

crystal_facet_uml user documentation

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| | <i>TITLE :</i> crystal_facet_uml user documentation | | |
| <i>ACTION</i> | <i>NAME</i> | <i>DATE</i> | <i>SIGNATURE</i> |
| WRITTEN BY | Andreas Warnke | 2019-06-12 | |

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| REVISION HISTORY |
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| NUMBER | DATE | DESCRIPTION | NAME |
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1 Introduction



crystal_facet_uml creates sysml/uml diagrams to document system and software architecture.

1.1 Goal



As software architect, you create a set of diagrams describing use-cases, requirements, structural views, behavioral and deployment views.

crystal_facet_uml keeps element names and element hierarchies consistent. It exports diagrams in svg, pdf, ps and png formats to be used in text processing systems like docbook, html, latex. This tool runs on your local linux PC and is based on glib, gdk, gtk, cairo, pango, sqlite.

1.2 Features



crystal_facet_uml provides a graphical user interface to

- create diagrams
(use-case, deployment, component, composite-structure, package, class, activity, state, timing, communication, sequence)
- create uml elements
(actor, system-boundary, use-case, node, component, part, interface, package, class, activity, state, object, artifact, comment, requirement)
- move, modify and delete uml elements
- create, modify and delete relationships
(dependency, association, aggregation, composition, generalization, realization, contains, sync-call, return-call, async-message, communication-path, control-flow, object-flow, deployment, manifest, include, extend)
- create, modify and delete features
(port, field, operation)
- cut, copy, paste uml elements between diagrams
- undo and redo are supported
- multiple windows can show different or same parts of the uml model

Diagrams are layouted part-automatically:

- The user chooses the relative location of uml elements towards others
- crystal_facet_uml selects the exact locations of uml elements

- The user controls the positions of messages/transitions in sequence and timing diagrams
- crystal_facet_uml auto-lays out relationships in other diagrams

crystal_facet_uml manages a meta model:

- Diagrams are organized as a tree, similar to a book's table-of-contents
- Uml elements exist only once even if shown in many diagrams
- Relationships and features are consistent between all diagrams
- Diagram-local messages/transitions are supported in scenario-based diagrams (sequence, communication, timing)

crystal_facet_uml exports diagrams as

- vector graphics
(pdf, ps, svg)
- pixel graphics
(png)
- textual representation
(utf-8-txt, docbook, xhtml)

crystal_facet_uml can also be started from command line to check and repair database files.

1.3 Usage Overview



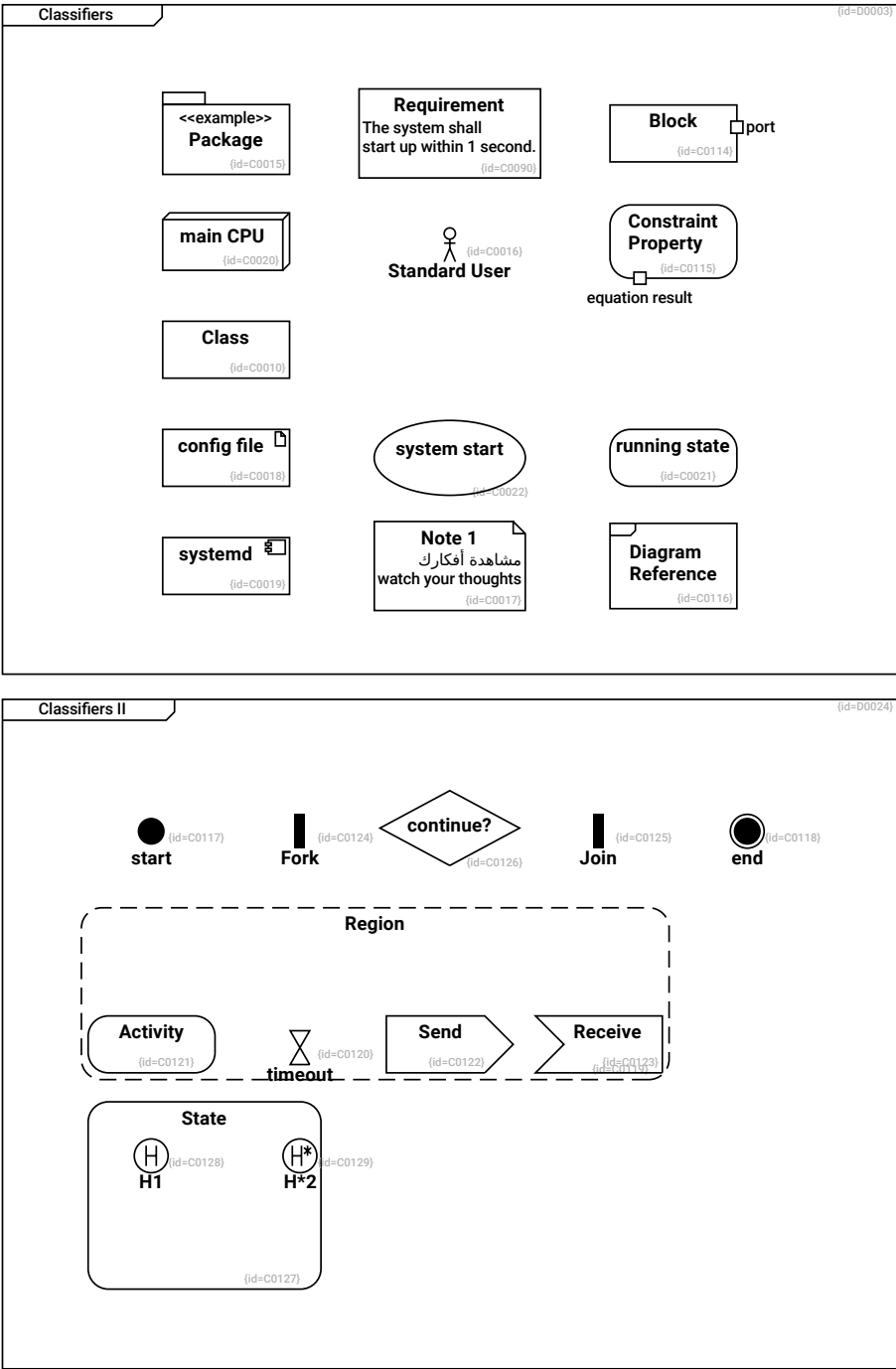
crystal_facet_uml can be started in graphical mode (see Section 3) or from command line (for help run **crystal_facet_uml -h**).

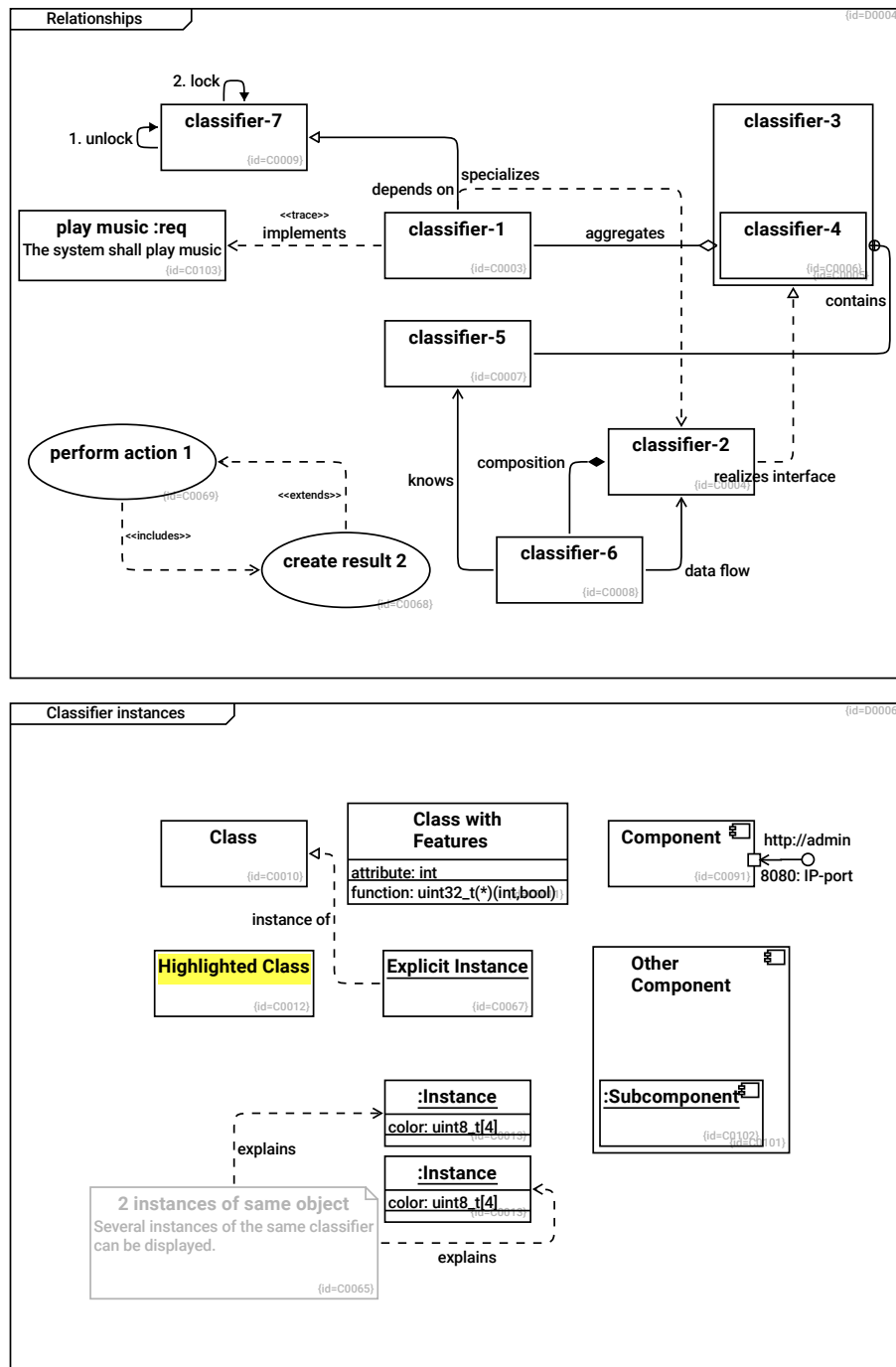
2 Example Diagrams

This sections presents the features of crystal_facet_uml.

2.1 Feature List

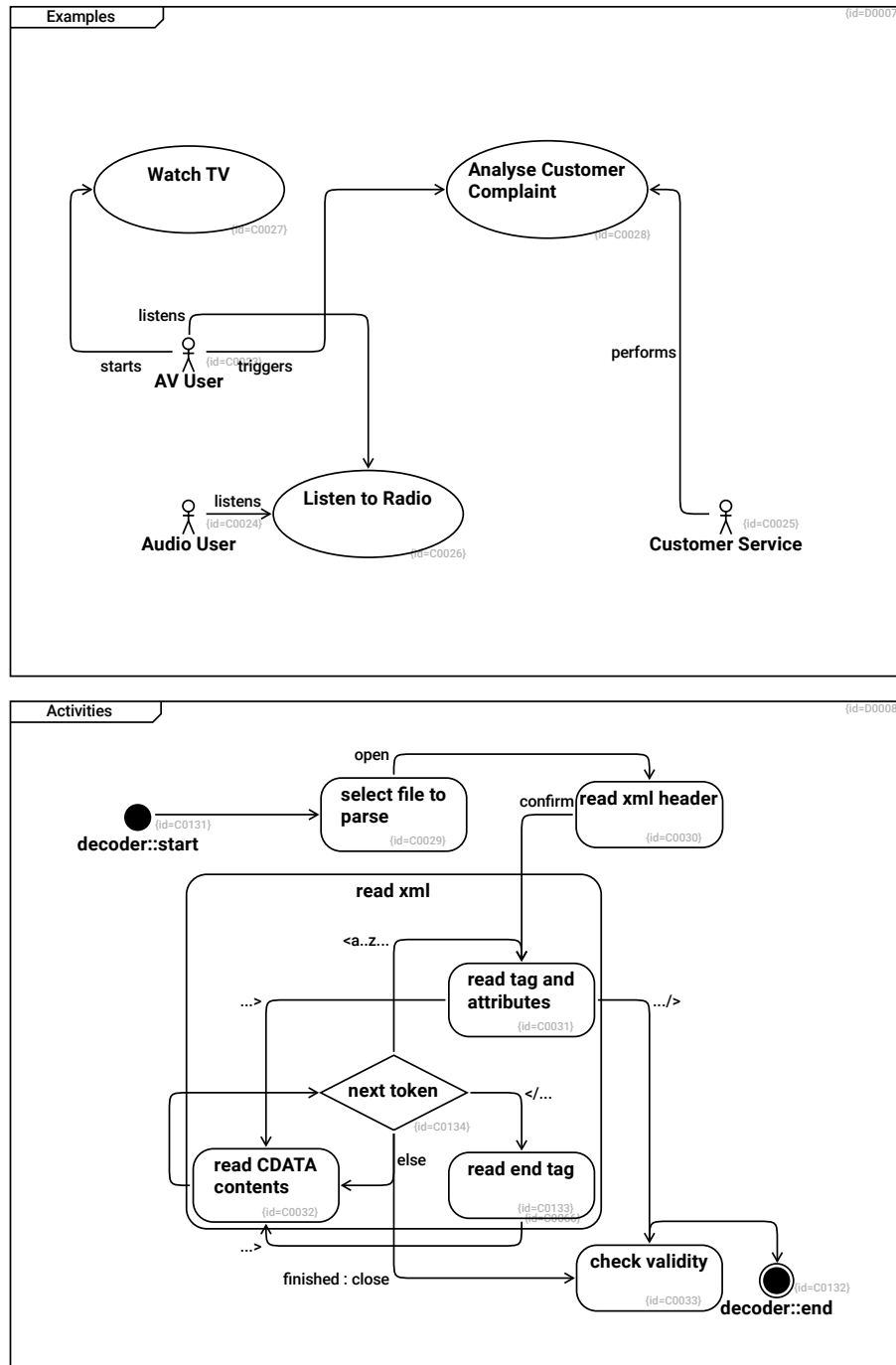
This section lists what kind of elements crystal_facet_uml can draw in diagrams.

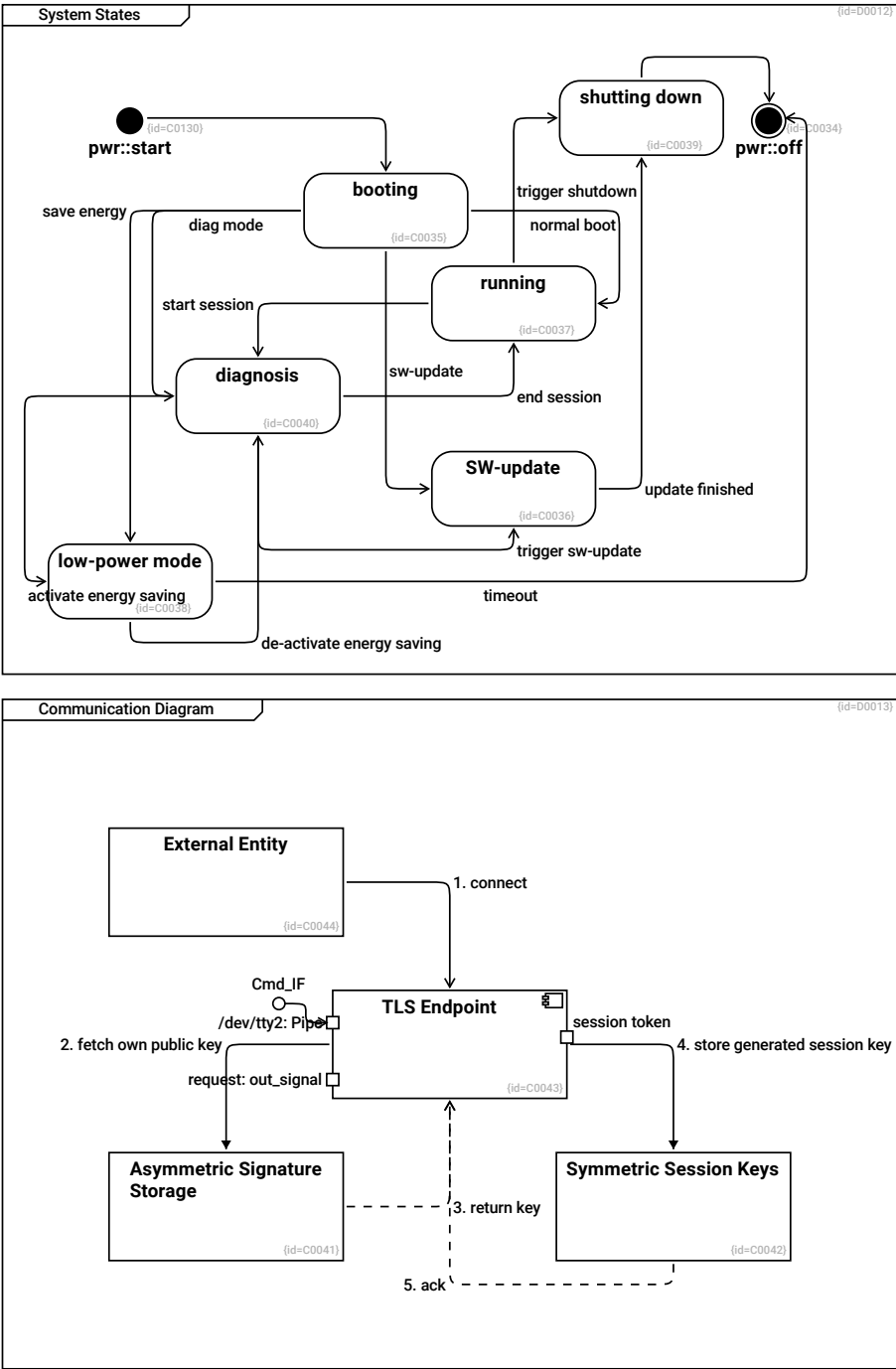


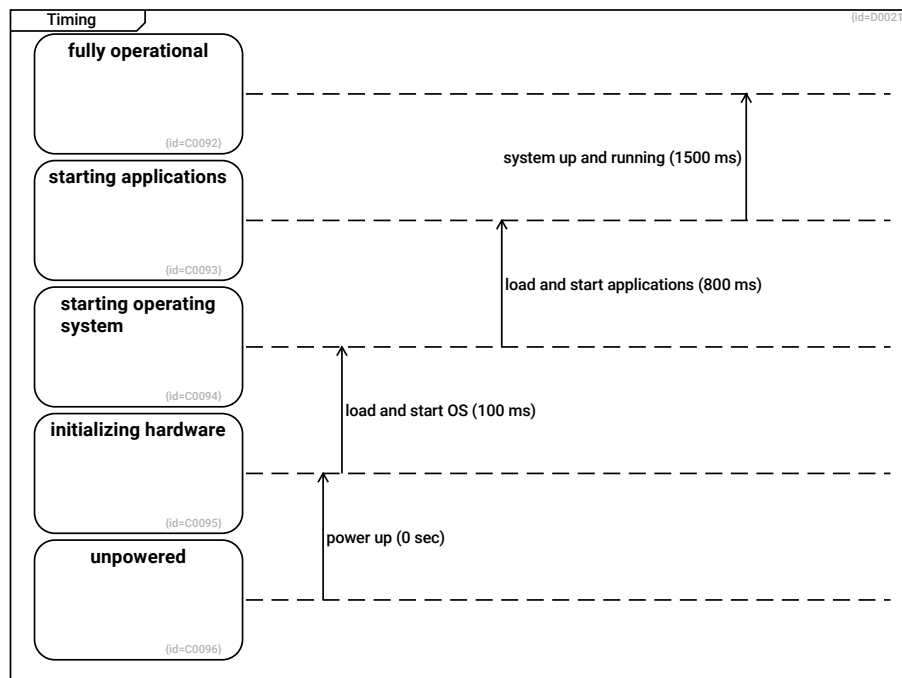
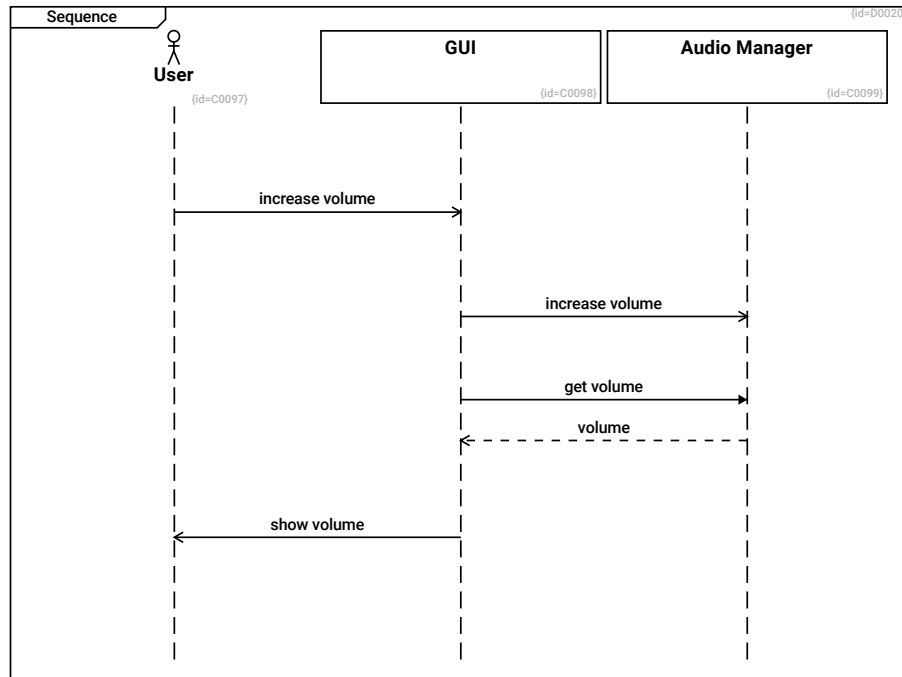


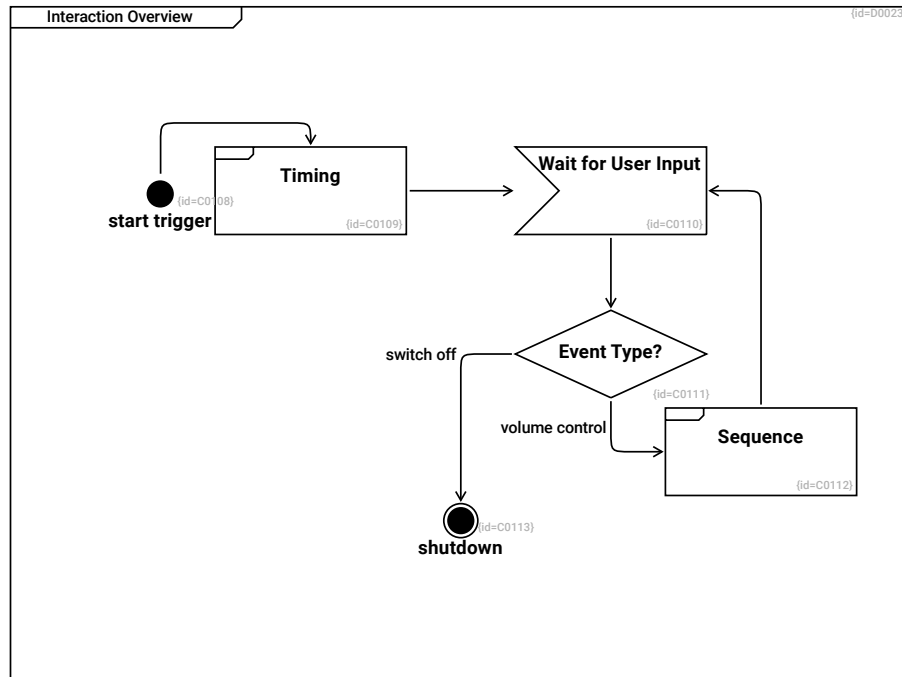
2.2 Example UML Behavioral Views

This section lists what kind of elements crystal_facet_uml can draw in diagrams.



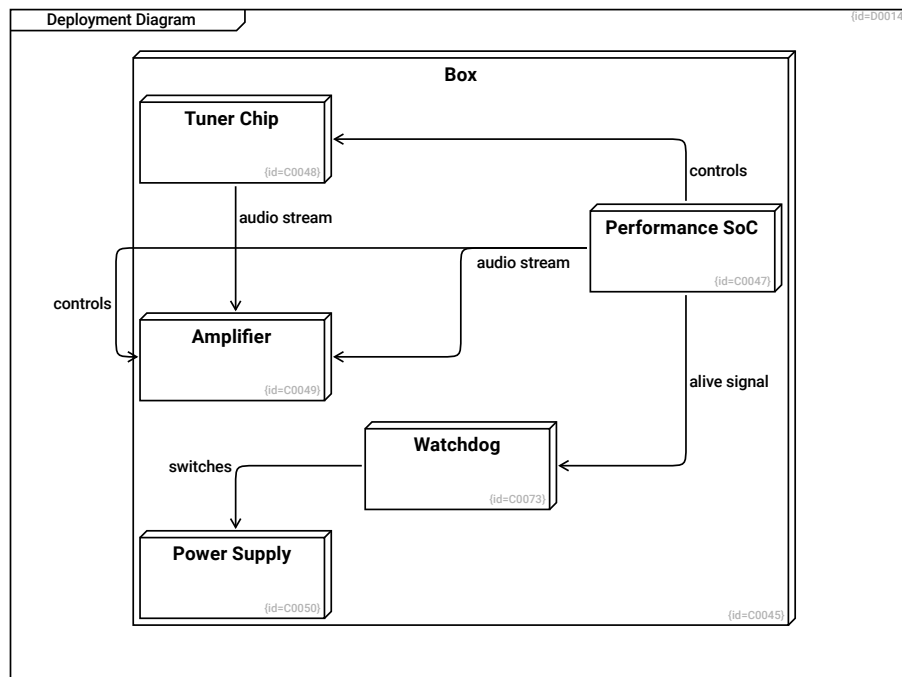


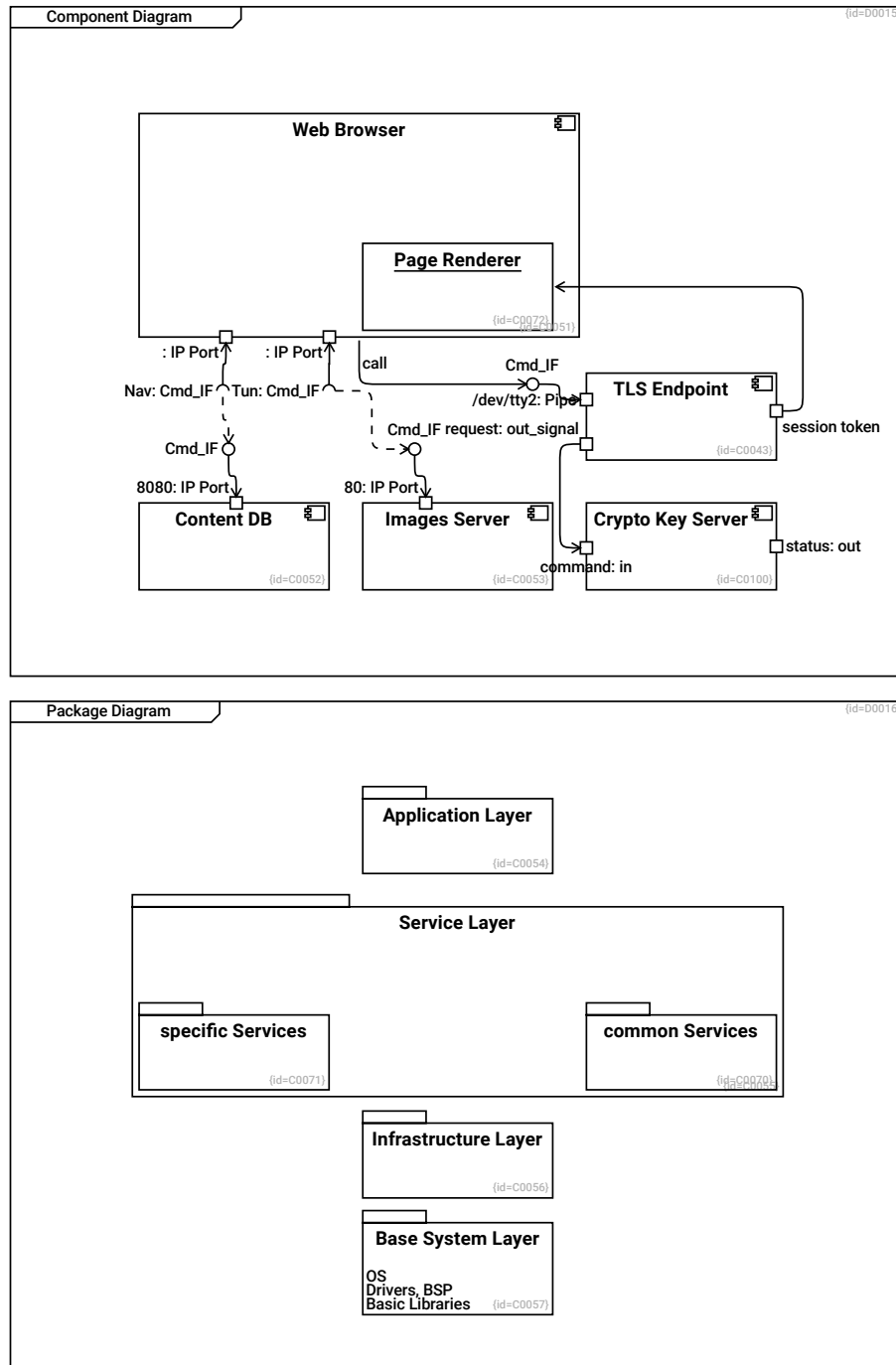


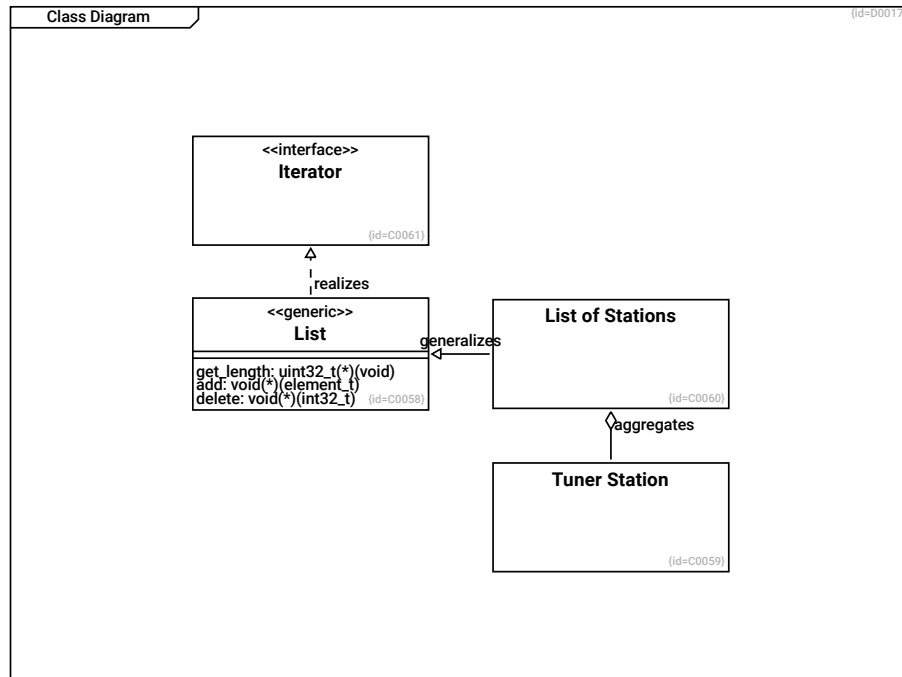


2.3 Example UML Static Views

This section lists what kind of elements crystal_facet_uml can draw in diagrams.

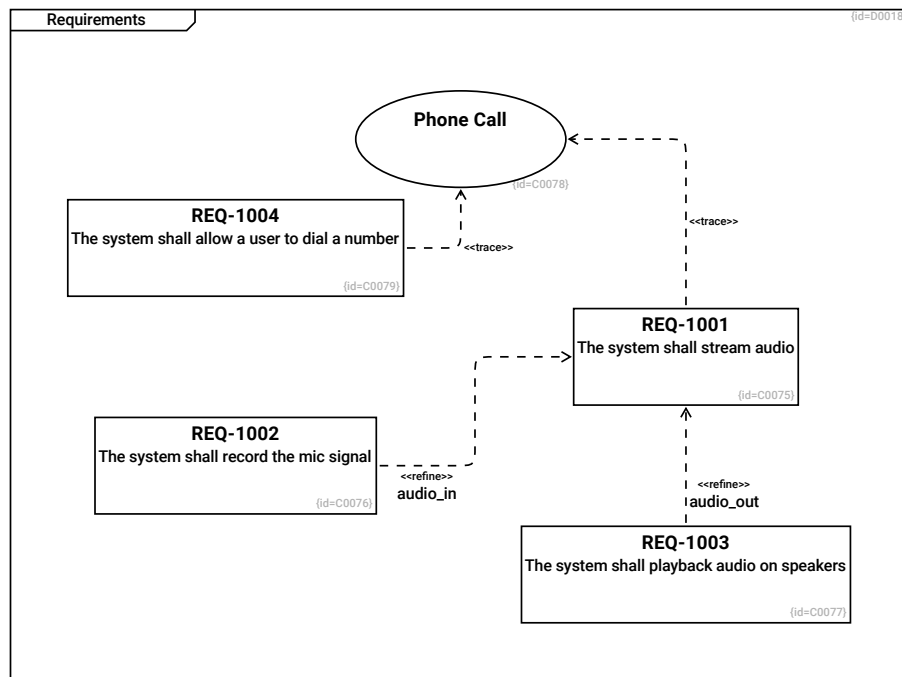


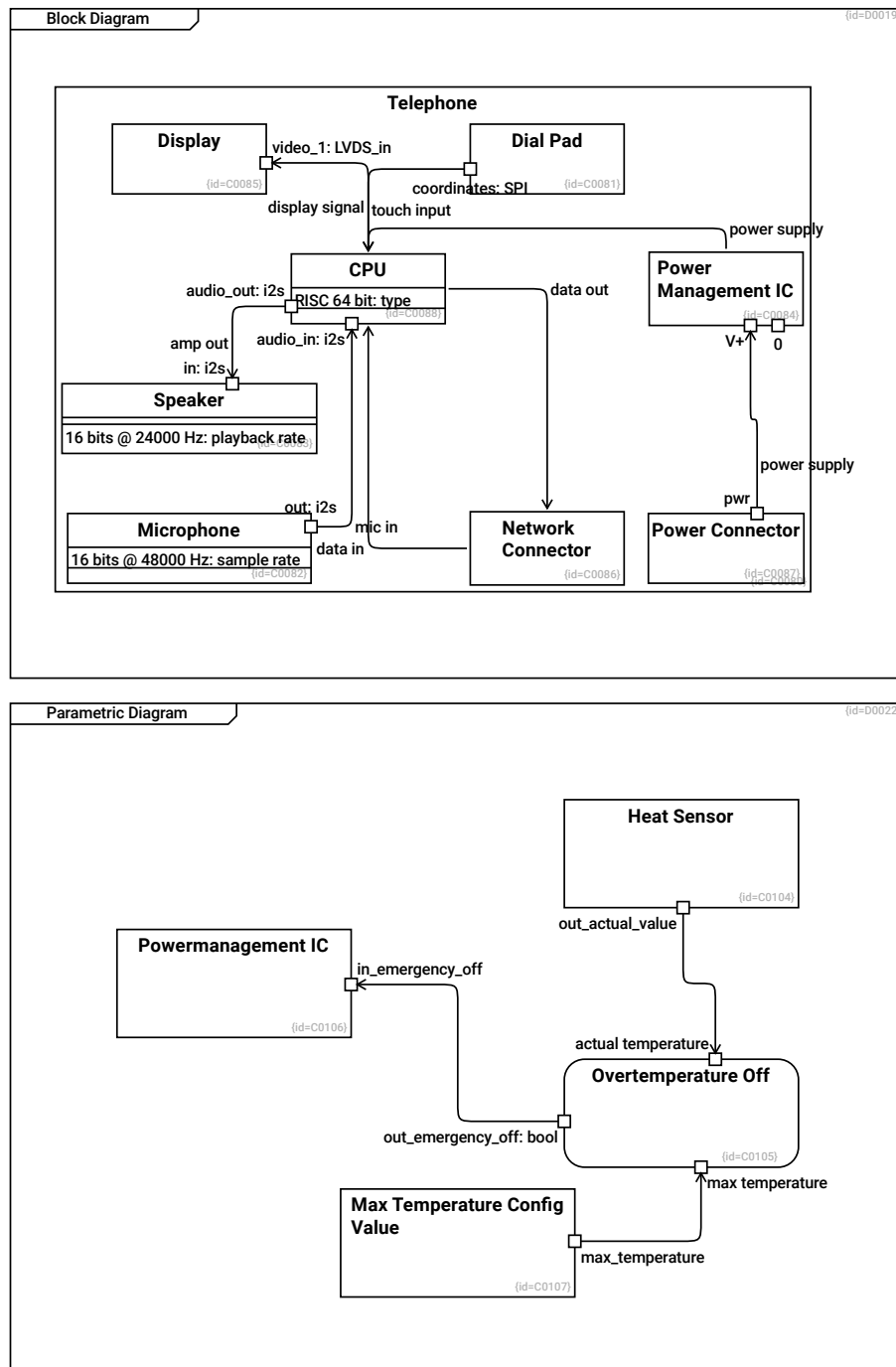




2.4 Example SysML Views

This section lists what kind of elements crystal_facet_uml can draw in diagrams.





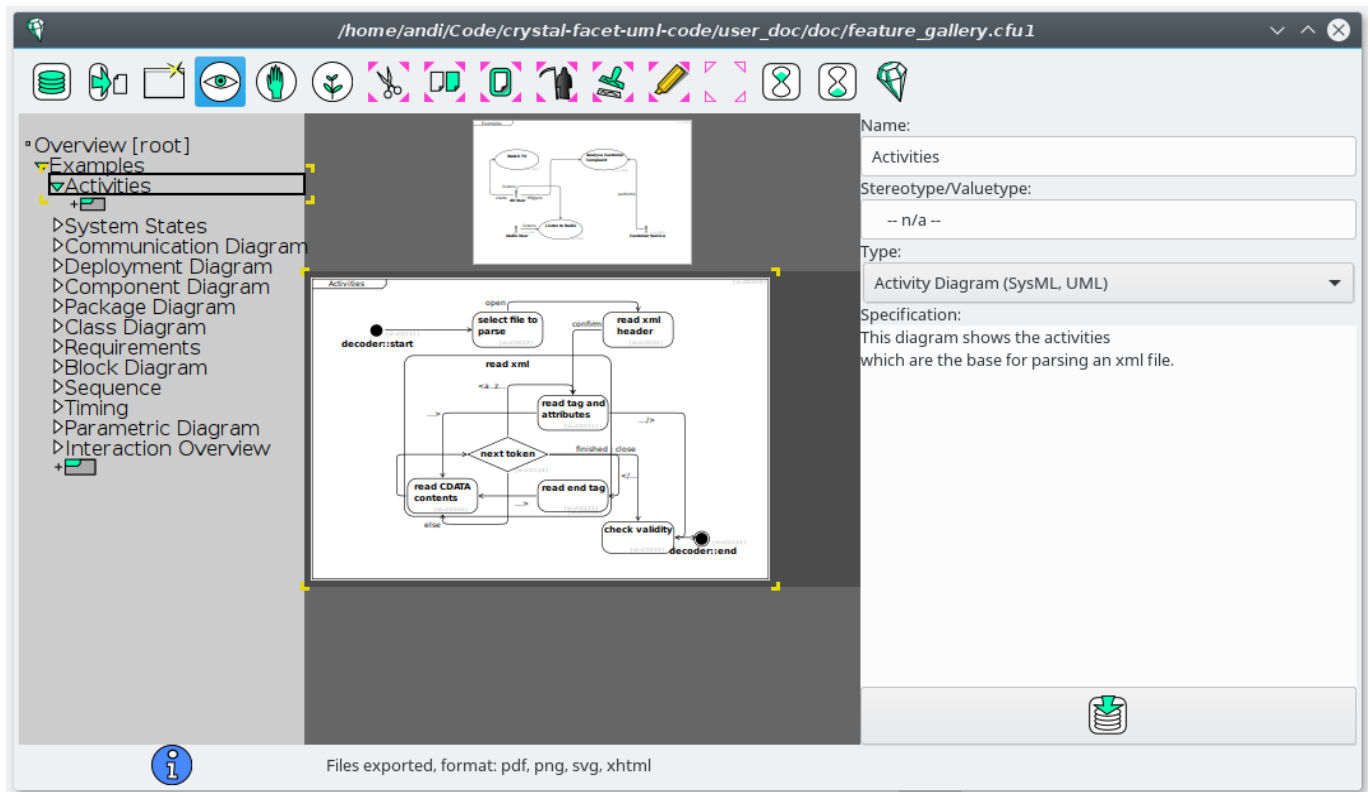
3 GUI / Usage Manual

3.1 Window Area Overview

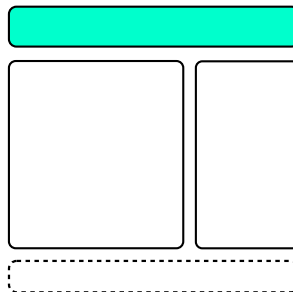
If started in graphical mode, crystal_facet_uml shows a window with

- toolbar on top,
- drawing area in the center,
- element configuration widgets to the right and

- an optional notification bar at the bottom.



3.2 Tool Bar



3.2.1 Create/Use DB



- Opens an existing database file or creates a new database file

3.2.2 Export



- Exports all diagrams to the selected folder (supported formats are txt, png, pdf, ps and svg)

3.2.3 New Window



- Opens another window on the same database.

This option allows you to work reliably with multiple windows on the same database.

3.2.4 Navigate



- Navigate to parent or child diagrams
- Create a new diagram (see Section [3.3.1](#))

3.2.5 Edit



- Modify elements in the diagram (see Section [3.3.2](#))

3.2.6 Create



- Create elements in the diagram (see Section [3.3.3](#))

3.2.7 Cut



- Cut all pink-cornered elements to the clipboard (features of classifiers are cut independantly of their corner-colors)

3.2.8 Copy



- Copy all pink-cornered elements to the clipboard (features of classifiers are copied independantly of their corner-colors)

3.2.9 Paste



- Pastes diagrams and classifiers from the clipboard to the uml model. (Relationships are not pasted) If id and name are identical to an existing element, an instance of the existing element is pasted to the diagram. Otherwise a new element is created.

3.2.10 Delete



- Deletes all pink-cornered elements. This operation may fail if a marked diagram contains unmarked elements.

3.2.11 Instantiate



- Toggles the pink-cornered classifiers between classes and anonymous instances.
- No effect on classifiers that are already instances: Object, Part.
- No effect on relationships and features.

3.2.12 Highlight



- Toggles the pink-cornered classifiers between yellow-marked, greyed-out and normal. (Does not work for relationships and features)

3.2.13 Reset Selection



- Resets the pink-cornered selection

3.2.14 Undo



- Un-does the last operation (Opening a database and exporting files cannot be undone)
-

3.2.15 Redo



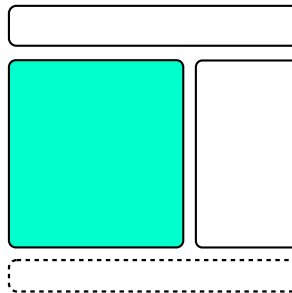
- Re-does the last un-done operation

3.2.16 About



- Shows version, license and copyrights



3.3 Drawing Area



Diagrams are layouted automatically. You can influence the locations of classifiers only. When adding too many classifiers or relations, auto layouting may not achieve the expected results. In many cases, splitting the diagram into two or more diagrams solves the layouting issues and at the same time improves understandability by focusing on one aspect/topic per diagram.

3.3.1 Navigate



- To navigate to parent, sibling or children diagrams, click on the diagram.
- To create a new diagram, click on the  icon, or the smaller  icon for a new child-diagram.
- To restructure the diagram tree, drag a diagram name to the new location.

3.3.2 Edit

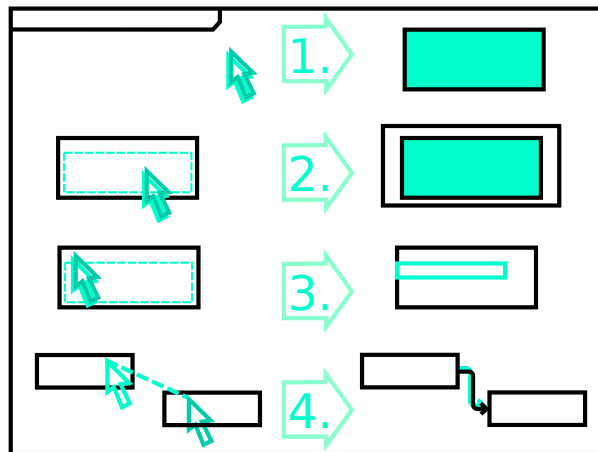


- To select the diagram or a classifier or a feature or a relationship with yellow corners, click on this object.
- To mark an element with pink corners, click on these objects twice.
- To move classifiers within the diagram, 1.) press, 2.) drag and 3.) release the mouse button.

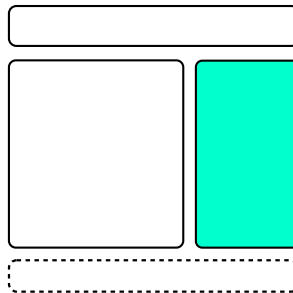
3.3.3 Create



1. To create a classifier, click at an empty space in the diagram.
2. To create a child classifier, click into the white space of a classifier. (Alternatively, create a classifier (see 1) and a containment relationship (see 4).)
3. To create a feature, click onto a classifier (name or border).
4. To create a relationship, press on the source classifier and drag it to the destination classifier.



3.4 Element Configuration Area



Edit the properties of the yellow-cornered object.

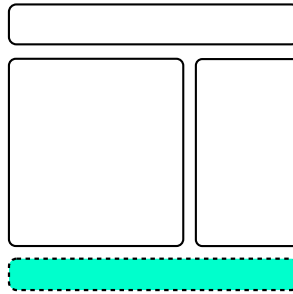
- name of the focused object
- stereotype/valuetype of the focused object (deactivated depending on object-type)
- type of the focused object
- description of the focused object

3.4.1 Commit



- Stores the latest changes to the database immediately. This feature is optional, it is not necessary to explicitly save the file.

3.5 Notification Bar



3.5.1 Information



- Informs on success of an operation, e.g. an export

3.5.2 Warning



- Informs on a possible problem

3.5.3 Error



- Informs on an error

4 Diagrams and Elements Spec



This program creates diagrams that strive for compatibility to

- UML 2.5
- SysML 1.5
- MOF 1.4.1


In some cases, it deviates from these standards for several reasons:


- Reduce complexity to be able to handle such models in a small open source project
- Reduce feature-set to improve understandability of diagrams even to non-software-architects
- Reduce feature-set to enhance usability of the program

This section gives an overview on standards and implementation-status of crystal_facet_uml. It may be incomplete.

4.1 Classifiers

Classifiers are the nodes in the model-graph.

| | Spec | Concept |  Filter | Comment |
|---------------------------------|------------|---------|--|--|
| Block | SysML | I(+C) | - | Limitations: Compartment Order is "properties, operations" instead of "constraints, operations, receptions, parts, (bound) references, values, properties, stereotype-tagged-values, behavior, namespace, structure" Limitations: No labeled compartments Limitations: no Multiplicities of Block-Instances. |
| Constraint Property/Equation | SysML | dyn | - | Limitations: Only the rounded-rect symbol is supported, ports are not completely inside the rounded-rect. |
| Node | UML | I(+C) | - | |
| Component | UML | C(+I) | - | |
| Part | UML | I only | - | |
| Interface | UML | C(+I) | - | |
| Package | UML, SysML | C(+I) | - | |
| Class | UML | C(+I) | - | |
| Object | UML | I only | - | |
| Artifact | UML | I(+C) | - | |
| Comment | UML, SysML | I(+C) | unconditional features | |
| Feature | - | I(+C) | - | Represents a group of requirements |
| Requirement | SysML | I(+C) | - | |
| Actor | UML, SysML | C(+I) | unconditional features | |
| Use Case | UML, SysML | dyn | - | Limitations: No SysML extension points |
| System Boundary | UML, SysML | I(+C) | unconditional features | |
| Diagram Reference | UML | I(+C) | unconditional features | |
| Activity | UML | dyn | unconditional features | |
| Interruptable Region | UML | dyn | unconditional features | |
| Fork | UML, SysML | dyn | unconditional features | |
| Join | UML, SysML | dyn | unconditional features | |
| Accept Event | UML, SysML | dyn | unconditional features | |
| Accept Time Event | UML, SysML | dyn | unconditional features | |
| Send Signal | UML, SysML | dyn | unconditional features | |

| | Spec | Concept |  Filter | Comment |
|-----------------------|------------|---------|--|---|
| Decision | UML, SysML | dyn | unconditional features | |
| Initial Node | UML, SysML | dyn | unconditional features | Limitations: There is no distinction in ActivityInitial and FlowInitial |
| Final Node | UML, SysML | dyn | unconditional features | Limitations: There is no distinction in ActivityFinal and FlowFinal |
| State | UML, SysML | dyn | unconditional features | |
| Shallow History | UML, SysML | dyn | unconditional features | |
| Deep History | UML, SysML | dyn | unconditional features | |
| Value Type | SysML | C(+I) | - | not supported. Limitations: Compartment Order of Classifiers is "properties, operations" instead of "operations, properties, stereotype-tagged-values" |
| Enumeration | UML, SysML | C(+I) | - | not supported. Note: Use a class instead. |
| ActivityParameterNode | SysML | dyn | - | not supported. |
| MergeNode | UML, SysML | dyn | unconditional features | not supported. Note: Either directly connect to the target activity or use a decision node. |
| ActivityPartition | UML, SysML | dyn | unconditional features | not supported. Note: Use a parent activity instead. |

LEGEND

Concept Defines if the classifier can be abstract(class) and concrete (instance)

C The classifier is an abstract concept that can be instantiated

I The classifier is a concrete instance

dyn The classifier describes dynamic behavior. Only the context of the diagram defines if a single-instance or a concept is described.



TODO Marker

4.2 Features

Features are elements attached to one classifier.

| | Spec | Scope | Comment |
|-----------|------------|---------------|--|
| Property | UML, SysML | unconditional | Limitations: no SysML Flow-Properties refinement |
| Operation | UML, SysML | unconditional | |

| | Spec | Scope | Comment |
|--------------------|------------|-------------------------|--|
| Port | UML, SysML | unconditional | Limitations: no SysML-compartment Notation supported Limitations: no SysML-nested-ports, SysML-proxy-port, SysML full-ports supported |
| Provided Interface | UML, SysML | unconditional | |
| Required Interface | UML, SysML | unconditional | |
| Lifeline | UML, SysML | scenario, 1 per diagram | Limitations: One lifeline is visible only in one diagram |

LEGEND

Scope scope is unconditional if a feature belongs to a classifier unconditionally, scenario if only applicable in 1 diagram






4.3 Relationships

Relationships are the edges of the model-graph.

| | Spec | Diagram Types | Comment |
|--------------------|----------------|----------------------|---|
| Dependency | UML, SysML | any | |
| Containment | UML, SysML | Deployment, Package | |
| Deploy | UML | Deployment | |
| Manifest | UML | Deploy | |
| Communication Path | UML, SysML | Component, Use Case | |
| Association | UML, SysML | Class Diag | Note: SysML calls this ReferenceAssociation Limitations: no AssociationClass(SysML: ParticipantProperty) exists. Limitations: no AssociationEnd Classes exist, no Multiplicities, no Roles. |
| Aggregation | UML, SysML | Class Diag | Note: SysML calls this SharedAssociation |
| Composition | UML, SysML | Class Diag | Note: SysML calls this PartAssociation |
| Generalization | UML, SysML | Class Diag, Use Case | Limitations: no Generalization-Sets supported |
| Realization | UML | Class Diag | |
| Trace | SysML | Requirement | |
| Refine | SysML | Requirement | |
| Extend | UML, SysML | Use Case | Limitations: no SysML-condition-notes can be attached to this relationship |
| Include | UML, SysML | Use Case | |
| Control Flow | UML, SysML | Activity | |
| Object Flow | UML, SysML | Activity | |
| Async. Call | UML, SysML (?) | Sequence | |
| Sync. Call | UML, SysML (?) | Sequence | |
| Return Call | UML, SysML (?) | Sequence | |
| Connector | UML, SysML | Internal Block Diag. | not supported. Limitations: No Bi-directional Connectors Note: SysML calls this BindingConnector Note: Use a Communication Path instead. |
| Item Flow | SysML | Block Definition | not supported. Note: Use an Object Flow instead. |

4.4 Diagrams

Diagrams are views on the model-graph. They select classifiers and may filter their features and relationships.

| | Spec | Filter | Comment |
|------------------------------|------------|--|---|
| List Diagram | - |  features, relationships | This is an overview diagram showing only classifiers without features and without relationships |
| Box Diagram | - |  features, relationships | This is an overview diagram showing only classifiers without features and without relationships |
| Block Definition Diagram | SysML | lifelines | |
| Internal Block Diagram | SysML | lifelines | |
| Parametric Diagram | SysML | lifelines | |
| Deployment Diagram | UML | lifelines | |
| Component Diagram | UML | lifelines | |
| Composite Structure Diagram | UML | lifelines | |
| Package Diagram | UML, SysML | lifelines | |
| Class Diagram | UML | lifelines | |
| Profile Diagram | UML | lifelines | not supported |
| Requirements Diagram | SysML | lifelines | |
| Use Case Diagram | UML, SysML | lifelines | |
| Interaction Overview Diagram | UML | lifelines | Limitations: There is no link from Diagram-References to referenced Diagrams |
| Activity Diagram | UML, SysML | lifelines | |
| State Machine Diagram | UML, SysML | lifelines | |
| Communication Diagram | UML |  unconditional relationships except containments(ro), unconditional features (Scenario) | |
| Sequence Diagram | UML, SysML |  unconditional relationships, unconditional features (Scenario) | |
| Timing Diagram | UML |  unconditional relationships, unconditional features (Scenario) | |

LEGEND

Filter Defines which elements are not visible in the diagram

Scenario Diagrams show only relationships associated with the lifeline of visible classifiers.



TODO Marker

4.5 Maximum stringlengths

All strings (names, descriptions, stereotypes) have a maximum length.

Ascii characters require one, most other characters two bytes. Current sizes in bytes are:

Classifiers:

- DATA_CLASSIFIER_MAX_NAME_LENGTH = 47,
- DATA_CLASSIFIER_MAX_STEREOYPE_LENGTH = 47,
- DATA_CLASSIFIER_MAX_DESCRIPTION_LENGTH = 4095,

Features:

- DATA_FEATURE_MAX_KEY_LENGTH = 47, (name)
- DATA_FEATURE_MAX_VALUE_LENGTH = 255, (type)
- DATA_FEATURE_MAX_DESCRIPTION_LENGTH = 1023,

Relationships:

- DATA_RELATIONSHIP_MAX_NAME_LENGTH = 47,
- DATA_RELATIONSHIP_MAX_DESCRIPTION_LENGTH = 1023,

Diagrams:

- DATA_DIAGRAM_MAX_NAME_LENGTH = 47,
- DATA_DIAGRAM_MAX_DESCRIPTION_LENGTH = 8191,

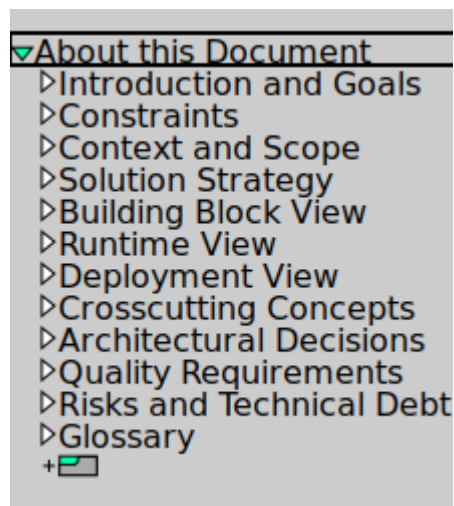
5 Modelling Guidelines

This page lists remarks on creating a software architecture and design document in general and it lists hints on getting along with the tool crystal_facet_uml. As all tools, this program has its strengths and weaknesses. This page helps in making use of the strenghts.

5.1 crystal_facet_uml Hints

5.1.1 Tree Structure

Diagrams are organized as a tree. Start the root of the tree explaining the document structure. At the second level of the tree, list the main areas to be shown, for example based on the arc42 template <https://arc42.org/overview/> :



5.1.2 Focus

Put only few elements into each diagram. This increases understandability of the main purpose of the diagram. Put further aspects of a topic into a separate diagram. Do not hesitate to copy an element from one diagram to the next. This is what crystal_facet_uml is good at: it keeps the model in sync.

5.1.3 Namespaces

Put a prefix to all your elements denoting its namespace. You can then distinguish a GLOBAL_START_STATE from an AUDIO_START_STATE. Or global::start from audio::start.

5.1.4 Attic/Storage room

If you are not sure if you really want to delete elements, 1) copy them to an attic-diagram and then 2) delete them from the original diagram.

5.2 General Hints on Architecture Documentation

5.2.1 Problem vs. Solution

Distinguish things that are

- given constraints (problem space),
- decisions, chosen and rejected alternatives and
- the designed solution

5.2.2 Names

Names of things are crucial: If the reader gets a wrong understanding by the name of an element, a hundred correct sentences of describing text cannot set this straight again.

5.2.3 Description

Every design element needs a description, maybe a list of responsibilities: What shall this element do, what is it for? Names alone cannot explain a system part.

5.2.4 Precise sentences

Be precise: Write in active form, e.g. The persistence component shall store and retrieve binary data records identified by string-based keys.

5.2.5 Distinguish similar things

Things that are similar but not the same shall be different entities when modelling. E.g. The process in which an example application runs may be different from the storage location and may be different from the software-component. These are three things: Example_App_Process (Type: Node), Example_App_ObjectFile (Type:Artifact) and Example_App_SWComponent (Type:Component).

A Download Information

A.1 Download Links

Find the latest version at:

- <https://sourceforge.net/projects/crystal-facet-uml/>
- https://github.com/awarnke/crystal_facet_uml
- https://build.opensuse.org/package/show/home:awarnke/crystal_facet_uml

User documentation is available here:

- http://www.andreaswarnke.de/crystal_facet_uml/crystal_facet_uml_user_documentation.pdf
- https://github.com/awarnke/crystal_facet_uml/blob/master/user_doc/crystal_facet_uml_user_documentation.pdf

A.1.1 Install

The .deb and .rpm packages can be installed by the package installers of your system.

For installation on ubuntu, debian or raspbian, you may e.g. invoke **sudo dpkg --install <filename>** on the command line:

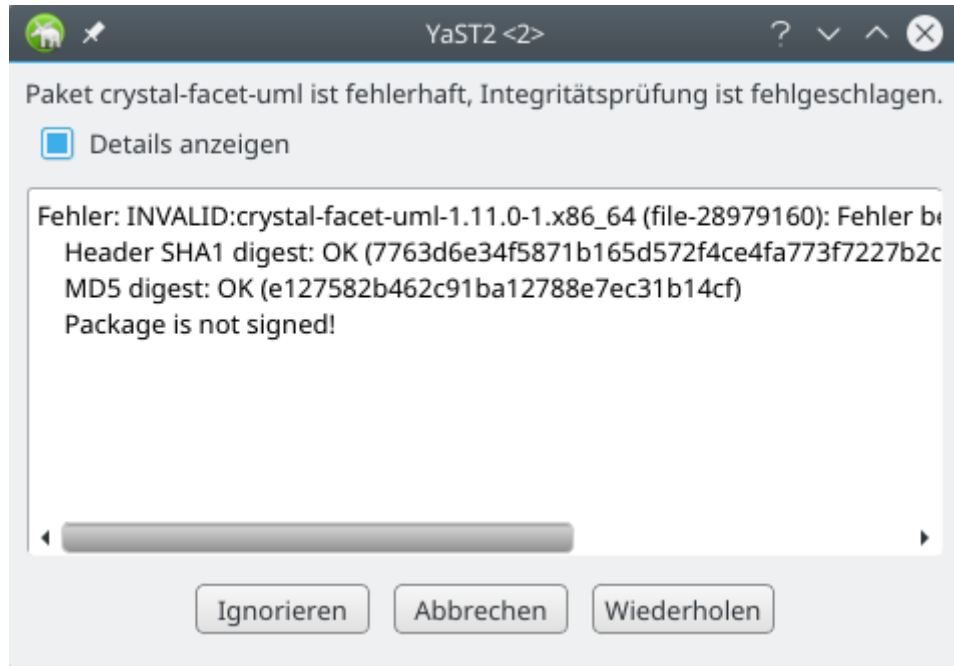
```
andi@debian1zotac:~/Downloads$ sudo dpkg --install crystal-facet-uml_1.12.0-1_amd64.deb

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

#1) Respect the privacy of others.
#2) Think before you type.
#3) With great power comes great responsibility.

[sudo] password for andi:
Selecting previously unselected package crystal-facet-uml.
(Reading database ... 198990 files and directories currently installed.)
Preparing to unpack crystal-facet-uml_1.12.0-1_amd64.deb ...
Unpacking crystal-facet-uml (1.12.0-1) ...
Setting up crystal-facet-uml (1.12.0-1) ...
Processing triggers for gnome-menus (3.13.3-9) ...
Processing triggers for desktop-file-utils (0.23-1) ...
Processing triggers for mime-support (3.60) ...
Processing triggers for man-db (2.7.6.1-2) ...
andi@debian1zotac:~/Downloads$
```

Because the packages are not signed, you may want to ignore the warning.



Alternatively, you may want to build the software from the .orig source-package and then install it by **sudo make install**; see the readme file for more information.

A.1.2 License

License of crystal_facet_uml is Apache-2.0. (c) 2016-2019 Andreas Warnke; Email-contact: cfu-at-andreaswarnke-dot-de