crystal_facet_uml user documentation

COLLABORATORS			
	TITLE : crystal_facet_uml user documentation		
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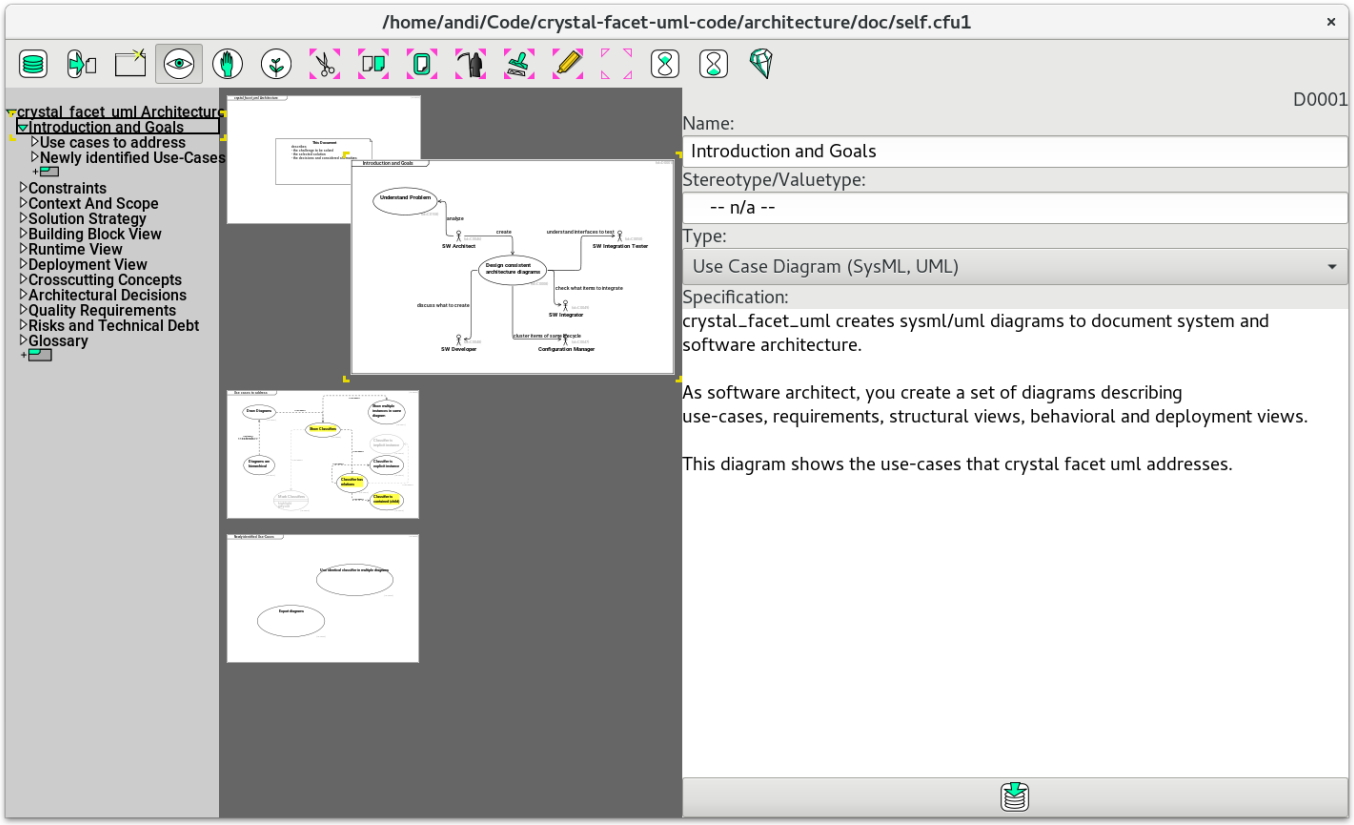
REVISION HISTORY			
NUMBER	DATE	DESCRIPTION	NAME

Contents

1 Introduction

crystal_facet_uml creates diagrams to document system and software architecture.



Similar to a crystal which shows different facets of the same thing, this application shows different views of the same system.

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 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-layouts 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

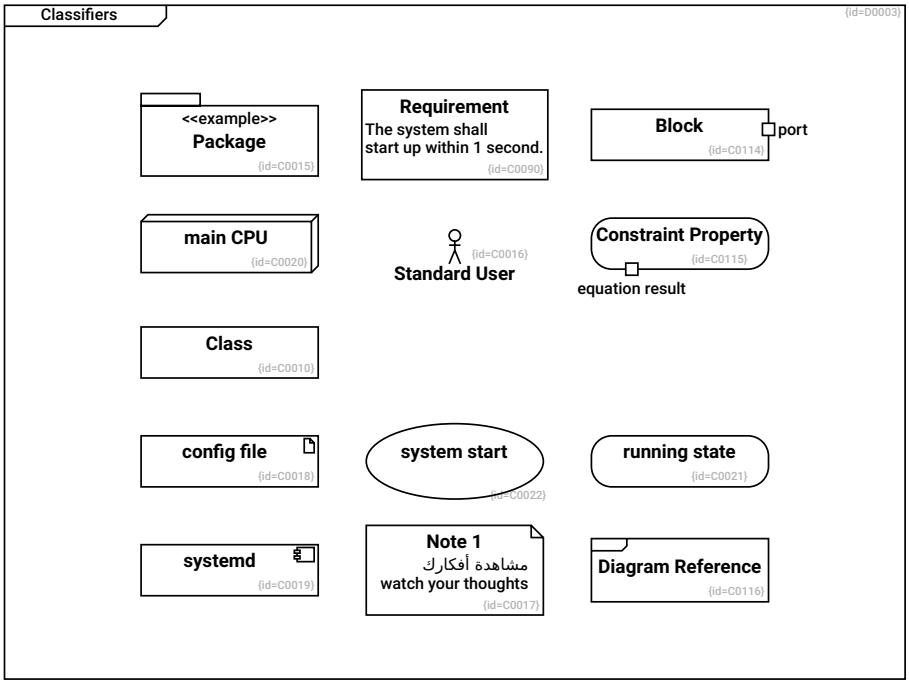
crystal_facet_uml can be started in graphical mode (see Section 3) or from command line (for help run **`crystal_facet_uml -h`**).

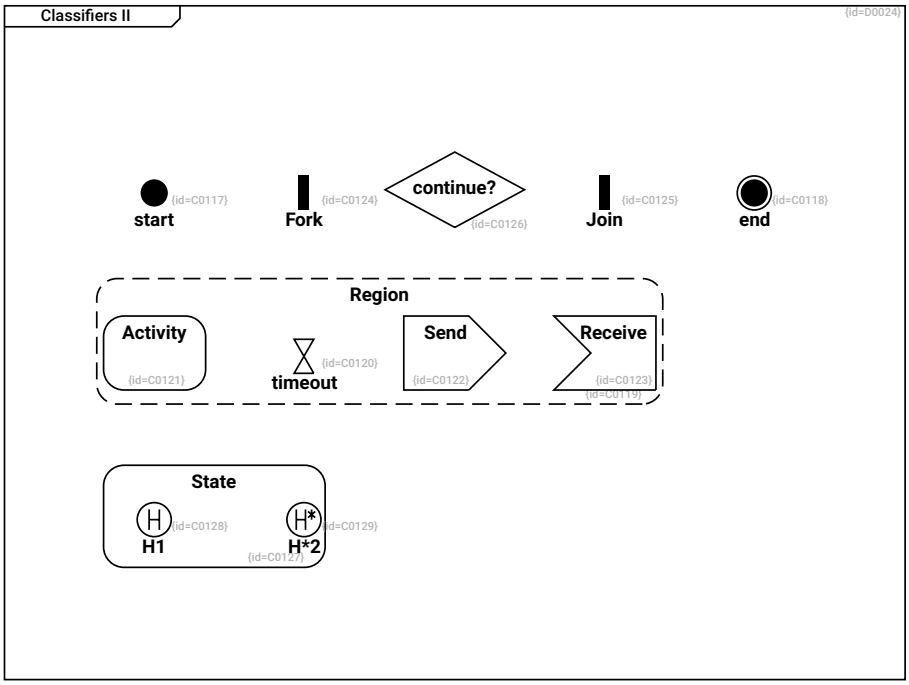
2 Example Diagrams

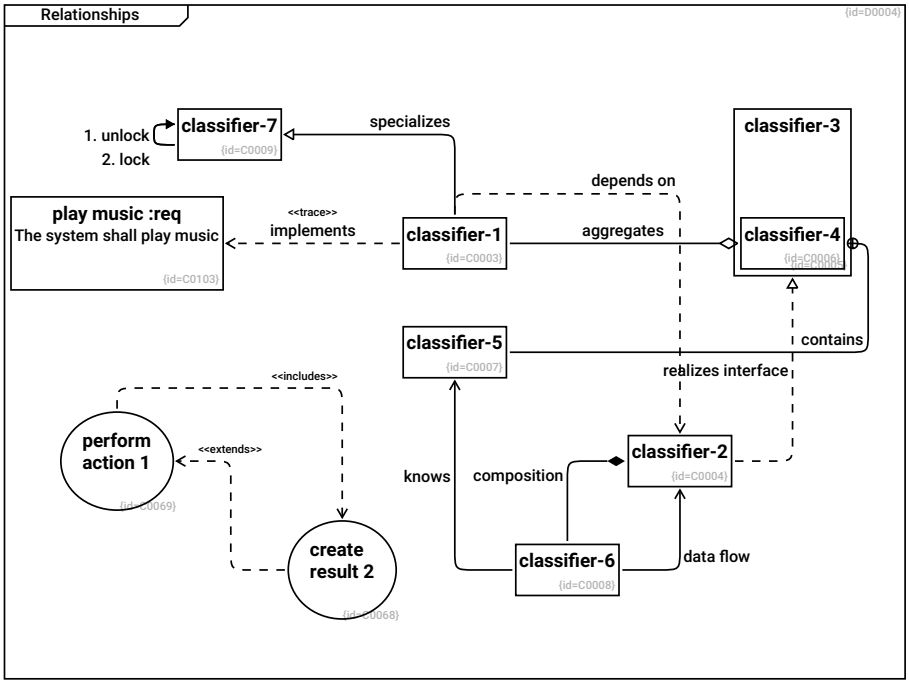
This sections presents the features of crystal_facet_uml.

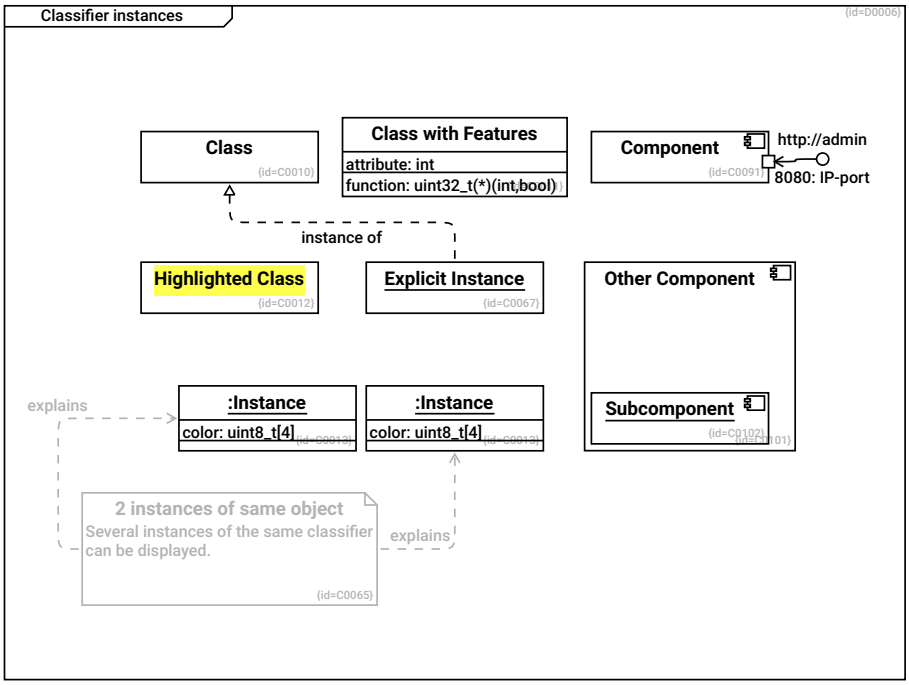
2.1 Feature List

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



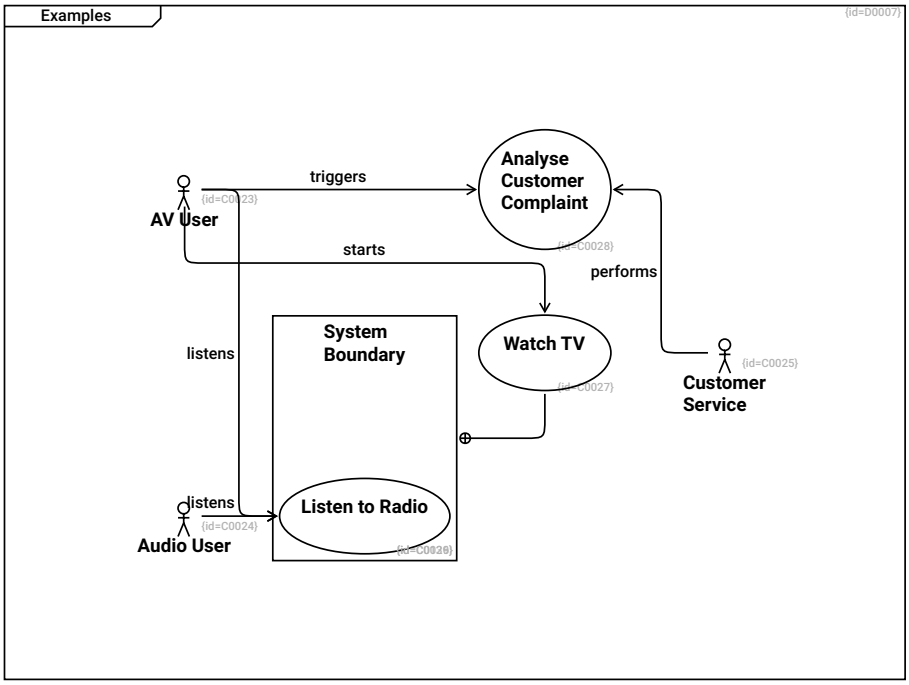

Classifiers II
{id=D0024}
start
{id=C0117}
Fork
{id=C0124}
continue?
{id=C0126}
Join
{id=C0125}
end
{id=C0118}
Region
Activity
{id=C0121}
timeout
{id=C0120}
Send
{id=C0122}
Receive
{id=C0123}
{id=C0119}
State
H1
{id=C0128}
H*2
{id=C0129}
{id=C0127}

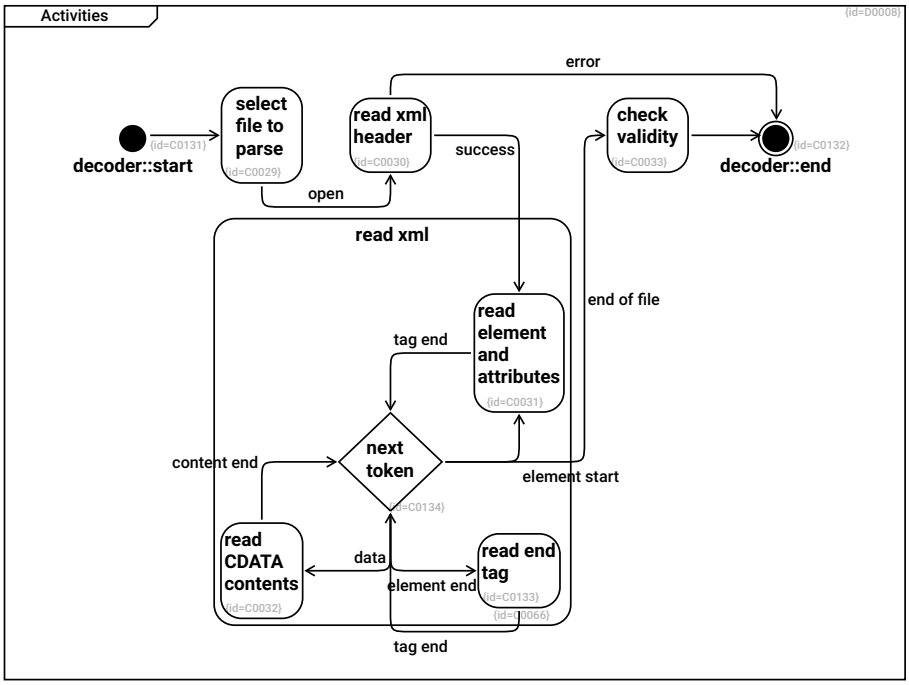

Relationships
{id=D0004}
1. unlock
2. lock
classifier-7
{id=C0009}
specializes
classifier-3
depends on
play music :req
The system shall play music
{id=C0103}
<<trace>>
implements
classifier-1
{id=C0003}
aggregates
classifier-4
{id=C0006}
contains
classifier-5
{id=C0007}
realizes interface
<<includes>>
perform action 1
{id=C0069}
<<extends>>
create result 2
{id=C0068}
knows
composition
classifier-2
{id=C0004}
classifier-6
{id=C0008}
data flow

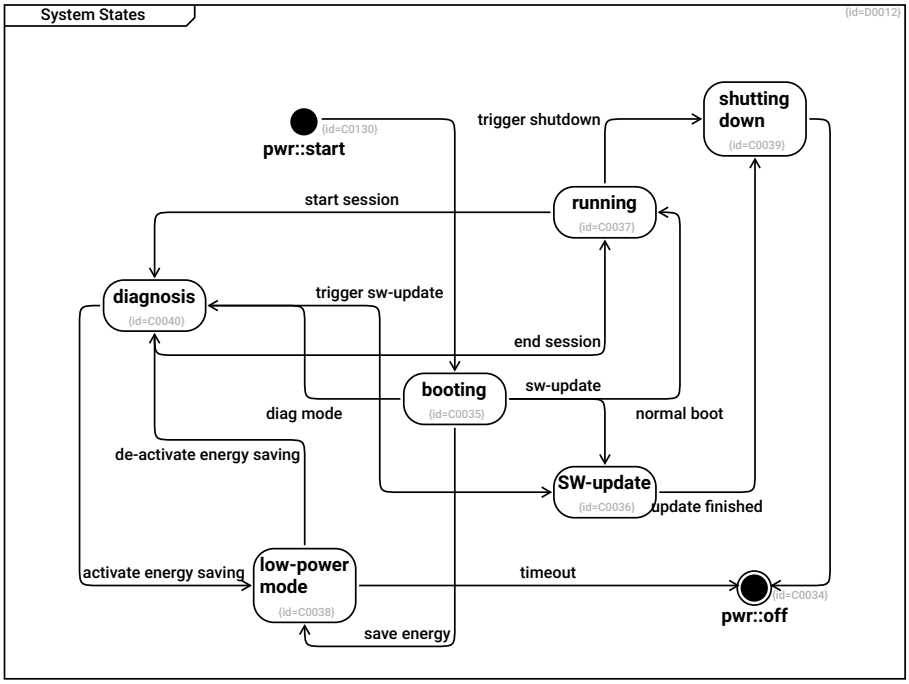


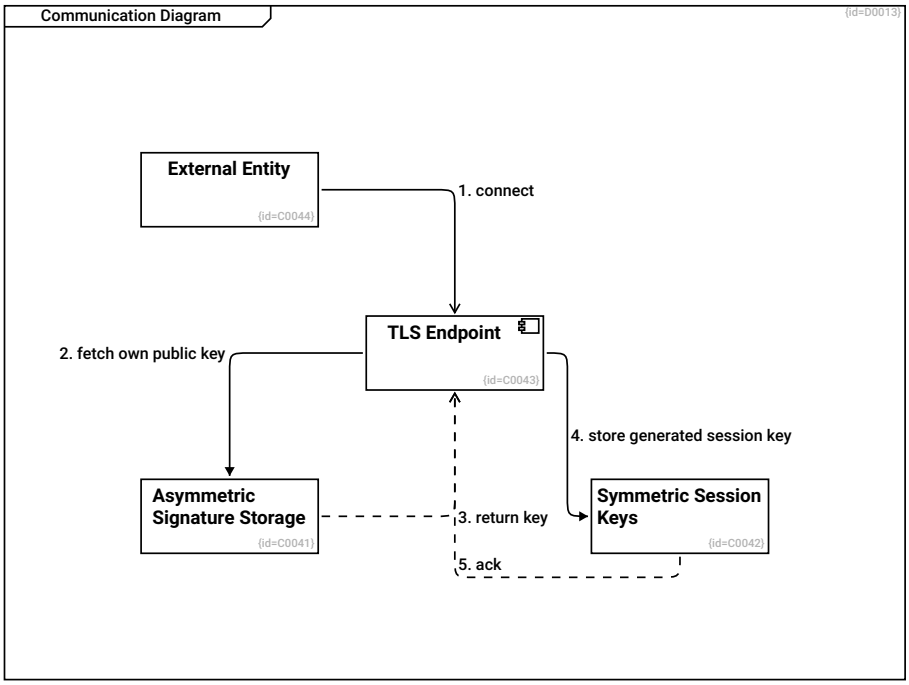
2.2 Example UML Behavioral Views

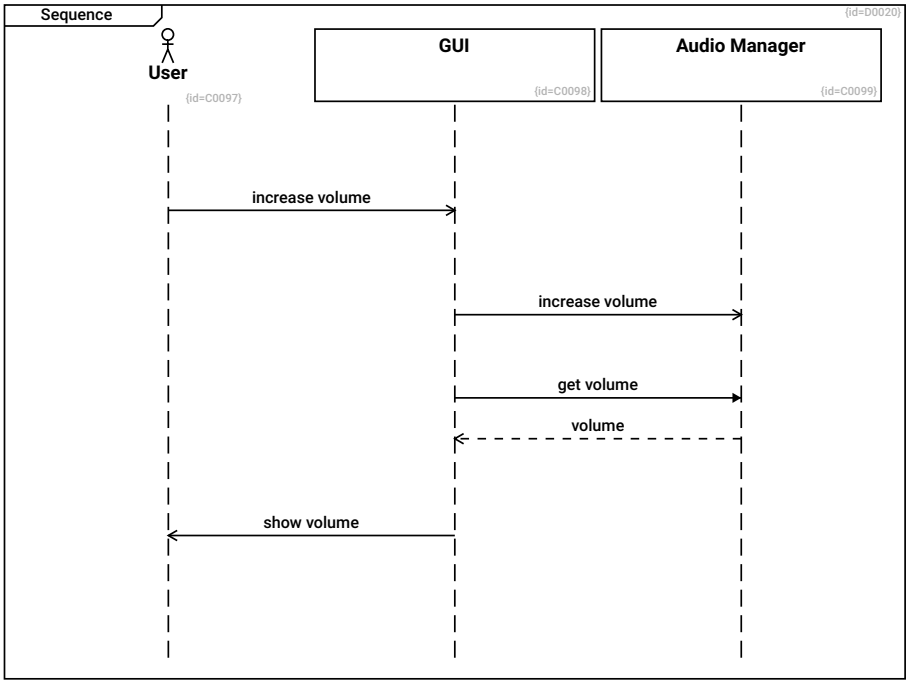
This section lists what kind of elements crystal_facet_uml can draw in diagrams.

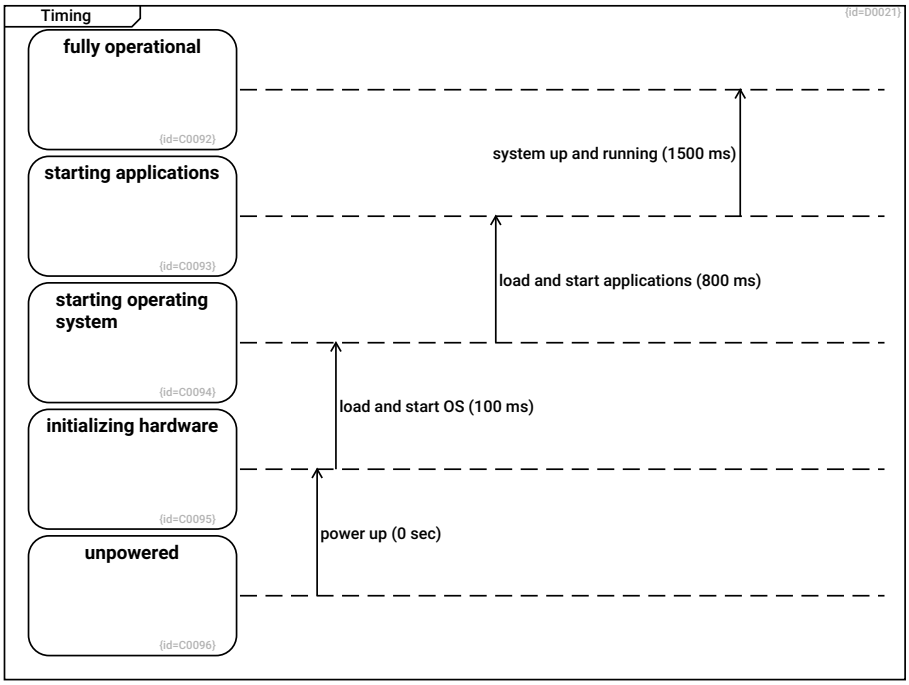


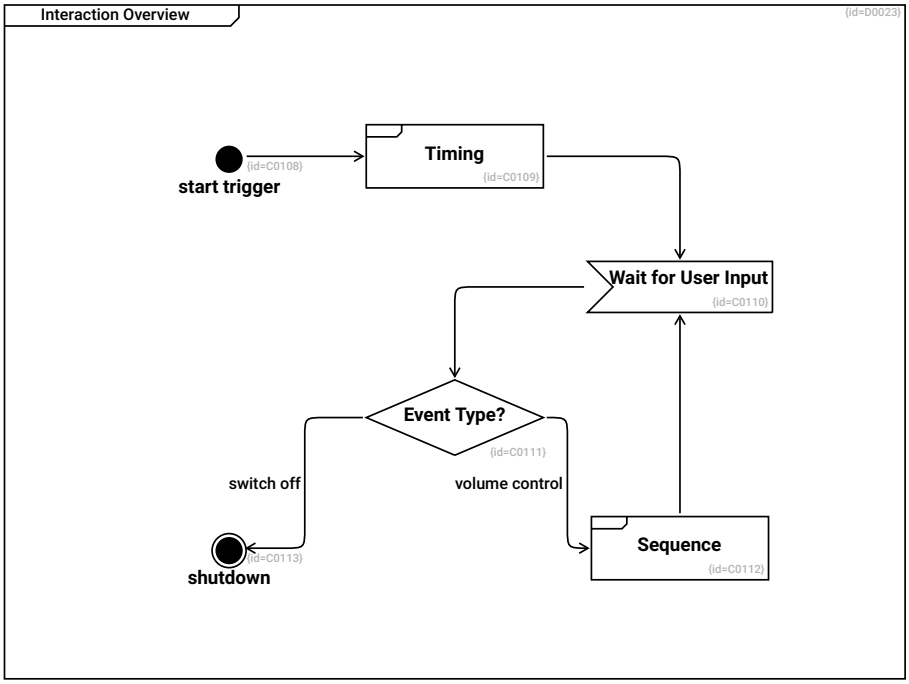

Activities
{id=D0008}
error
select file to parse
{id=C0029}
read xml header
{id=C0030}
check validity
{id=C0033}
{id=C0131}
decoder::start
{id=C0132}
decoder::end
success
open
read xml
read element and attributes
{id=C0031}
end of file
tag end
next token
{id=C0134}
content end
element start
read CDATA contents
{id=C0032}
data
read end tag
{id=C0133}
{id=D0066}
element end
tag end


System States
{id=D0012}
{id=C0130}
pwr::start
trigger shutdown
shutting down
{id=C0039}
start session
running
{id=C0037}
diagnosis
{id=C0040}
trigger sw-update
end session
booting
{id=C0035}
sw-update
diag mode
normal boot
de-activate energy saving
SW-update
{id=C0036}
update finished
activate energy saving
low-power mode
{id=C0038}
timeout
{id=C0034}
pwr::off
save energy


Communication Diagram
{id=D0013}
External Entity
{id=C0044}
1. connect
TLS Endpoint
{id=C0043}
2. fetch own public key
4. store generated session key
Asymmetric Signature Storage
{id=C0041}
3. return key
Symmetric Session Keys
{id=C0042}
5. ack

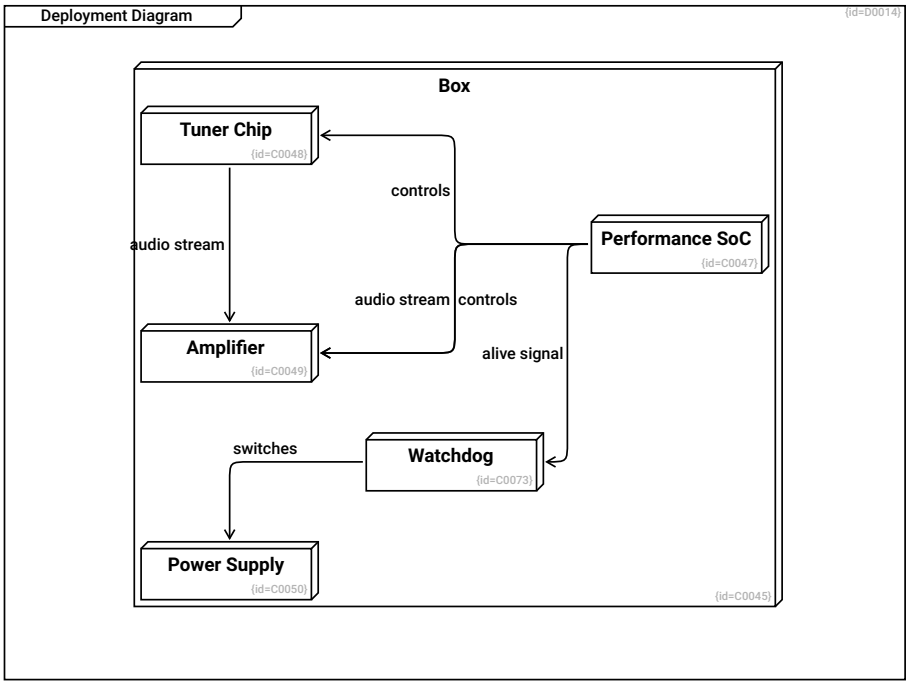

Sequence
{id=D0020}
User
{id=C0097}
GUI
{id=C0098}
Audio Manager
{id=C0099}
increase volume
increase volume
get volume
volume
show volume

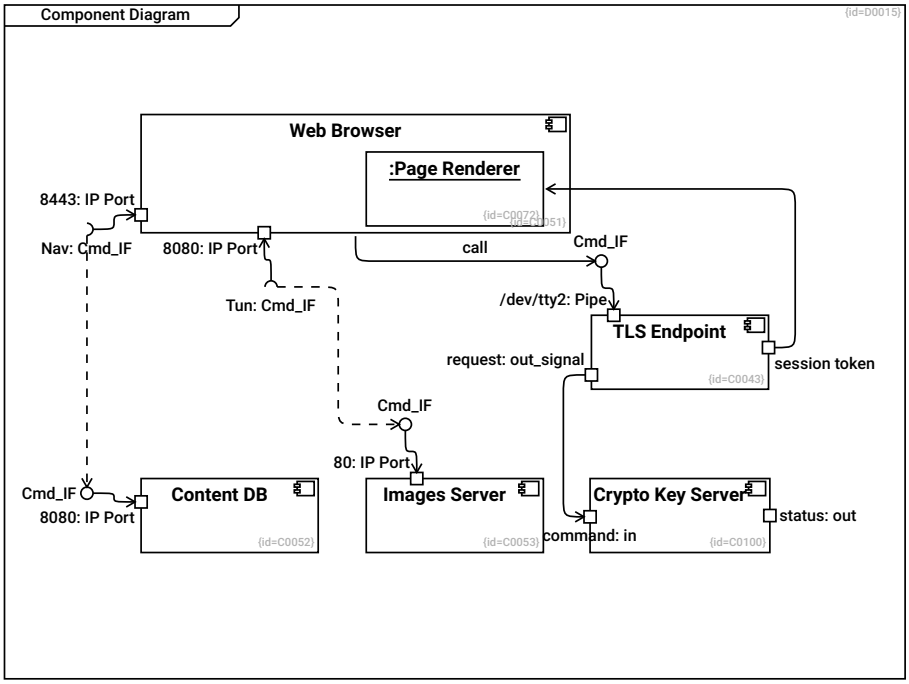


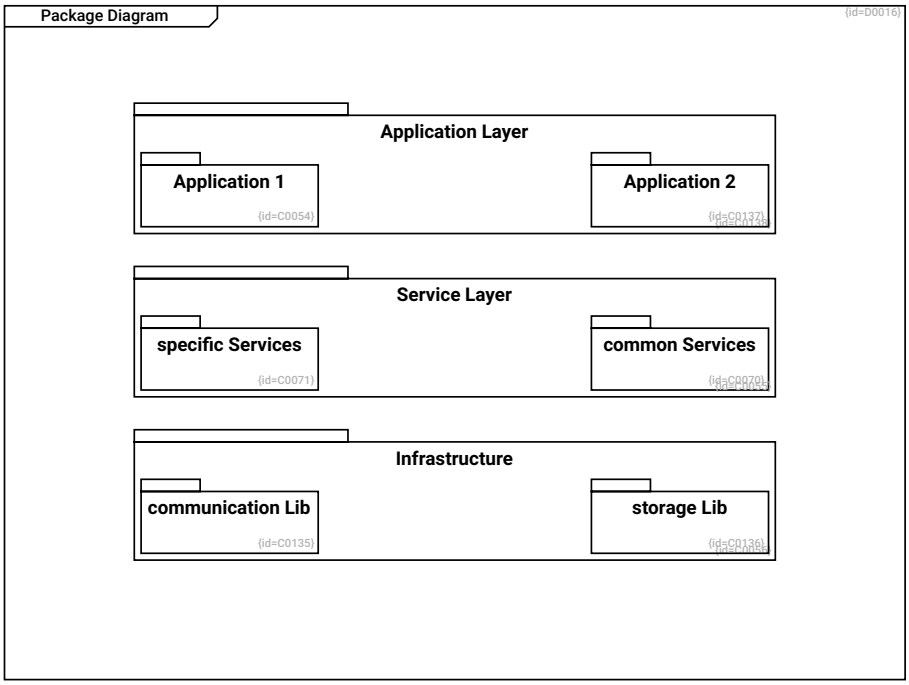


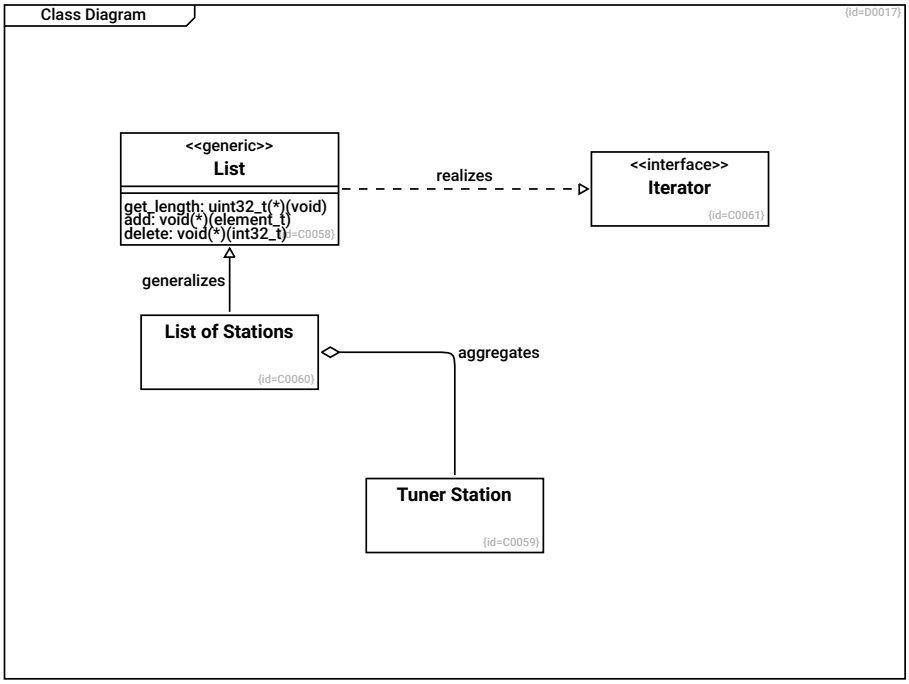
2.3 Example UML Static Views

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


Deployment Diagram
{id=D0014}
Box
Tuner Chip
{id=C0048}
controls
audio stream
Performance SoC
{id=C0047}
audio stream
controls
Amplifier
{id=C0049}
alive signal
switches
Watchdog
{id=C0073}
Power Supply
{id=C0050}
{id=C0045}

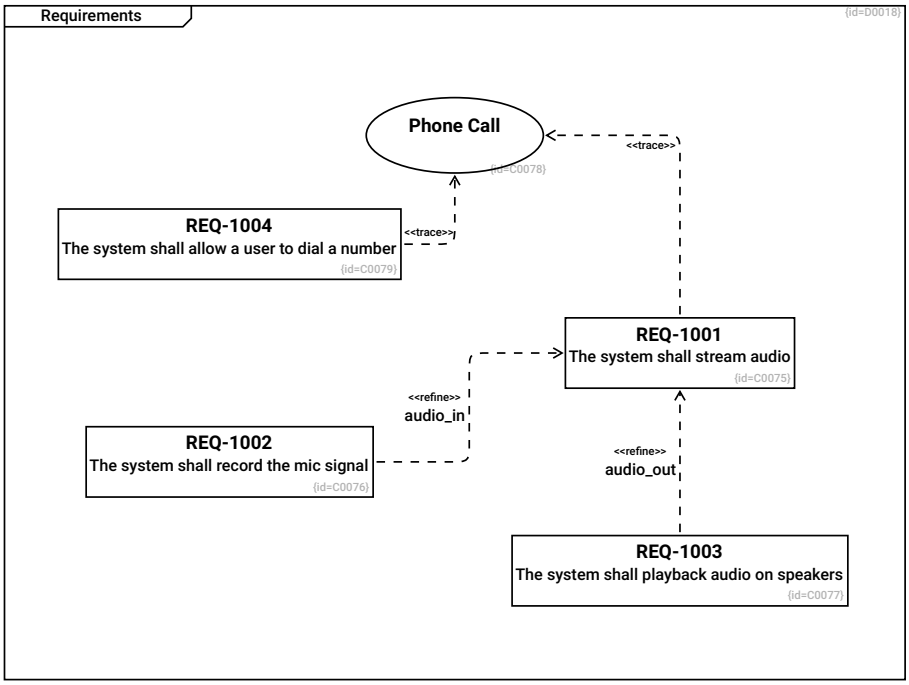

Component Diagram
{id=D0015}
Web Browser
:Page Renderer
{id=C0072}
8443: IP Port
Nav: Cmd_IF
8080: IP Port
call
Cmd_IF
Tun: Cmd_IF
/dev/tty2: Pipe
TLS Endpoint
request: out_signal
session token
{id=C0043}
Cmd_IF
80: IP Port
Cmd_IF
8080: IP Port
Content DB
{id=C0052}
Images Server
{id=C0053}
Crypto Key Server
status: out
command: in
{id=C0100}

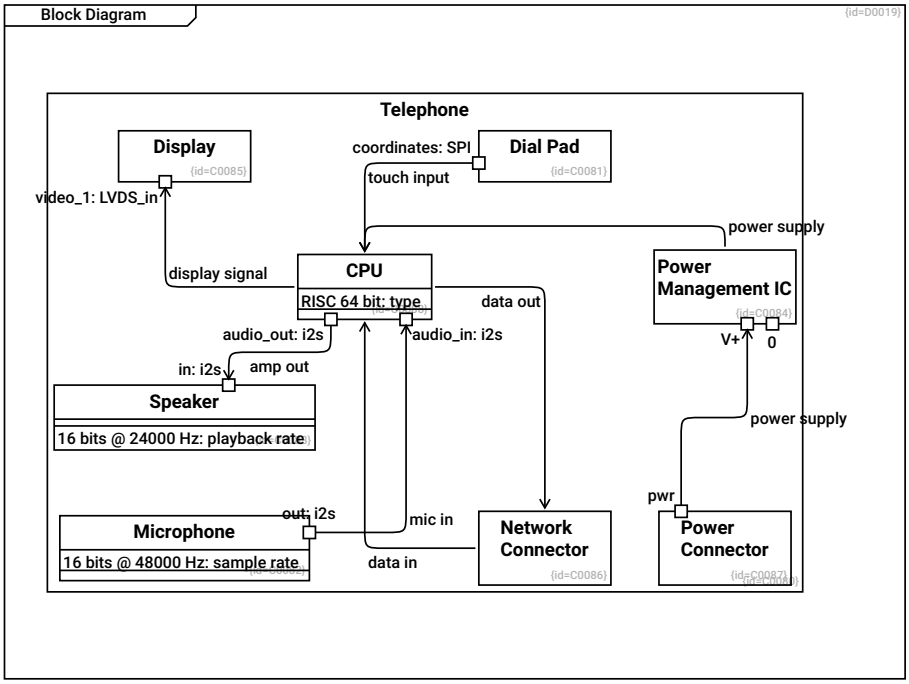


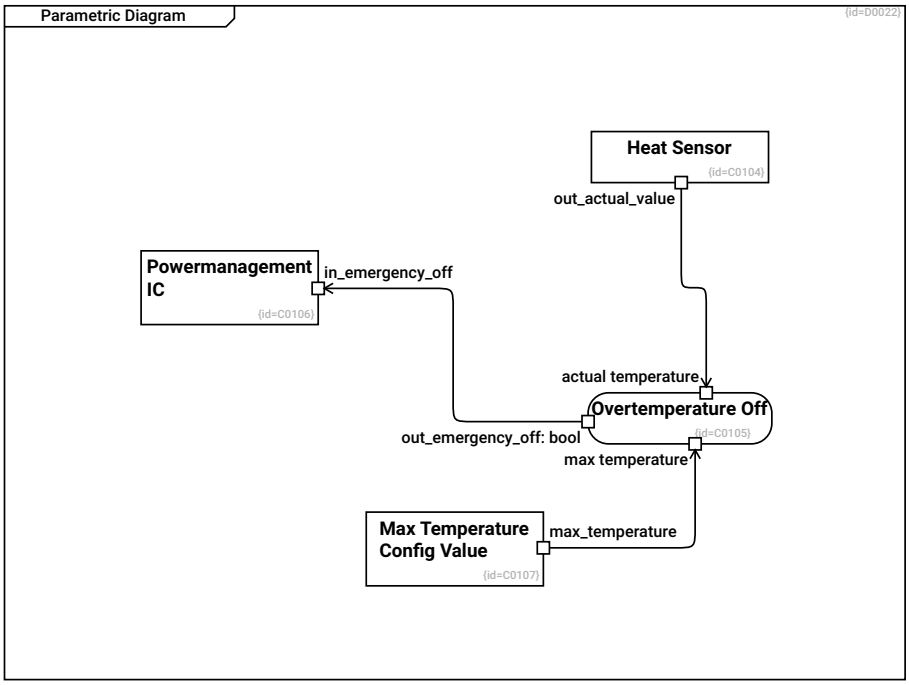


2.4 Example SysML Views

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


Requirements
{id=D0018}
Phone Call
{id=C0078}
<<trace>>
REQ-1004
The system shall allow a user to dial a number
{id=C0079}
<<trace>>
REQ-1001
The system shall stream audio
{id=C0075}
<<refine>>
audio_in
REQ-1002
The system shall record the mic signal
{id=C0076}
<<refine>>
audio_out
REQ-1003
The system shall playback audio on speakers
{id=C0077}


Block Diagram
{id=D0019}
Telephone
Display
{id=C0085}
video_1: LVDS_in
coordinates: SPI
touch input
Dial Pad
{id=C0081}
power supply
display signal
CPU
RISC 64 bit: type
data out
Power
Management IC
{id=C0084}
V+
0
audio_out: i2s
audio_in: i2s
in: i2s
amp out
Speaker
16 bits @ 24000 Hz: playback rate
power supply
pwr
out: i2s
mic in
Microphone
16 bits @ 48000 Hz: sample rate
data in
Network
Connector
{id=C0086}
Power
Connector
{id=C0087}

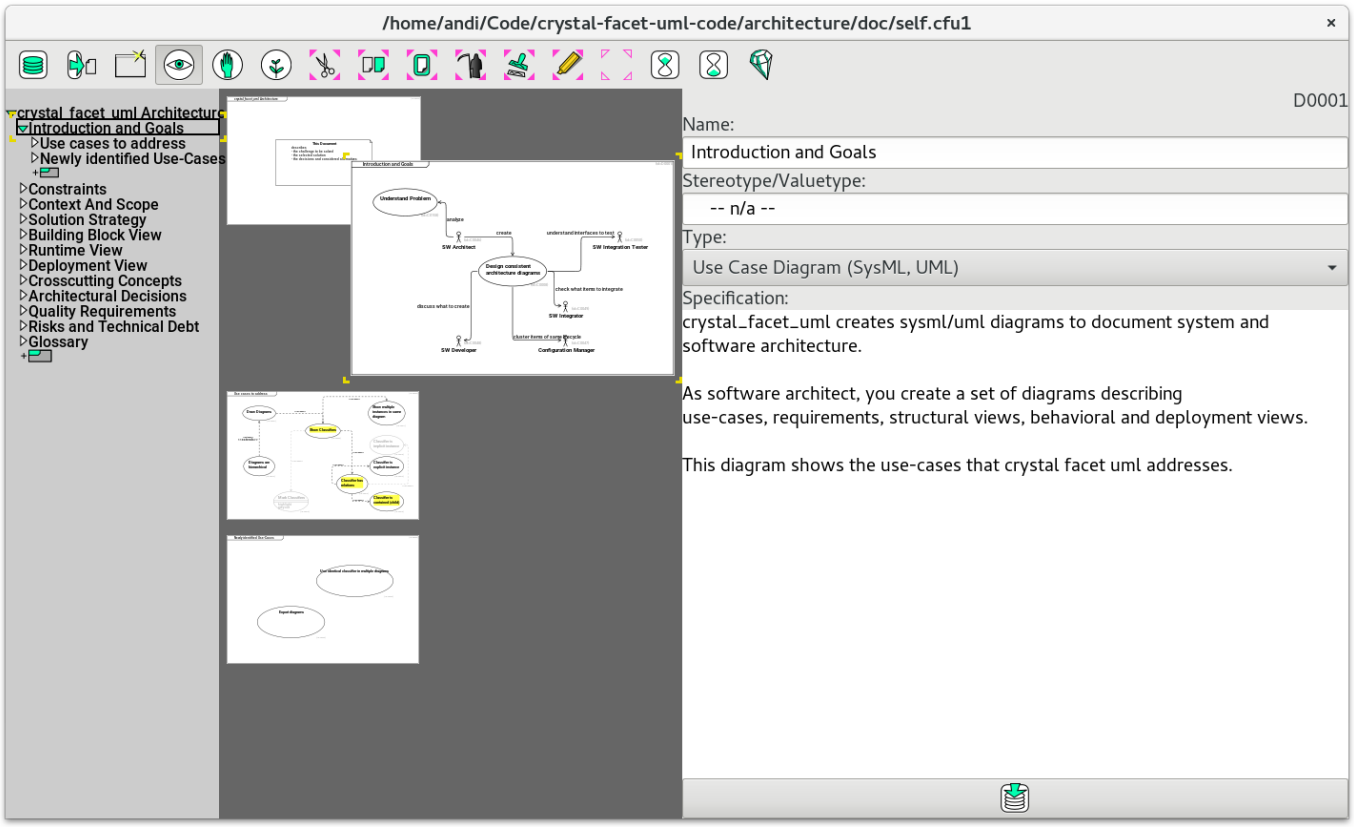


3 GUI / Usage Manual

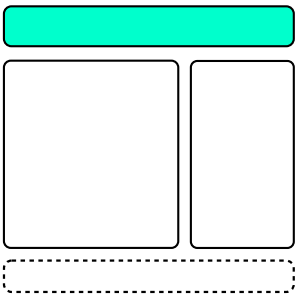
3.1 Window Area Overview

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 Search

- Find diagrams that contain the searched element (see Section 3.3.1)

3.2.5 Navigate

- Navigate to parent or child diagrams
- Create a new diagram (see Section 3.3.2)

3.2.6 Edit

- Modify elements in the diagram (see Section 3.3.3)

3.2.7 Create

- Create elements in the diagram (see Section 3.3.4)

3.2.8 Cut

- Cut all pink-cornered elements to the clipboard (features of classifiers are copied if the classifier is selected)

3.2.9 Copy

- Copy all pink-cornered elements to the clipboard (features of classifiers are copied if the classifier is selected)

3.2.10 Paste

- If the clipboard contains a diagram, this diagram is pasted below the current diagram. All other elements are pasted into the new diagram.
- If the clipboard does not contain diagrams, classifiers and relationships from the clipboard are copied into the current diagram.
- If the name of a classifier is identical to an existing one, an instance of the existing classifier is pasted to the diagram. Otherwise a new classifier is created.

3.2.11 Delete

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

3.2.12 Instantiate

- Toggles the pink-cornered classifiers between classes, named instances and anonymous instances.
- No effect on relationships and features.

3.2.13 Highlight

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

3.2.14 Reset Selection

- Resets the pink-cornered selection

3.2.15 Undo

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

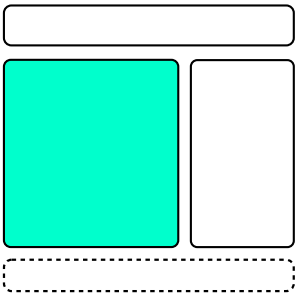
3.2.16 Redo

- Re-does the last un-done operation

3.2.17 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 Search

- To find a list of diagrams containing a given element, enter the ID (e.g. C0001) into the search field and press enter.

3.3.2 Navigate

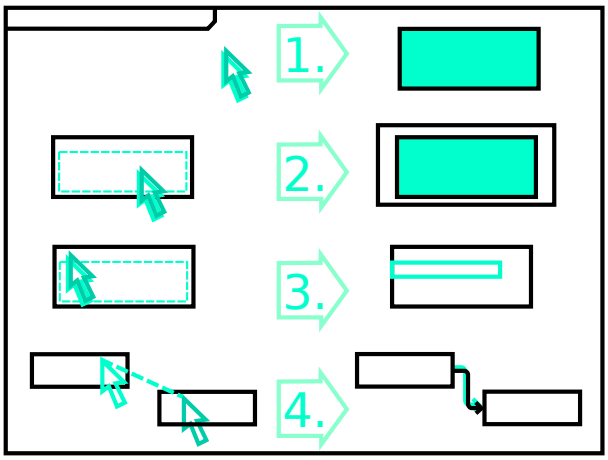
- To navigate to parent, sibling or children diagrams, click on the diagram.
- To create a new diagram, click on the  icon, or the smaller icon for a new child-diagram.
- To restructure the diagram tree, drag a diagram name to the new location.

3.3.3 Edit

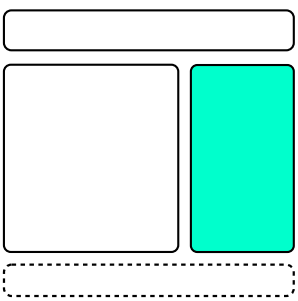
- To select the diagram or a classifier or a feature or a relationship with yellow corners, click on this object.
- To mark an element with pink corners, click on these objects twice.
- To move classifiers within the diagram, 1.) press, 2.) drag and 3.) release the mouse button.

3.3.4 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.

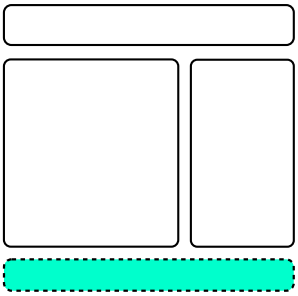
- name of the focused object

- 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.

The table shows the classifier types introduced by different specifications, if they filter/hide their features and a comment stating how this is implemented in crystal_facet_uml.

	Spec	Filter Features	Comment
 Block	SysML	-	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	-	Limitations: Only the rounded-rect symbol is supported, ports are not completely inside the rounded-rect.
 Node	UML	-	
 Component	UML	-	
 Part	UML	-	

	Spec	Filter Features	Comment
 Interface	UML	-	
 Package	UML, SysML	-	
 Class	UML	-	Limitations: No active classes
 Object	UML	-	
 Artifact	UML	-	
 Comment	UML, SysML	unconditional features	
 Feature	-	-	Represents a group of requirements, can be used for SysML Composite Requirements
 Requirement	SysML	-	
 Actor	UML, SysML	unconditional features	
 Use Case	UML, SysML	-	Limitations: No SysML extension points
 System Boundary	UML, SysML	unconditional features	
 Diagram Reference	UML	unconditional features	
 Activity	UML 2.5 (ch15.2)	-	Limitations: Object Node Pin notation not supported, draw the object between activities
 Interruptable Region	UML	unconditional features	
 Fork	UML, SysML	unconditional features	
 Join	UML, SysML	unconditional features	

	Spec	Filter Features	Comment
 Accept Event	UML, SysML	unconditional features	
 Accept Time Event	UML, SysML	unconditional features	
Send Signal	UML, SysML	unconditional features	
 Decision/Choice	UML 2.5 (ch14.2.4,15.3), SysML	unconditional features	In activity diagrams, this is called decision, in statesmachines it is called choice
Initial Node	UML 2.5 (ch14.2.4), SysML	unconditional features	Limitations: There is no distinction in ActivityInitial and FlowInitial Limitations: There is no separate entryPoint state-type
 Final Node	UML 2.5 (ch14.2.4), SysML	unconditional features	Limitations: There is no distinction in ActivityFinal and FlowFinal Limitations: There is no separate exitPoint and terminate state-type
 State	UML 2.5 (ch14.2), SysML	-	Limitations: No symbol for hidden decompositions, no regions (swimlanes) in composite states Limitations: entry/exit/do list Limitations: entryPoint and exitPoint states cannot be drawn on parent state border line
 Shallow History	UML 2.5 (ch14.2.4), SysML	unconditional features	
 Deep History	UML 2.5 (ch14.2.4), SysML	unconditional features	
× Value Type	SysML	-	not supported. Limitations: Compartment Order of Classifiers is "properties, operations" instead of "operations, properties, stereotype-tagged-values"
× Enumeration	UML, SysML	-	not supported. Note: Use a class instead.
× ActivityParameterNode	SysML	-	not supported.
× MergeNode/Junction	UML 2.5 (ch15.3), SysML	unconditional features	In activity diagrams, it is called merge, in state diagrams junction node. This is not supported. Note: You may directly connect the arrows to the target activity/state.

	Spec	Filter Features	Comment
× ActivityPartition	UML, SysML	unconditional features	not supported. Note: Use a parent activity instead.

LEGEND

Filter Defines which elements related to a classifier are not visible

An InstanceSpecification (UML) denotes an instantiation of a classifier. crystal_facet_uml allows any classifier to appear in different diagrams as classifier, as anonymous InstanceSpecification or as named InstanceSpecification. (Rationale: If a classifier is an instance may depend on the context: An M1-class may be an instance if shown in an M2-meta-class diagram, an XML-parser-class may be an instance if shown in the context of stream processors.)

4.2 Features

Features are elements attached to one classifier.

The table shows the feature types introduced by different specifications, if they are visible in any diagram or just once, and a comment stating how this is implemented in crystal_facet_uml.

	Spec	Scope	Comment
 Property	UML, SysML	unconditional	Limitations: no SysML Flow-Properties refinement
 Operation	UML, SysML	unconditional	
 Port	UML, SysML	unconditional	Limitations: no SysML-compartment Notation supported Limitations: no SysML-nested-ports, SysML-proxy-port, SysML full-ports supported Limitations: no flow property, no compartment notation, no port-compartments Limitations: no UML behavior ports
 Provided Interface	UML, SysML	unconditional	
 Required Interface	UML, SysML	unconditional	
 Lifeline	UML 2.5 (ch17.2), SysML	scenario, 1 per diagram	Limitations: One lifeline is visible only in one diagram Limitations: Lifelines start and end only at diagram border Limitations: ExecutionSpecification (ActivityBar) are not supported

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.

The table shows the relationship types introduced by different specifications, a classification in which diagram type to use them preferably, and a comment stating how this is implemented in crystal_facet_uml.

	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, no ownership (dot notation). Limitations: no ternary associations (only two ends supported). Limitations: no non-navigateable ends (crosses) suported yet - see todo.txt.
 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	SysMLˆ	Requirement	
 Refine	SysML	Requirement	

	Spec	Diagram Types	Comment
 Extend	UML, SysML	Use Case	Limitations: no SysML-condition-notes can be attched 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.
× Exception Flow	UML 2.5 (ch15.5)	Block Definition	not yet supported, see todo.txt.

4.4 Diagrams

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

The table shows the diagram types introduced by different specifications, if they filter/hide their features and/or relationships and a comment stating how this is implemented in crystal_facet_uml.

	Spec	Filter	Comment
 List Diagram	-	any feature, any relationship	This is an overview diagram showing only classifiers without features and without relationships
 Box Diagram	-	any feature, any relationship	This is an overview diagram showing only classifiers without features and without relationships
 Block Definition Diagram	SysML	lifelines	

	Spec	Filter	Comment
 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 2.5 (ch15.2), SysML	lifelines	Limitations: Swimlanes not supported
 State Machine Diagram	UML, SysML	lifelines	
 Communication Diagram	UML	unconditional relationships (Scenario), unconditional features	

	Spec	Filter	Comment
 Sequence Diagram	UML, SysML	unconditional relationships (Scenario), unconditional features	
 Timing Diagram	UML	unconditional relationships (Scenario), unconditional features	

LEGEND

Filter Defines which elements are not visible in the diagram

Scenario Diagrams show only relationships associated with a lifeline of a visible classifier.

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_STEREOTYPE_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,

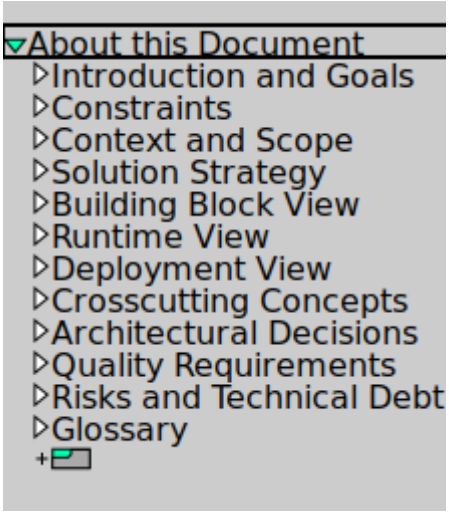
5 Modeling Guidelines

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.

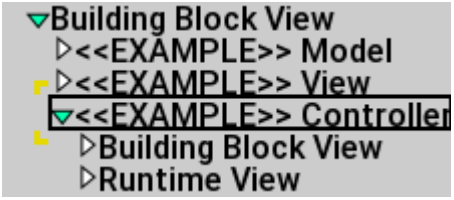
5.1 crystal_facet_uml Hints

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/ :



In case you show several layers of abstraction, each building block may contain its sub-blocks, sub-blocks may again show sub-sub-blocks. In this case, structure the specification of the sub-blocks in the same way: apply the proposed folder structure recursively, omitting possibly empty or superfluous folders.



5.1.2 Focus

Put only few elements into each diagram. This increases understandability of the main purpuse 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 indentified 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 Configuration

A.1 Download, Installation and License

A.1.1 Download Links

Find the latest version of crystal_facet_uml at:

- https://www.heise.de/download/product/crystal-facet-uml/
- 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
- https://salsa.debian.org/debian-edu-pkg-team/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.1.2 Installation on Linux

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:

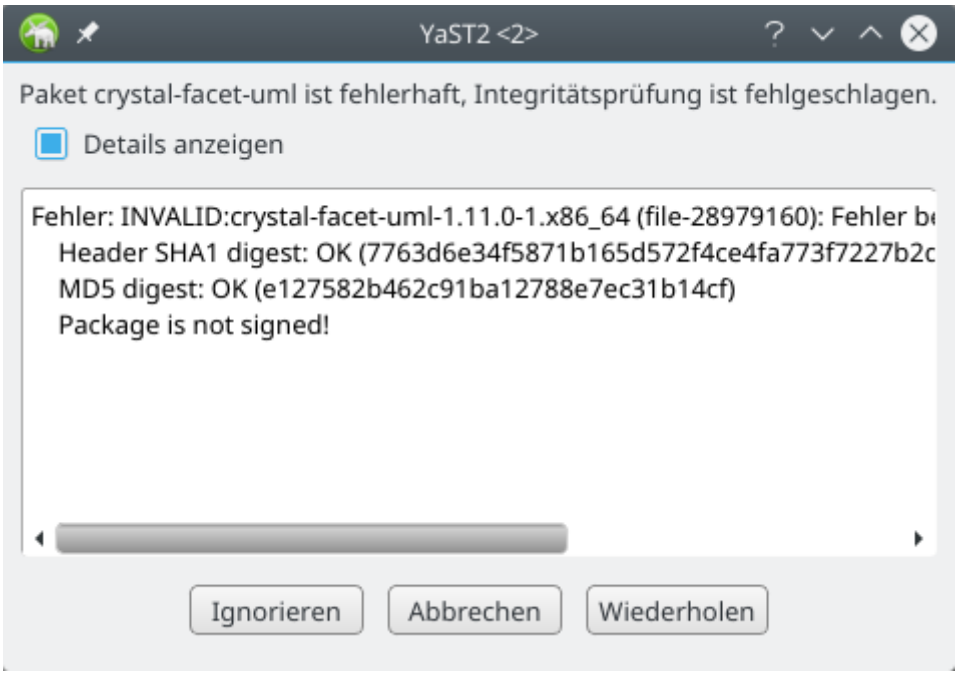
```
andi@debian1zotac:~/Downloads$ sudo dpkg --install crystal-facet-uml_1.12.0-1_amd64.deb

    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$
```

For installation you may use a gui-installation tool like yast. Because the packages are not signed, you may want to ignore the warning.



For installation on opeSuSE, you may e.g. invoke **`sudo zypper install <filename>`** on the command line:

```
andi@linux-uv90:~/Downloads>  sudo zypper install crystal-facet-uml-1.13.1-1.x86_64.rpm
[sudo] Passwort für root:
Repository-Daten werden geladen...
Installierte Pakete werden gelesen...
Paketabhängigkeiten werden aufgelöst...

Das folgende Paket wird aktualisiert:
```

```
    crystal-facet-uml

    1 Paket wird aktualisiert.
    Gesamtgröße des Downloads: 698,6 KiB. Bereits im Cache gespeichert: 0 B. Nach der  ↩
        Operation werden zusätzlich 8,8 KiB belegt.
    Fortfahren? [j/n/...? zeigt alle Optionen] (j): j
    Paket crystal-facet-uml-1.13.1-1.x86_64 abrufen  ↩
                                                                                (1/1), 698,6 KiB  ↩
        (  1,2 MiB entpackt)
    crystal-facet-uml-1.13.1-1.x86_64.rpm:
    Package is not signed!

    crystal-facet-uml-1.13.1-1.x86_64 (Einfacher Cache für RPM-Dateien): Fehler beim  ↩
        Überprüfen der Signatur [6-File is unsigned]
    Abbrechen, wiederholen, ignorieren? [a/w/i] (a): i
    Überprüfung auf Dateikonflikte läuft:  ↩
        ..........................................................................................
        fertig]
    (1/1) Installieren: crystal-facet-uml-1.13.1-1.x86_64  ↩
        ..................................................................................[ ↩
        fertig]
    andi@linux-uv90:~/Downloads>
```

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.1.3 Installation on Windows/Wine

- On windows, doubleclick on **`crystal_facet_uml.exe`**,
- or using the wine emulation, call **`wine crystal_facet_uml.exe`** to start.

A.1.4 License

License of crystal_facet_uml is Apache-2.0. Copyright 2016-2020 Andreas Warnke; Email-contact: cfu-at-andreaswarnke-dot-de