CAD-FE integration using Open Source Software
Christian Caillet
c-caillet@opencascade.com

1st need: «multi-physics»

- **To improve efficiency**
  - Time request to build data card?
- **To simplify multi-physics**
  - Computation schema?
- **To simplify user training**
  - User friendly?

- Strategic
- high level of Innovation
- Large investment

To focus R&D on the core competency
Optimize the investment
2nd need: « more simulation »

- Specific simulation solution within standard CAD solutions
  - Efficient Pre/Post processor
  - Mesh for CAD solution
  - Simulation data within PDM system

CAD / FE optimized integration

- Availability of standard formats and expertise in direct interfaces
- Integration of meshing algorithms and CAD / meshing associativity
- Trade-specific solution based on OCC
- Direct definition of attributes on the geometric model. Persistency of the attribute / geometry links with OCAF
- Shape healing module and access to geometric modeling algorithms
CAD-FE INTEGRATION REFERENCES

Industrial projects achieved, based on Open Source Software

SALOME

Open Source CAD-FE integration platform to build specific simulation solutions
**TECHNICAL CHOICES**

- **Standards adoption**
  - Operating system
  - Software architecture
  - CAD data interface

- **Open Source adoption**
  - [http://www.opencascade.org](http://www.opencascade.org)
  - re-use of approval Open Source component:

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| Python | VTK | Open CASCADE | Q | omniORB | HDF |
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**DEVELOPMENT CONSTRAINTS**

- **Portable**
  - Portable source code
  - Support of Linux (development), Windows, Unix

- **User friendly**
  - Look&Feel
  - Heavy model
  - component approach
2 MAIN FEATURES

♦ CAD-FE Integration
  ♦ CAD interface and Correction
  ♦ Idealization of CAD Model
  ♦ Basic CAD modeling features
  ♦ CAD-MESH associativity
  ♦ FE properties assigned on CAD model

♦ Coupled/Multi-physics problems
  ♦ Same user interface
  ♦ Computational schema
  ♦ Distributed computation
  ♦ Exchange format (MED)
SOFTWARE ARCHITECTURE

Graphical User Interface

GEOMETRY  MESH  DATA  SUPERV  POST-PRO

STUDY
KERNEL

Graphical 2D et 3D

MED

Persistant Model

EFFORT ENGAGED

♦ Know-how of 9 partners

♦ Resources / 2 years (Sept-2000, Sept-2002)
  ♦ 540 man.months
  ♦ Around 50 people

♦ Has received RNTL label
TRADITIONAL IT DEVELOPMENT PROCESS

Software vendor

R&D Proprietary

Industrialization

Service provider

Integration

Incomes

License, training, support

Consulting, Customization

NEW IT DEVELOPMENT PROCESS

Platform collaborative projects

R&D OpenSource.org

Software vendor

Industrialization

Service provider

Integration

Licenses

Consulting, training, support, customization
PARTNERS MOTIVATION

To focus their R&D investment on their core competency

SALOME Project

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PARTNERS ROLE

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SALOME BENEFITS

♦ Improved CAD / FE integration and process
  ♦ Geometry ready to be meshed by automatic algorithms
  ♦ Time reduction for meshing modifications
  ♦ Openness to any type of physics, and multi-physics

♦ End-user Productivity
  ♦ Modern technology
  ♦ Scripting language

♦ Independence from a software vendor’s policy
  ♦ Open Source and service approach
  ♦ No run time fee associated with the use of the technology
  ♦ Keep control of the development strategy

EFFORT : 23 partners

- Project Management / Open Source / CAD
- Standards / STEP
- Numerical Simulation

Partners:
- CEA
- EADS
- EDF
- CSTB
- ESI Group
- Université de Paris-Saclay
- IRISA
- ENSTA
- INRIA