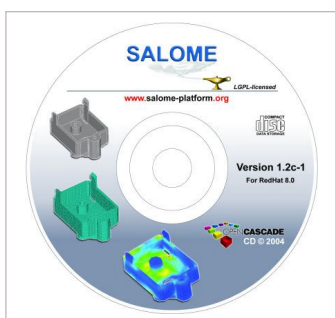


SALOME platform Overview

SALOME facilitates creation of industrial simulation applications for different technological domains

The Open Source Platform for
Numerical Simulation
Integration



What is SALOME?

The SALOME platform :

- supports interoperability between CAD modeling and computation software (CAD-CAE Link),
- makes easier the integration of new components for numerical computation,
- puts priority on coupling between computation software,
- provides a generic user interface, user-friendly and efficient, which helps reducing the costs and delays of carrying out the studies,
- reduces training time to the specific time for learning the software solution which has been based on this platform.

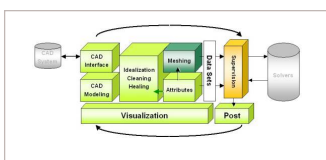
Main functions of the platform

SALOME functionality allows to:

- Define geometrical models (create/modify geometrical items), import and export them using the IGES and STEP formats.
- Define meshing of these geometrical items, import and export them
- Handle physical properties and quantities attached to geometrical items, import and export them in a reusable format.
- Perform computations using a solver (not provided in the platform): read input data, configure the solver, and write a result field (scalar or vectorial).
- Visualize result fields in 3D, 2D and export images of their visualization in an appropriate format.
- Manage study schemes: definition, save/restore.
- Manage computation schemes: definition, execution.

Modules of the platform

KERNEL component



The Kernel layer provides numerous general services.

It consists of two main parts - STUDY, which implements the generic persistence and document management, and Applicative Interface (IAPP), which provides generic GUI functionality.

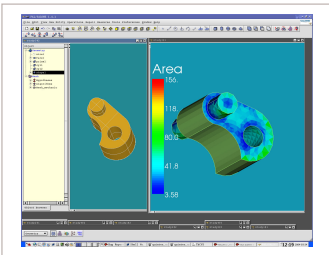
STUDY

The module **STUDY** provides to the user the whole set of functions available to carry out a document (study). A study is made of data of one (or several) components. Several studies can be opened at the same time; but only one study is active at a given instant

The functions of the STUDY module:

- ✓ **Create** new document
- ✓ **Save** documents
- ✓ **Open** saved on disk documents

- ✓ **Load/Unload** an existing document
- ✓ **SaveAs** a document
- ✓ **Copy/Paste** objects
- ✓ **Properties** of the document (author, creation date, modifications ...)

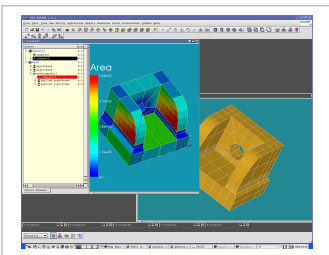


▪ IAPP

The module IAPP provides generic GUI services through main **Desktop** where other components integrate their own GUI controls.

Desktop contains different functions which are used by custom components:

- ✓ **Three kinds of viewers**, two 3D (OpenCASCADE and VTK based) and one 2D (QWT based) with the following list of functions:
 - **Zoom, Rotate, Pan**
 - **Fit, Rectangle Fit,**
 - **Scaling** (linear, logarithmic)
 - Predefined **views** (top, bottom, left ...)
 - General **selection** of objects
 - **Snapshots** of the view
 - **Settings** for the viewer
- ✓ **Object browser** which visualizes the tree structure of a document and provides the selection mechanism
- ✓ **Python console**
- ✓ **Message console**, where each component can put messages
- ✓ **Preferences** menus with saving/loading user predefined settings
- ✓ **Window** management, creation of new windows, arranging existing
- ✓ **Help menu**, where each component puts its own help guides in HTML format



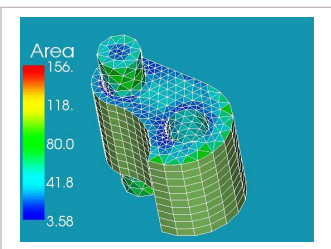
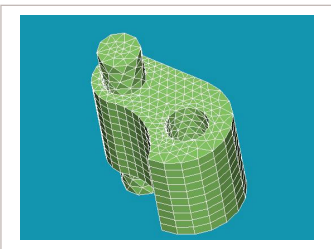
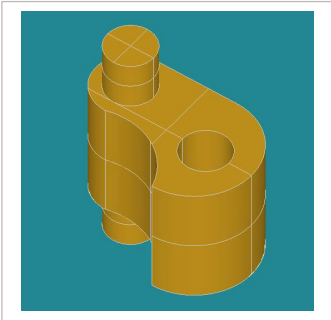
GEOM component

This component provides a list of functions for working with CAD models and adopts it for meshing algorithms.

The list of functions of this component:

- ✓ Visualization of models in 3D viewers
 - **Shading** mode
 - **Wireframe** mode
 - **Pre-highlighting**
 - **Selection**
 - **Changing color** of a model
 - **Display/Erase** a model
- ✓ **Import/Export CAD models** in the following formats:
 - **IGES 5.3**
 - **STEP AP203/214** schemas
 - **BREP** (OpenCASCADE internal format)
- ✓ Creation of **basic** geometrical objects:
 - **Point**
 - **Line**
 - **Circle**
 - **Ellipse**
 - **Arc**
 - **Vector**
 - **Plane**
- ✓ Creation of **primitives**:





- **Box**
 - **Cylinder**
 - **Sphere**
 - **Torus**
 - **Cone**
- ✓ Modeling operations:
 - **Extrusion**
 - **Revolution**
 - **Filling**
 - **Pipe creation**
 - **Offset**
 - ✓ Basic **Sketcher**
 - ✓ Creation of topological objects
 - **Vertex**
 - **Edge**
 - **Wire**
 - **Face**
 - **Shell**
 - **Solid**
 - **Compound**
 - ✓ **Explode** of topological objects
 - ✓ Boolean operations
 - **Fuse**
 - **Common**
 - **Cut**
 - **Section**
 - ✓ Transformation operations with objects
 - **Translation**
 - **Rotation**
 - **Mirror**
 - **Scaling**
 - **Multi translation**
 - **Multi rotation**
 - ✓ Advanced **partition/gluing** algorithm with support of material assignment
 - ✓ Creation of planes using the **Archimedean** law
 - ✓ Local operations
 - **Fillets**
 - **Chamfer**
 - ✓ Shape healing functions
 - **Sewing**
 - **Changing of face orientation**
 - **Suppressing hole**
 - **Suppressing face**
 - ✓ Topological information and dimensions
 - **Basic properties (length, surface area, volume)**
 - **Center of gravity**
 - **Axis of inertia**
 - **Bounding box**

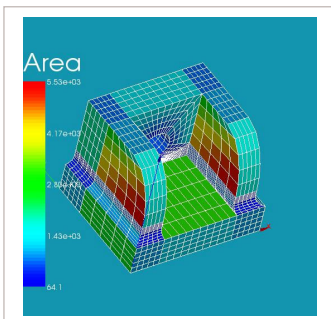
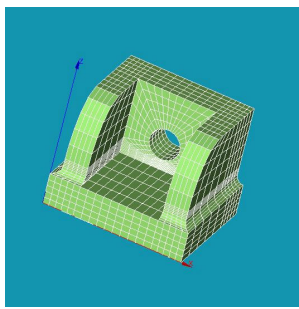
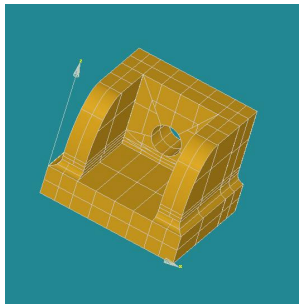
- **Minimal distance**
- **Tolerance of the shape**
- **Validity of the shape**
- **Topological information**

MESH component

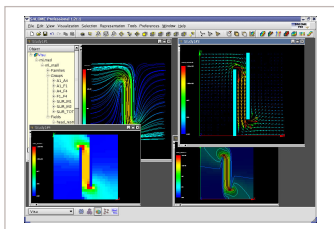
The goal of this module is creation of meshes on the basis of geometrical models created or imported into GEOM. It uses a set of meshing algorithms and the corresponding conditions (hypotheses) to compute meshes. A new mesher can be easily connected to this module using the existing plugin mechanism.

The function list of this component:

- ✓ **Visualization** of the mesh in 3D viewer:
 - **Shading**
 - **Wireframe**
 - **Shrink**
 - **Nodes**
 - Special **options** for mesh (color, lines width, shrink coefficient)
 - **Displaying/Erasing** of mesh and submeshes
- ✓ Computing meshes and submeshes on the basis of the following hypotheses for meshing
 - **Average length of edges**
 - **Number of segments**
 - **Maximal triangle area**
 - **Maximal tetrahedron or hexahedron volume**
- ✓ Computing meshes and submeshes using the following algorithms:
 - **Wire discretization**
 - **Triangulation (Mefisto2d)**
 - **Quadrangle (mapping)**
 - **Hexahedron (l,j,k)**
- ✓ **Group** management
 - **Creation** of groups of elements
 - **Add/Remove** elements from a group
 - **Remove** a group
 - **Display/Erase** a group
 - **Selection** of groups
 - **Highlighting** of groups
- ✓ **Information** about computed meshes
- ✓ **Import/Export**
 - **MED**
 - **UNV**
- ✓ **Quality controls** of meshes
 - **Length of edges**
 - **Free boundaries**
 - **Boundaries of multi-connections**
 - **Area**
 - **Taper**
 - **Aspect Ratio**
 - **Minimum angle**
 - **Warp**



- **Skew**
- ✓ Mesh modifications
 - **Add/Remove node, edge, triangle, quadrangle**
 - **Diagonal inversion**
 - **Changing orientation**
 - **Conversion of group of triangles into quadrangles**
 - **Conversion of group of quadrangles into triangles**
 - **Moving of node**

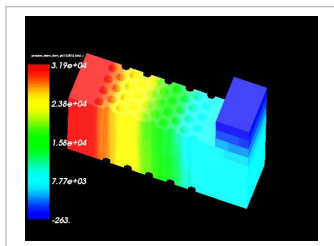
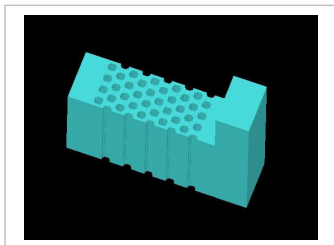


VISU component

The goal of this module is visualization of results of solver computations. It's a classical post-processing module, which provides a wide range of functions for visualization of results.

The function list of this module:

- ✓ **Visualization** of the presentations in different modes in 3D viewer:
 - **Shading**
 - **Wireframe**
 - **Shrink**
 - **Nodes**
 - **Insidewireframe**
 - Special **options** for presentation (color, lines width, shrink coefficient)
 - **Displaying/Erasing** of presentations
- ✓ **Visualization** of 2D presentations (curves) in 2D viewer
 - **Different style** of curves
 - **Different scaling modes**
 - **Auto or user defined legend**
- ✓ **Import MED** files
- ✓ **Import/Export ASCII files** of special format for curve representation
- ✓ Creation of 3D representations of results:
 - **Scalar map**
 - **Deformed shape**
 - **Vector** representations
 - **Iso surfaces**
 - **Cut planes**
 - **Cut lines**
 - **Stream lines**
 - Different **options** for presentations listed above
- ✓ **Creation 2D data** from 3D presentations
- ✓ **Physical animation** of the presentation in time
- ✓ Visualization of **tables**
- ✓ **Creation of curves** from tables
- ✓ **Creation of containers** of the curves
- ✓ **Information** about values on cells
- ✓ Creating/storing special **view parameters** (angle, zoom coefficient ...)



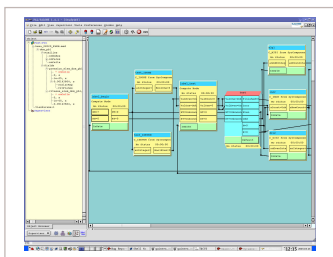
SUPERVISOR component

This aim of this module is building and execution of computation procedures. A computation procedure represents an object, which can define a sequence or a coupling between several computation software solvers. It uses a distributed schema of calculation, which means that each numerical component can be located on different computers with different operation systems.

The functions of this module are:

- ✓ **Creation** of a dataflow
- ✓ **Import/export** a dataflow into xml file

- ✓ **Edit** a dataflow
 - **Add** a node into a dataflow
 - **Remove** a node from a dataflow
 - **Connect** nodes in a dataflow
 - **Change node information**
 - **Rename** a node
 - **Put results** of a computation into the study
 - ✓ Different presentation **views** of a dataflow
 - **Control view**
 - **Full view**
 - **Table view**
 - ✓ **Execution** of a dataflow
 - **Run** execution
 - **Suspend** execution
 - **Kill** dataflow execution
 - **Step-by-step** execution
- Different kinds of nodes
- **Factory** nodes (distributed services)
 - **Inline** nodes (python based)
 - **Computation** node
 - **Switch** node
 - **Loop** node
 - **GoTo** node



On going developments

SALOME is developed with a RNTL project with more than 20 partners from which CEA DEN and EDF R&D. Here is an abstract from the development plan :

- ✓ **KERNEL** component
 - **DumpPython** functionality for writing automation scripts from GUI actions
 - **Optimization** of CORBA calls using embedded servers
- ✓ **GEOM** component
 - **GEOM groups**
 - **Local coordinate system** and transformation based on it
- ✓ **MESH** component
 - Modification of mesh
 - **Remuneration** nodes and elements
 - **Smoothing**
 - Visualization
 - **Clipping plane** type of visu (to see internal structure of volume mesh)
 - Mesher plugin
 - Plugin for **tetrahedron** commercial mesher
 - **Extrusion of 1D and 2D** mesh
 - Using **hypothesizes on geom** groups
 - Filters and group management
 - **Library of user defined filters**
 - **Filter of mesh elements on geometry**
 - **Operation on groups** - union, intersection, cut
 - Interfaces
 - **Plugin approach** for mesh interfaces
 - **NASTRAN** interface
 - **Abaqus** interface
- ✓ **VISU** component
 - Display of special presentation - **atomic configuration**
- ✓ **SUPERVISOR** component
 - **Macro node** - sub graph implementation
 - **MPI container** for parallel computing

