manipulation in Views for additional information. Note that as mentioned in constraints, insertion and deletion is restricted on some entities.



Data Manipulation Mode - Popup Menus

- **Add Row to table**: Adds a row to the highlighted table. The user specifies values for each column through a popup dialog.
- **Insert row(s) via query**: Pops up a query dialog from which the user is free to execute any SQL INSERT query.
- **Select row and update**: The user is prompted to select a row from the highlighted table. A dialog is then displayed that allows the user to update any of the row's column values.
- **Delete row(s) from table**: The user is prompted to select one or more rows from the highlighted table. The selected rows are then deleted from the table. Note that cascade behaviour for affected edges is invoked.
- **Delete row(s) via query**: Pops up a query dialog from which the user is free to execute any SQL DELETE query. cascade

- **View table contents**: Displays the contents of the highlighted table on the screen.

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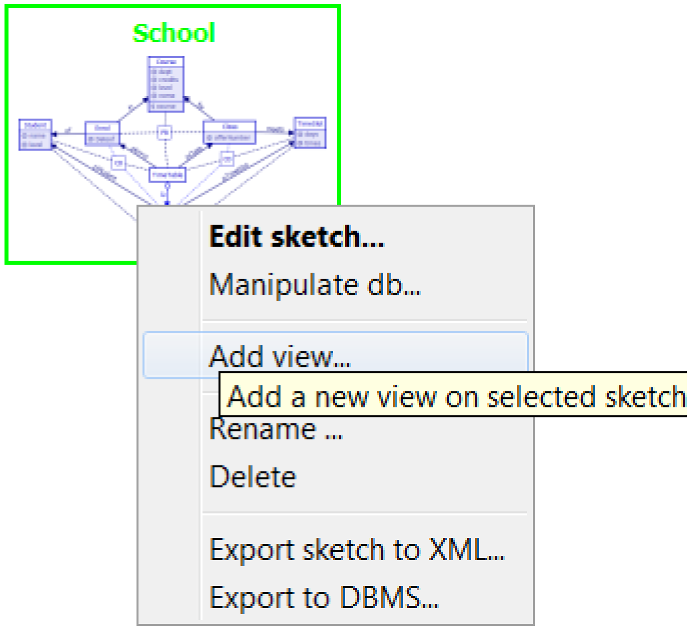
6 VIEWS

EASIK currently supports data manipulation of view nodes and the functionality of connecting view nodes via edges. Views of a sketch are automatically included when the sketch is exported to XML or SQL.



A view in EASIK is simply a collection of *query nodes* and edges. A query node is a named node on the view window. It defines an SQL view via an SQL SELECT query. Edges and constraints are automatically added in views when the required elements have been queried. For example, if the sketch contains two node nodes, en1 and en2, and a normal edge, f1, between them and we have two query nodes in the view, qn1 and qn2, which query en1 and en2 respectively then f1 will be added to the view automatically. Similarly for constraints, if a commutative diagram involves four entity nodes and all four are being queried - without WHERE clauses -- in the view then the constraint will be added to the view. WHERE clauses in a query node will void this constraint addition because we will not be able to guarantee constraint consistency.

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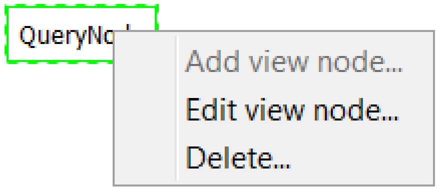
6.1 EDITING A VIEW



This section outlines the available actions when right clicking a view node while the view is opened for editing.

6.1.1 Add View Node

- The user is prompted for the view node name. This will become its SQL view name when exported to SQL. The query entered is an SQL SELECT statement that the view implements.

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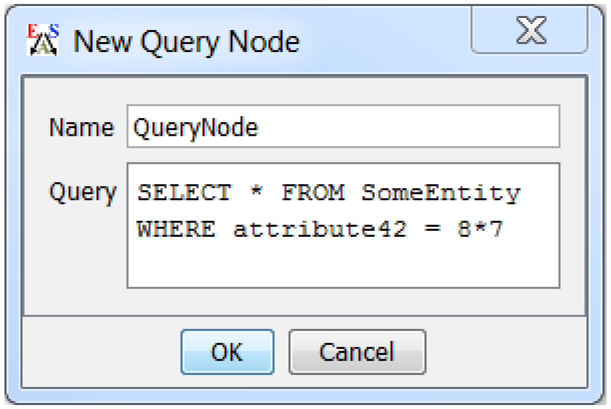
6.1.2 Edit View Node

- The user is prompted for a new name and new SELECT statement for the selected node.



Name: QueryNode

Query:
```
SELECT * FROM SomeEntity
WHERE attribute42 = 8*7
```

View - Editing Popup Menu

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6.1.3 Delete View Node

- When selected, a confirmation pop up is shown. If yes is selected, the view node is removed from the view as well as any edges that originate at the view node.

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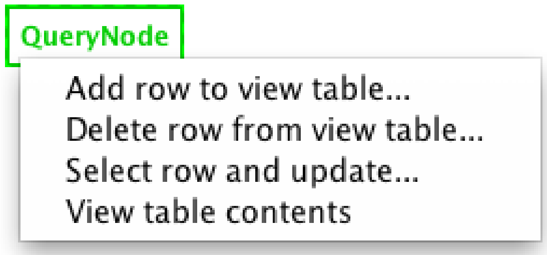
6.2 Data Manipulation in a View

For data manipulation in general see Database Manipulation



6.3 View Updatability

A view query node is updatable if these conditions are met

- The entity node it queries is updatable.
    - Entity nodes may not be insertable if they are part of a constraint. For example, we cannot directly insert into the target of a sum
- If inserting into a query node will cause an insert into another node, or will require you to choose a row in another node, all these nodes must be queried in the view for the query node to be updateable.
    - The entity node being queried has edges going to a target entity node that is not queried in the view.
    - The entity node is part of a constraint and inserting into it will cause a trigger to insert into a node which is not in the view. See constraints and updatability.
- The query node is SELECT * FROM <entity>

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6.4 Constraints and Updatability

When a view node is part of a constraint, inserting into it may cause an insert into another node in the constraint. In this type of situation we do not allow updates to that node unless all the nodes into which it may insert are also queried in the view. The following are all the situations where this occurs.

- In a sum constraint inserting into a summand will insert into sum.
- In a product constraint inserting into a factor will cause an insert into the product.
- In a pullback constraint inserting into a side node may cause an insert into the pullback.
- In an equalizer constraint inserting into the source node may cause an insert into the equalizer

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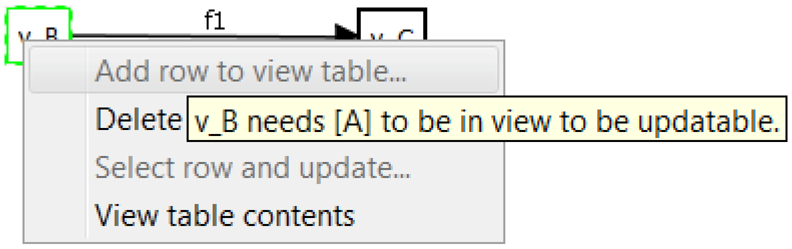
6.5 Updatability and Warnings



v_B needs [A] to be in view to be updatable.

In the above image we have right clicked on v_B which queries entity node B which is the source of an equalizer constraint. In this equalizer constraint A is the equalizer and C is the codomain. C is being queried by v_C but A is not in the view. We know that inserting into B may cause an insert into A, and since A is not being queried in the view, we do not allow an insert. Hovering over the add row to view table option, which is disabled, gives an appropriate message explaining why it is disabled.

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6.6 Sketch View Synchronization

Sketches and their Views are synchronized. If an edge is added to a sketch and its target and source entities are being queried by a view, that edge will also be added in the view. If it is deleted, it will be deleted from the view. In EASIK, views are a subsketch of their corresponding Sketch.

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7 PREFERENCES

Preferences are accessed through the Edit → Preferences menu of an overview or a sketch that is open for editing. (Note: on Mac OS X, the Preferences option is in the standard location in the main application menu, rather than the Edit menu).

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7.1 GENERAL

General preferences control the main EASIK settings.

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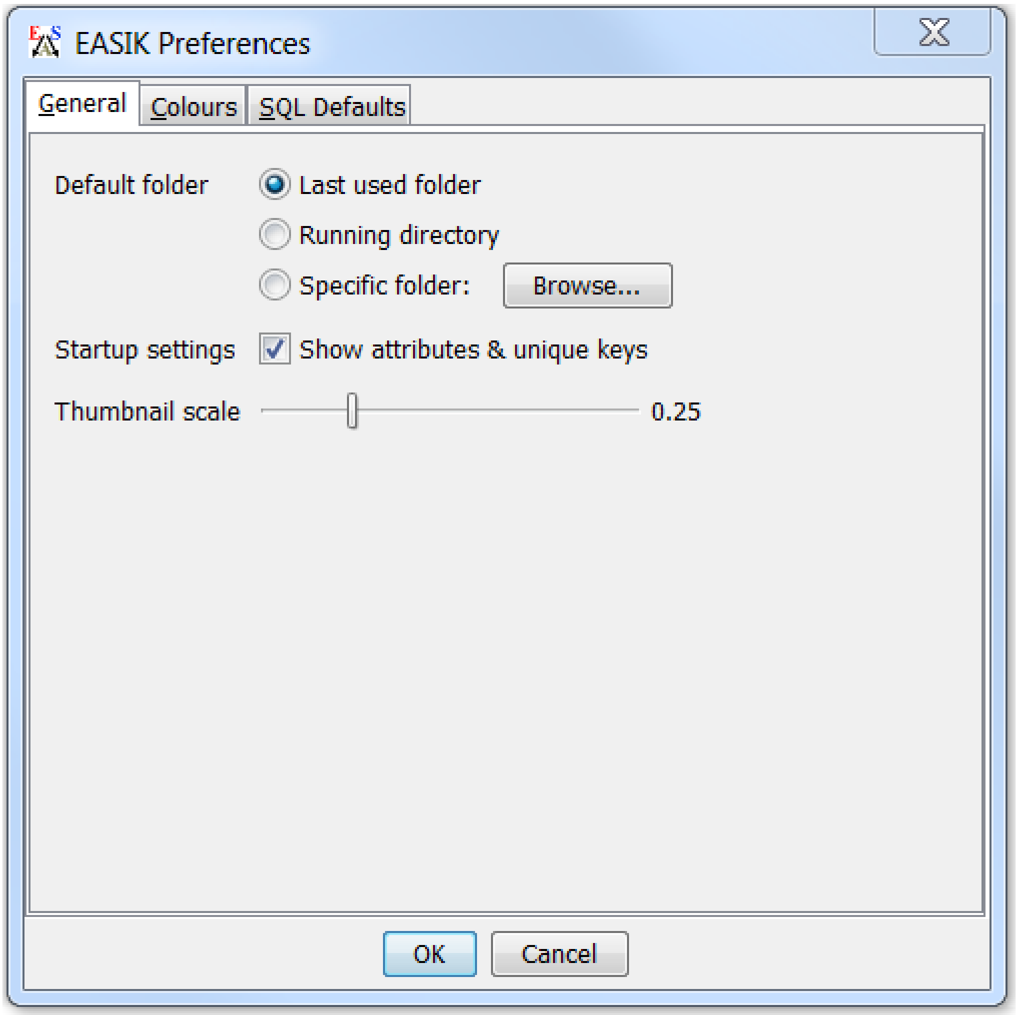

Default folder [✓ Last used folder] Running directory Specific folder:

Startup settings [✓ Show attributes & unique keys]

Thumbnail scale 0.25

7.1.1 Path

The path setting defines the default system folder EASIK uses when opening or saving files. You can set this to be the last folder a file was opened or saved from ("Last used folder"), the folder EASIK was started from ("Running directory"), or a specific folder.

The default setting is the last used folder.

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7.1.2 Show attributes & unique keys

This option controls whether or not attributes and unique keys are displayed in new sketches. The default option is enabled. This can be controlled for a sketch which is open for editing from the sketch window's Edit Menu.

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7.1.3 Thumbnail scale

This option controls the size of sketch and view thumbnails displayed in the overview. A setting of 0.25 means that the thumbnail of sketches and views will be 1/4 of their actual size; 0.5 would indicate half of the actual size.

The default setting is 0.25.

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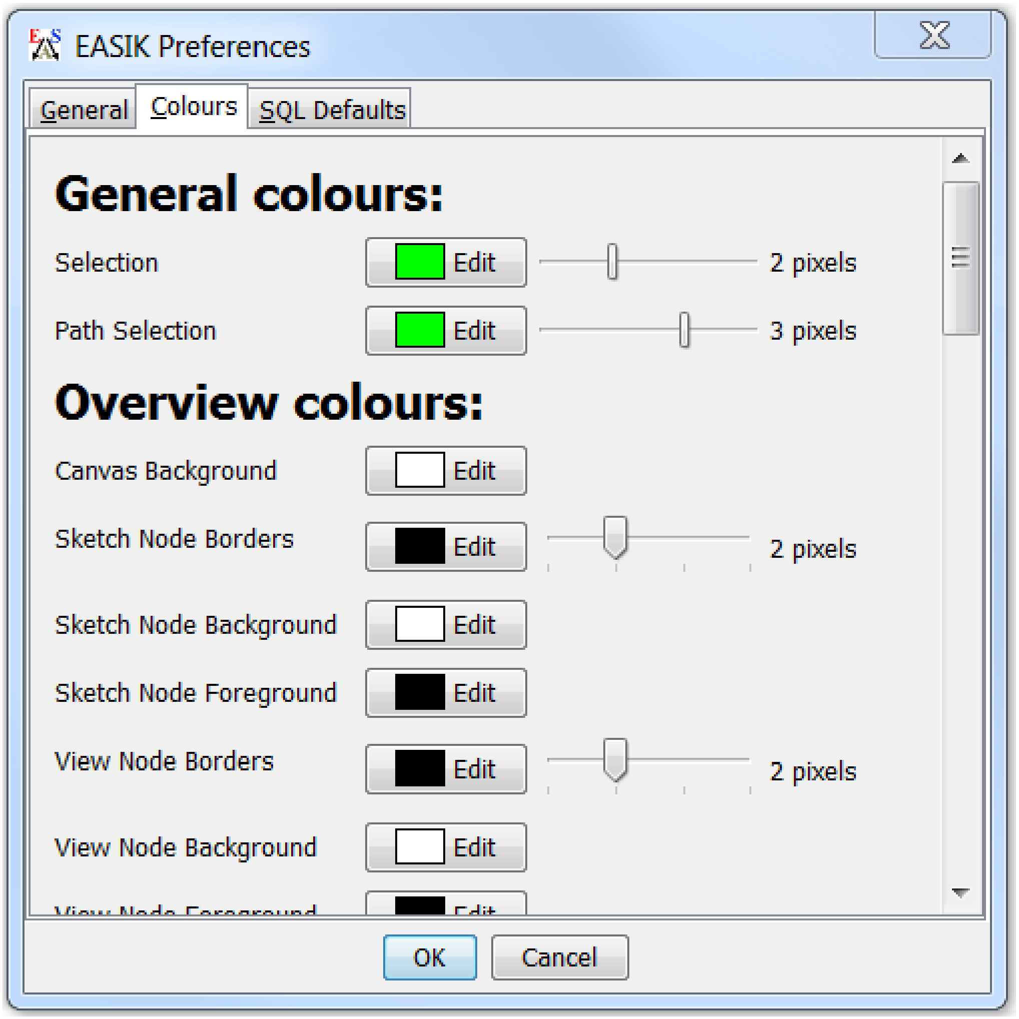
7.2 Colours

Colour settings control the look and feel of EASIK sketches, views, and the main overview window.


EASIK Preferences

General | Colours | SQL Defaults

General colours:

Selection	🟩 Edit	2 pixels
Path Selection	🟩 Edit	3 pixels

Overview colours:

Canvas Background	⬜ Edit	
Sketch Node Borders	⬛ Edit	2 pixels
Sketch Node Background	⬜ Edit	
Sketch Node Foreground	⬛ Edit	
View Node Borders	⬛ Edit	2 pixels
View Node Background	⬜ Edit	

The colours tab allows you to adjust the colours and, in some cases, line widths, used within EASIK for displaying sketches, overviews, and views. To change a colour, click the Edit button beside the colour you wish to change. To change a line or border width, drag the slider beside the colour to select the desired width.

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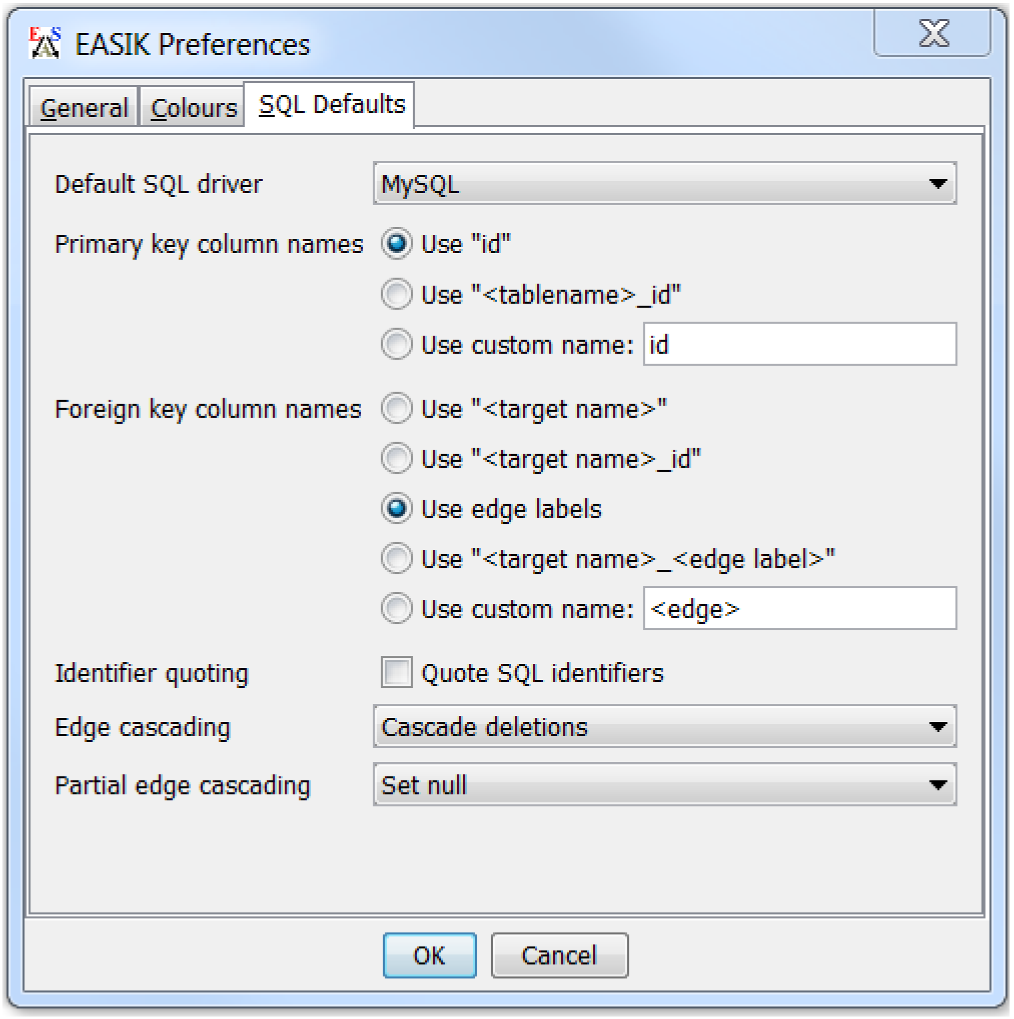
7.3 SQL Defaults

The SQL Defaults settings allow you to control the default settings to be used when connecting to a database, to manipulate an existing set of tables, or export a sketch to a database.



Default SQL driver: MySQL

Primary key column names: [✓ Use "id"] Use "<tablename>_id" Use custom name: id

Foreign key column names: Use "<target name>" Use "<target name>_id" [✓ Use edge labels] Use "<target name>_<edge label>" Use custom name: <edge>

Identifier quoting: Quote SQL identifiers ☐

Edge cascading: Cascade deletions

Partial edge cascading: Set null

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7.3.1 Default SQL driver

This setting controls the default SQL driver used when connecting and exporting. Currently, MySQL database connections are supported.

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7.3.2 Primary key column names

This setting controls how the primary key column will be named when exporting a sketch to an SQL server or an SQL file.

The default, "id", uses the name "id" for the primary key of all tables. Alternatively, "<tablename>_id" can be used to base the primary key column on the table name: for example, the primary key of the entity "Car" would be "Car_id". You can also use a custom name; <table> in this custom field will be replaced with the table name.

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7.3.3 Foreign key column names

This setting controls how foreign keys will be named when exporting a sketch to an SQL server or SQL file.

The default, "Use edge labels", will use the label specified for an edge name in a sketch as the foreign key column. Alternatively, you may use the target table name followed by the edge label, target table name alone, and target table name followed by _id name "id" as the foreign key columns. Note that using a foreign key that does not contain the edge label **will not work** if there are parallel edges between entities. You may also specify a custom naming scheme: <source> will be replaced with the source entity name; <target> with the target entity name; and <edge> with the edge label.

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7.3.4 Identifier quoting

This sets the default enabling of identifier quoting.

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7.3.5 Edge cascading

This setting allows you to set the default cascading mode for edges (foreign keys). You can also specify this for an edge within a sketch.

The two options here are **cascading**, and **restricted**. Cascading deletions means that when deleting a row, any referencing rows will also be deleted (subject to any foreign keys of the referencing rows). Restricted disallows any deletion while a row is still referenced. The default EASIK setting is cascading deletions.

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7.3.6 Partial edge cascading

This setting allows you to set the default cascading mode for partial edges (in SQL, these are nullable foreign keys). In addition to the two options available for edge cascading, you may also specify "Set null": this option sets any referring foreign key values to NULL when deleting a row. The "Set null" option is the default for partial edges.

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