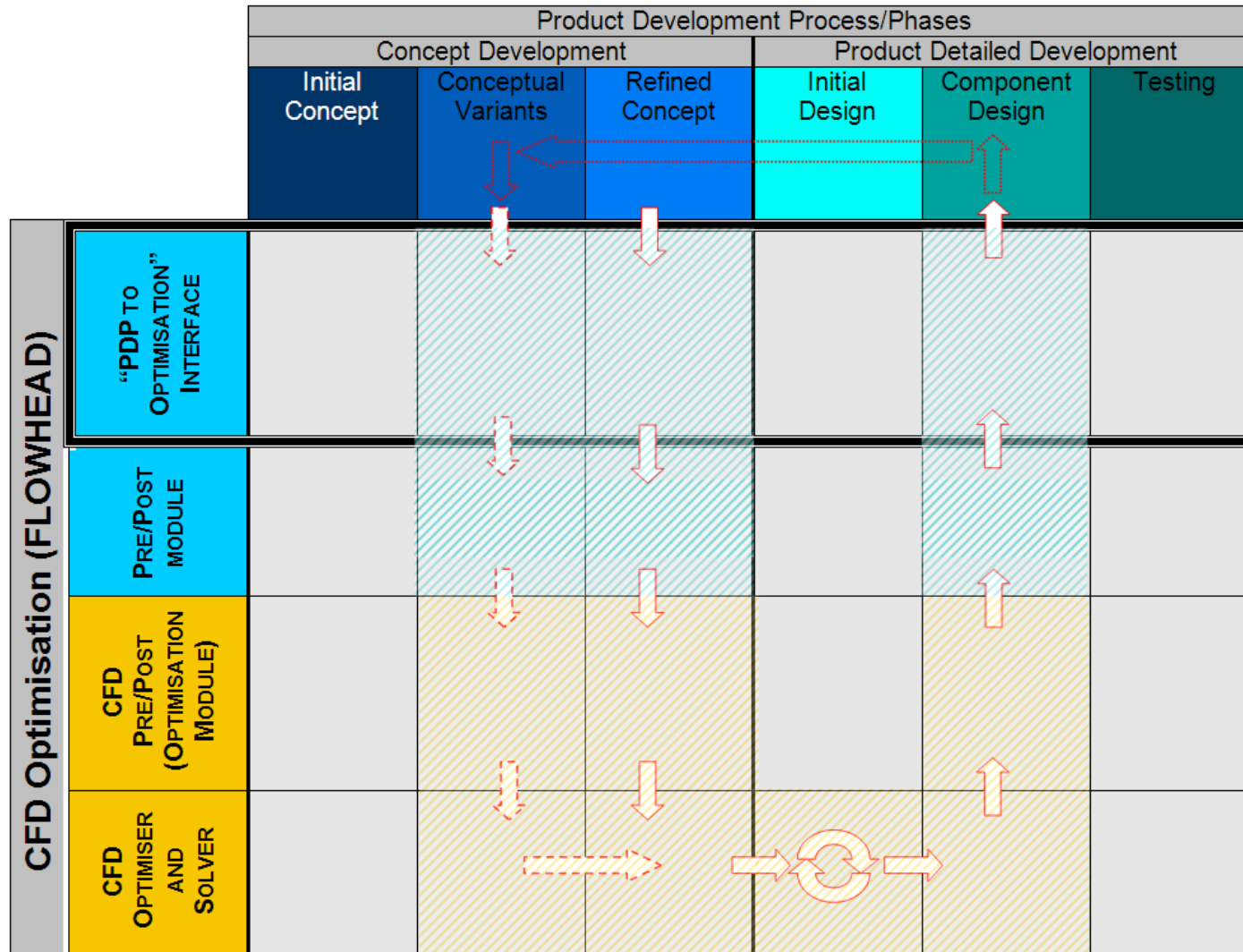


**INTERFACES FOR EMBEDDING CFD
OPTIMISATION WORKFLOWS INTO THE
PRODUCT DEVELOPMENT PROCESS**

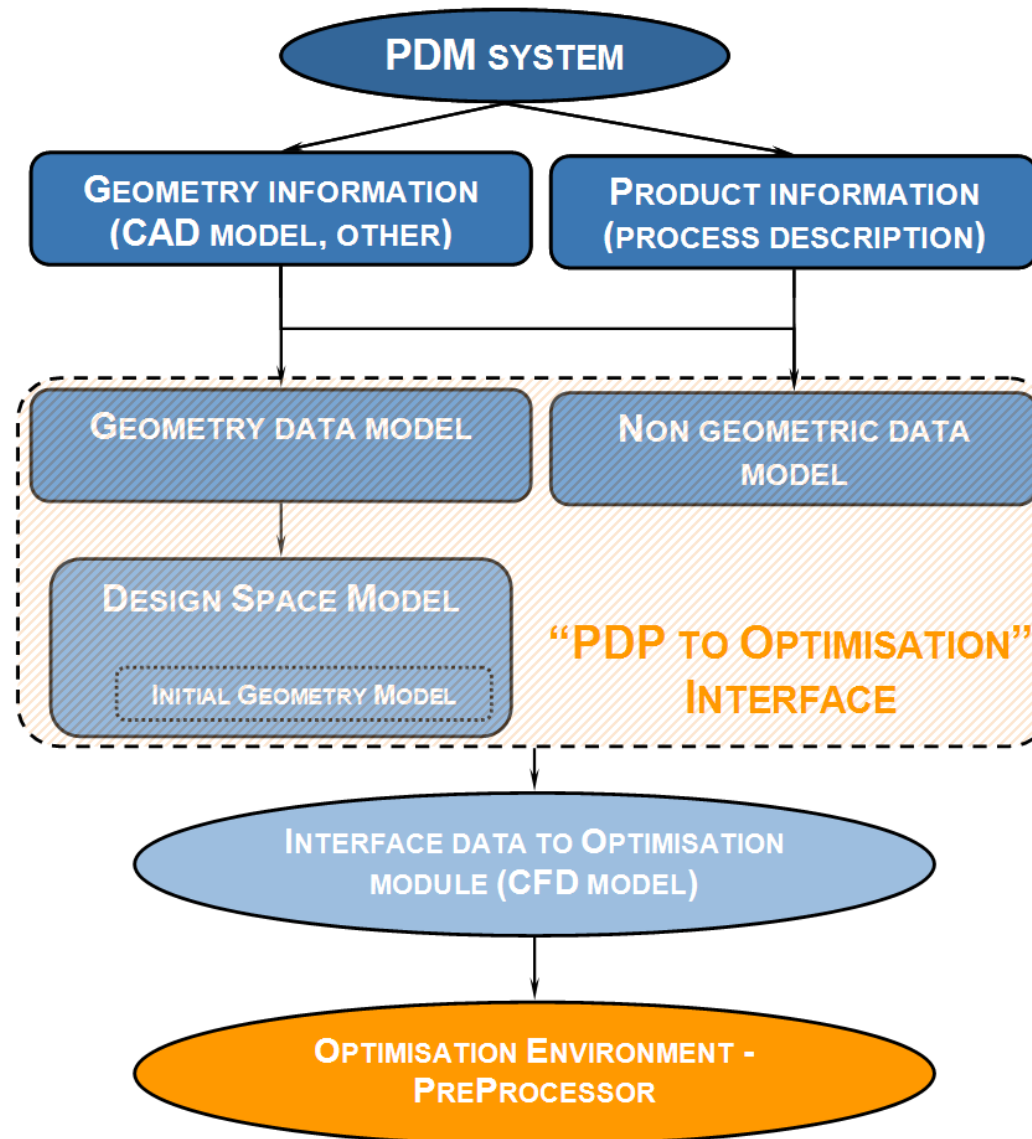
**Todorov, G.; Ovtcharova, J.; Romanov, B. & Kamberov, K.
Varna September 2010**

Introduction

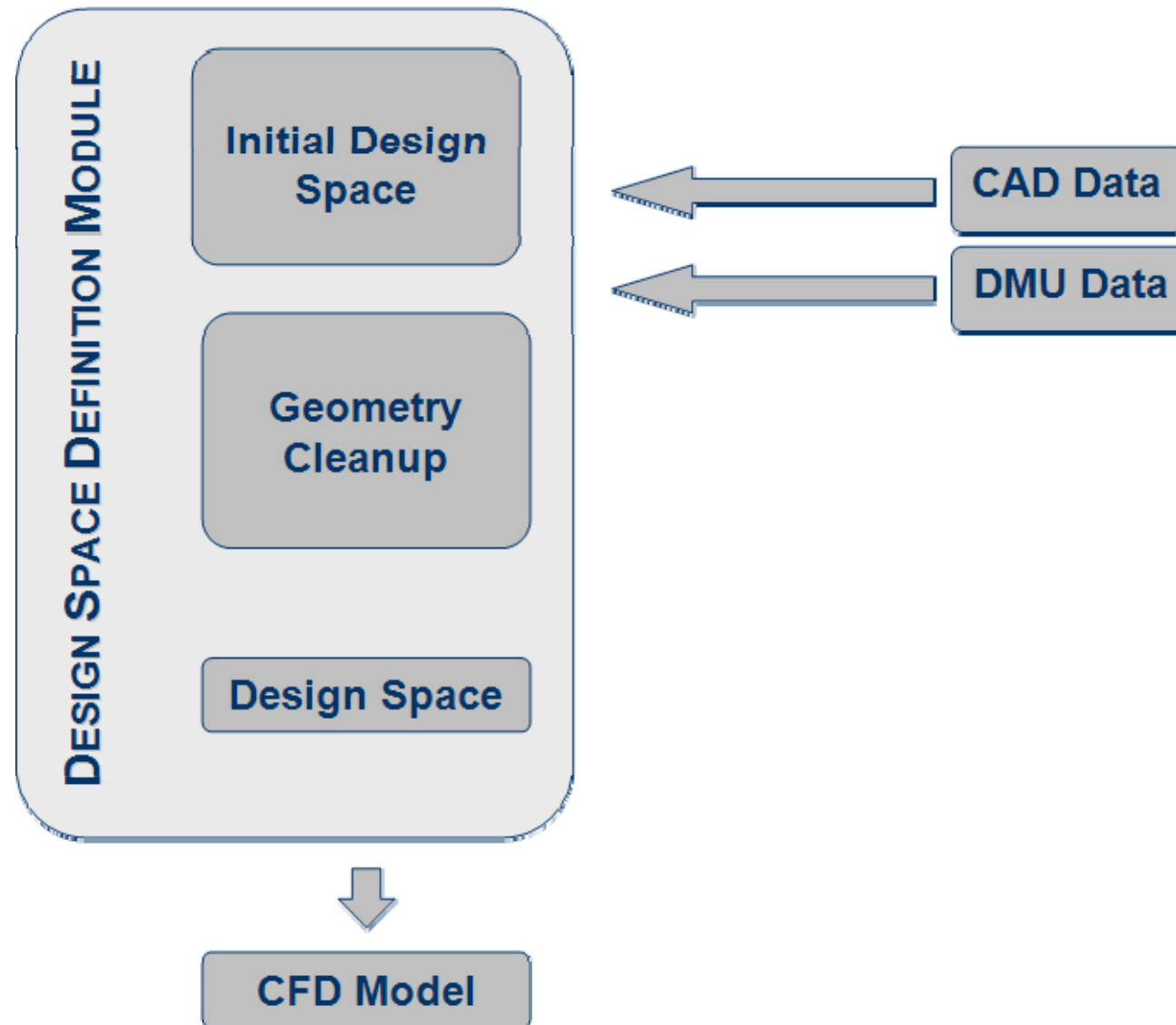
PDPs and CFD optimisation – embedding of workflows



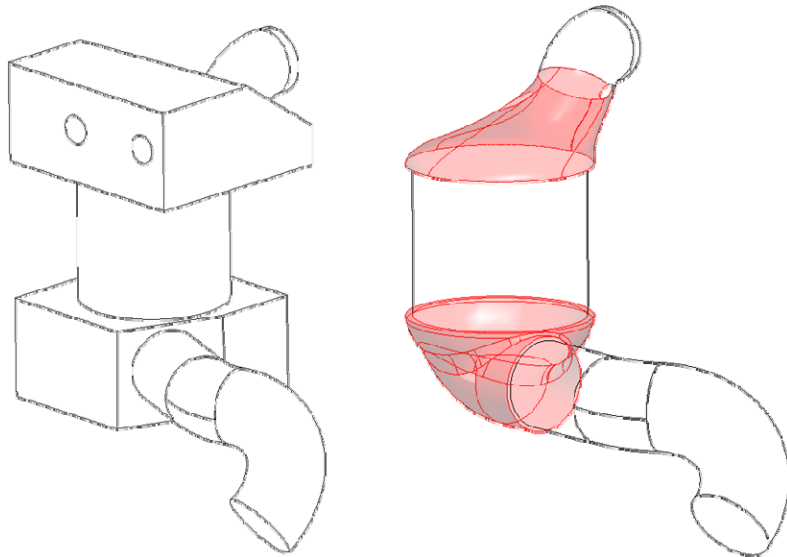
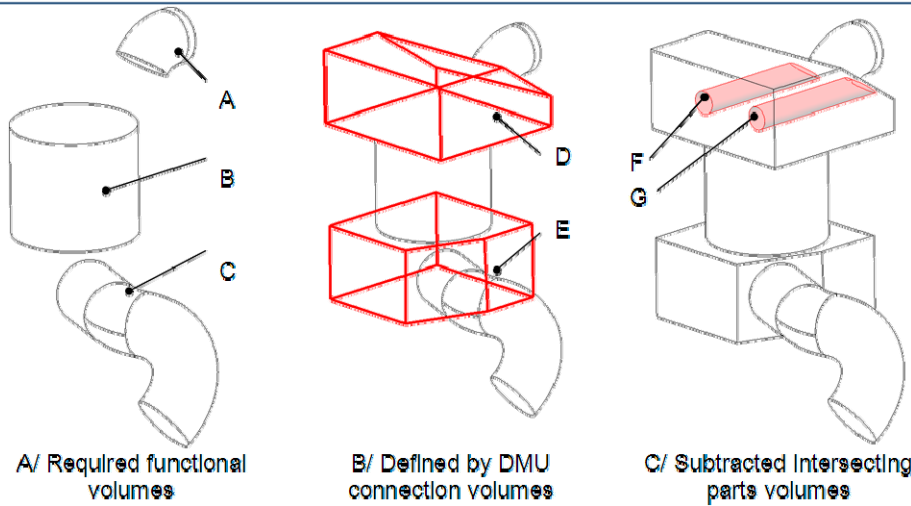
Interfaces PDP to Optimisation Module



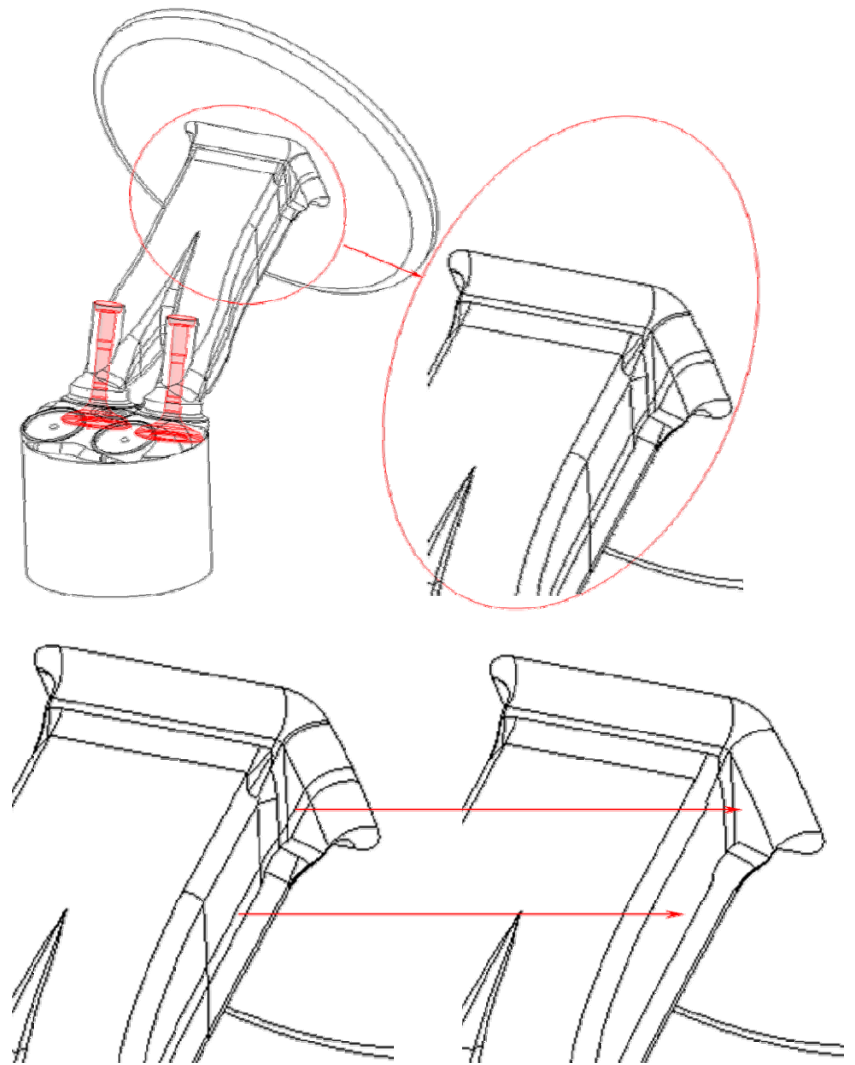
A conception for process of design space definition



Demonstration cases

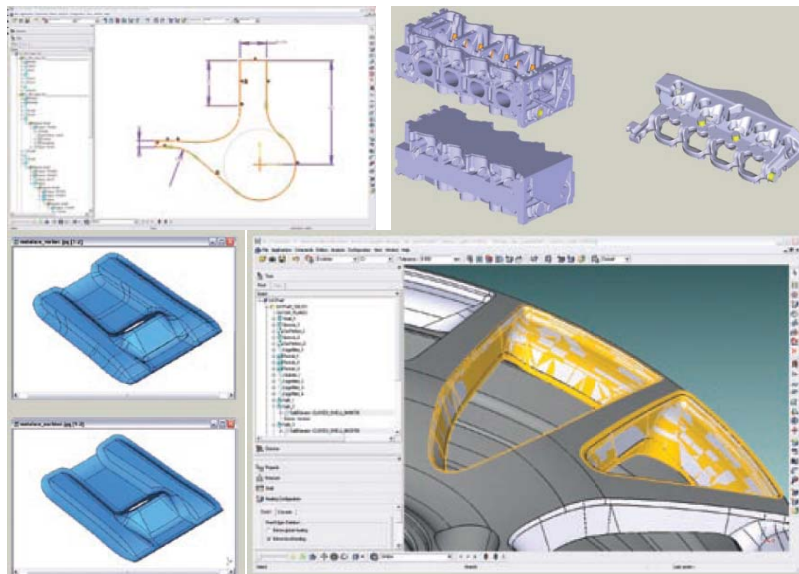


Catalytic converter

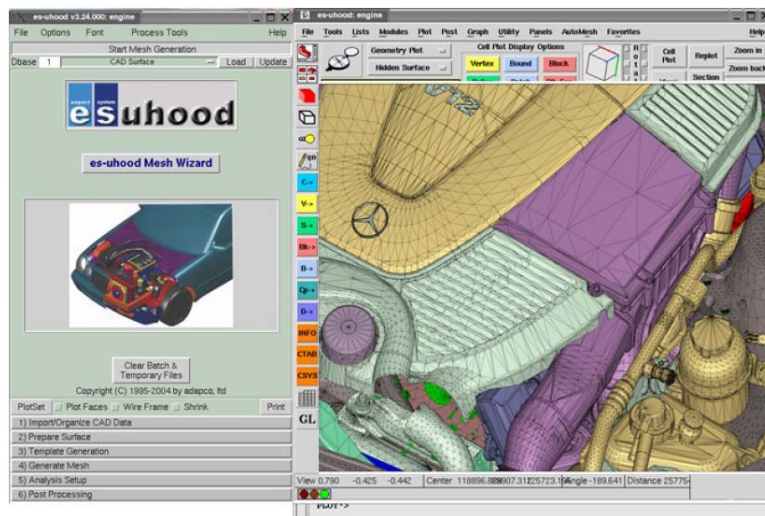


Petrol engine intake port

Initial design space cleanup using specialized modules

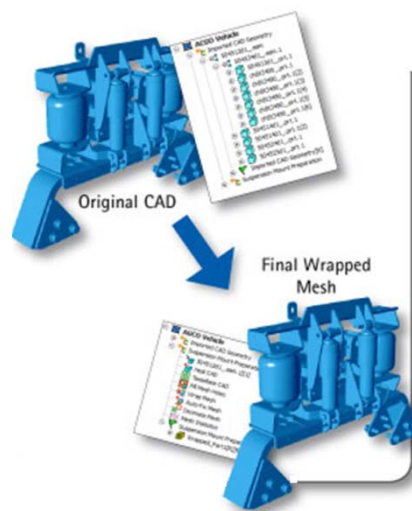


**3D_Evolution
(CoreTechnologie):**
possible feature based, healing
of gaps and overlapping,
inner volumes extraction,
surface wrapping, semi-
automatic holes/chamfers/etc.
removing

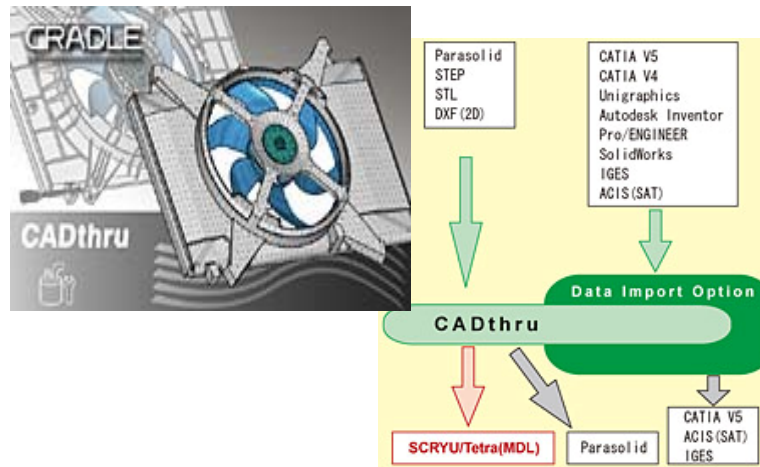


**Expert system wrapper (CD-
adapco):**
healing of gaps and
overlapping, surface
wrapping, semi-automatic
holes/chamfers/etc. removing

Initial design space cleanup using specialized modules

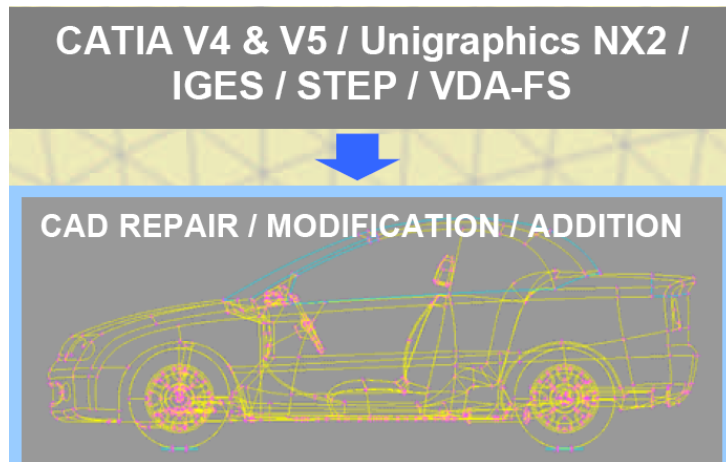


PowerDELTA & PowerCLAY (Exa Corporation):
possible feature based, healing of gaps and overlapping, surface wrapping, semi-automatic holes/chamfers/etc. removing

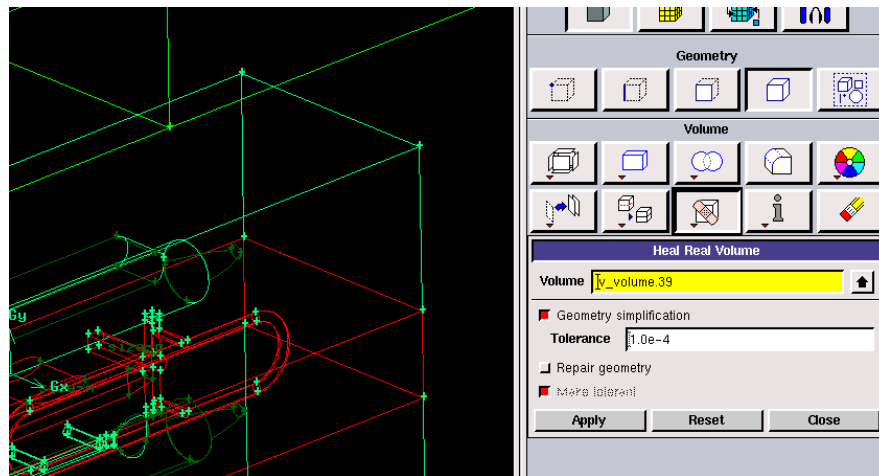


CADthru (Software Cradle, Co.):
healing of gaps and overlapping, inner volumes extraction, surface wrapping, semi-automatic holes/chamfers/etc. removing

Initial design space cleanup using conventional CAE preprocessors

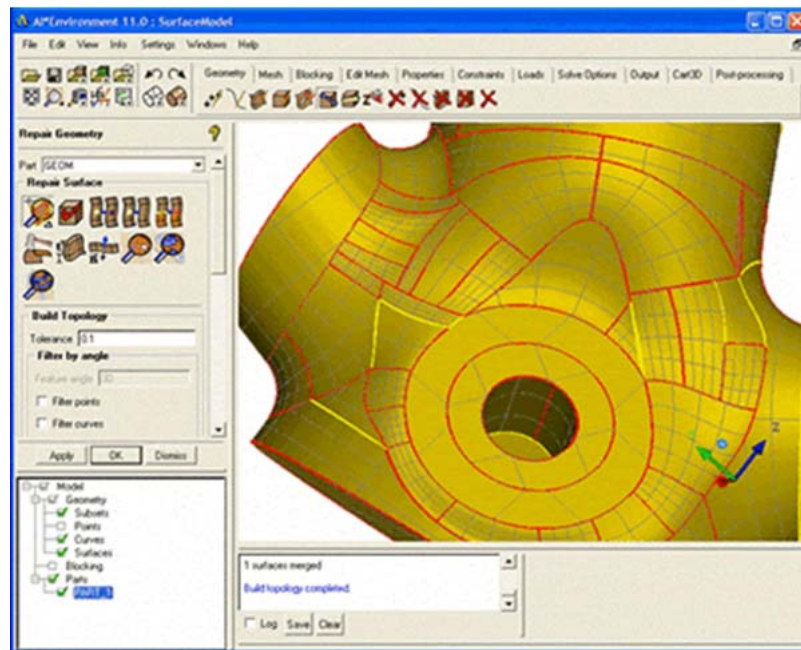


ANSA (BETA CAE Systems SA):
healing of gaps and overlapping, surface wrapping, semi-automatic holes/chamfers/etc. removing



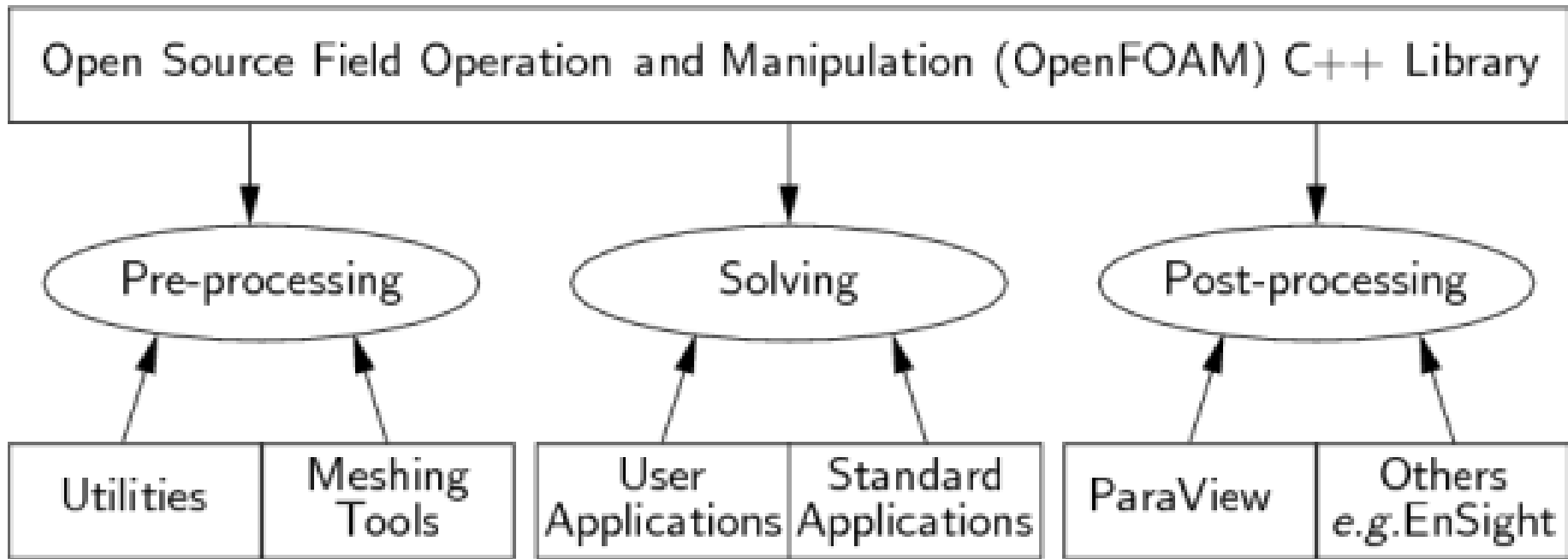
GAMBIT (FLUENT Inc / ANSYS Inc):
healing of gaps and overlapping, surface wrapping

Initial design space cleanup using conventional CAE preprocessors

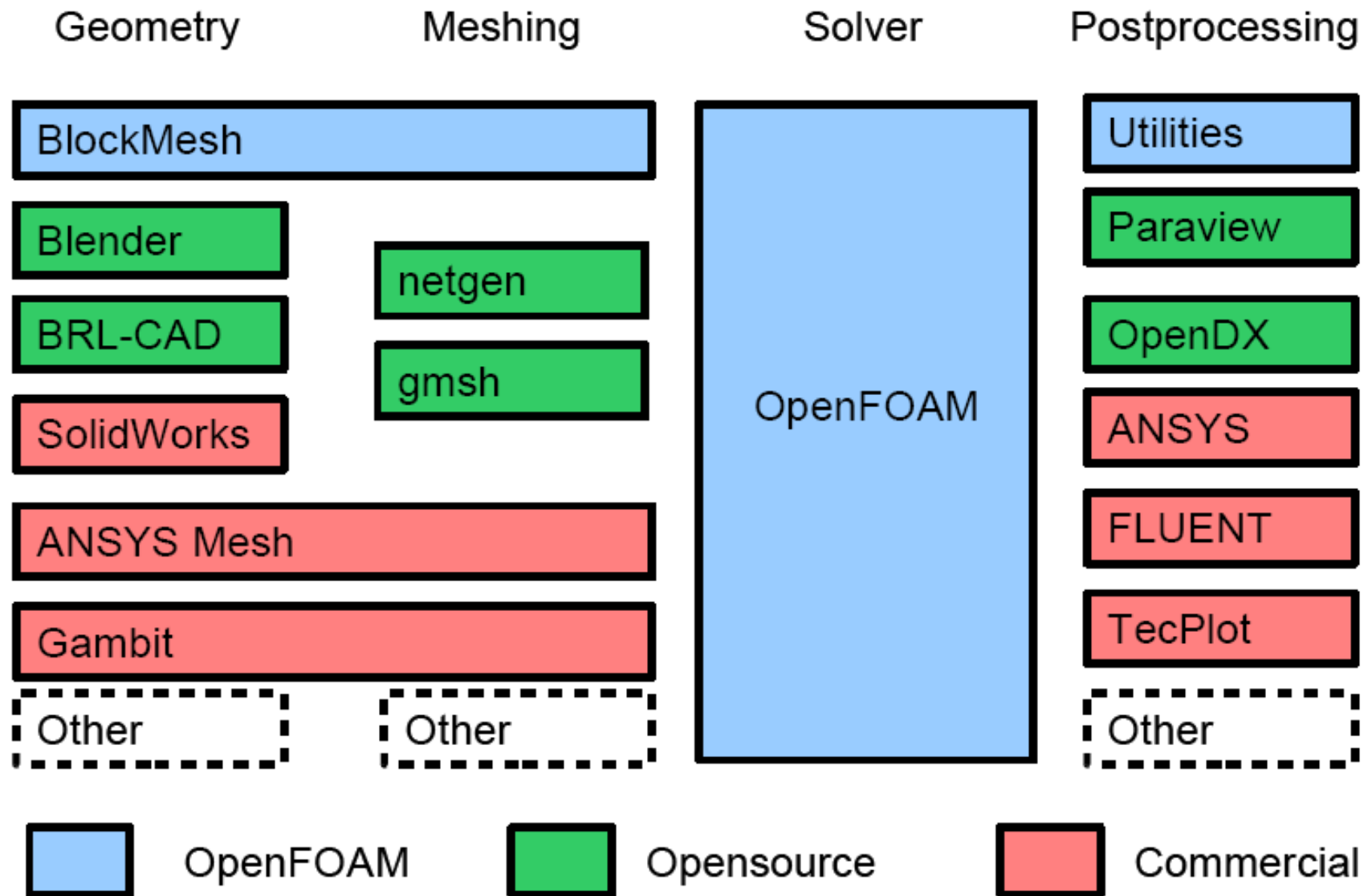


ANSYS ICEM CFD (ANSYS Inc):
healing of gaps and overlapping,
surface wrapping, semi-
automatic holes/chamfers/etc.
removing

Interface Preprocessing → optimisation module (OpenFOAM)



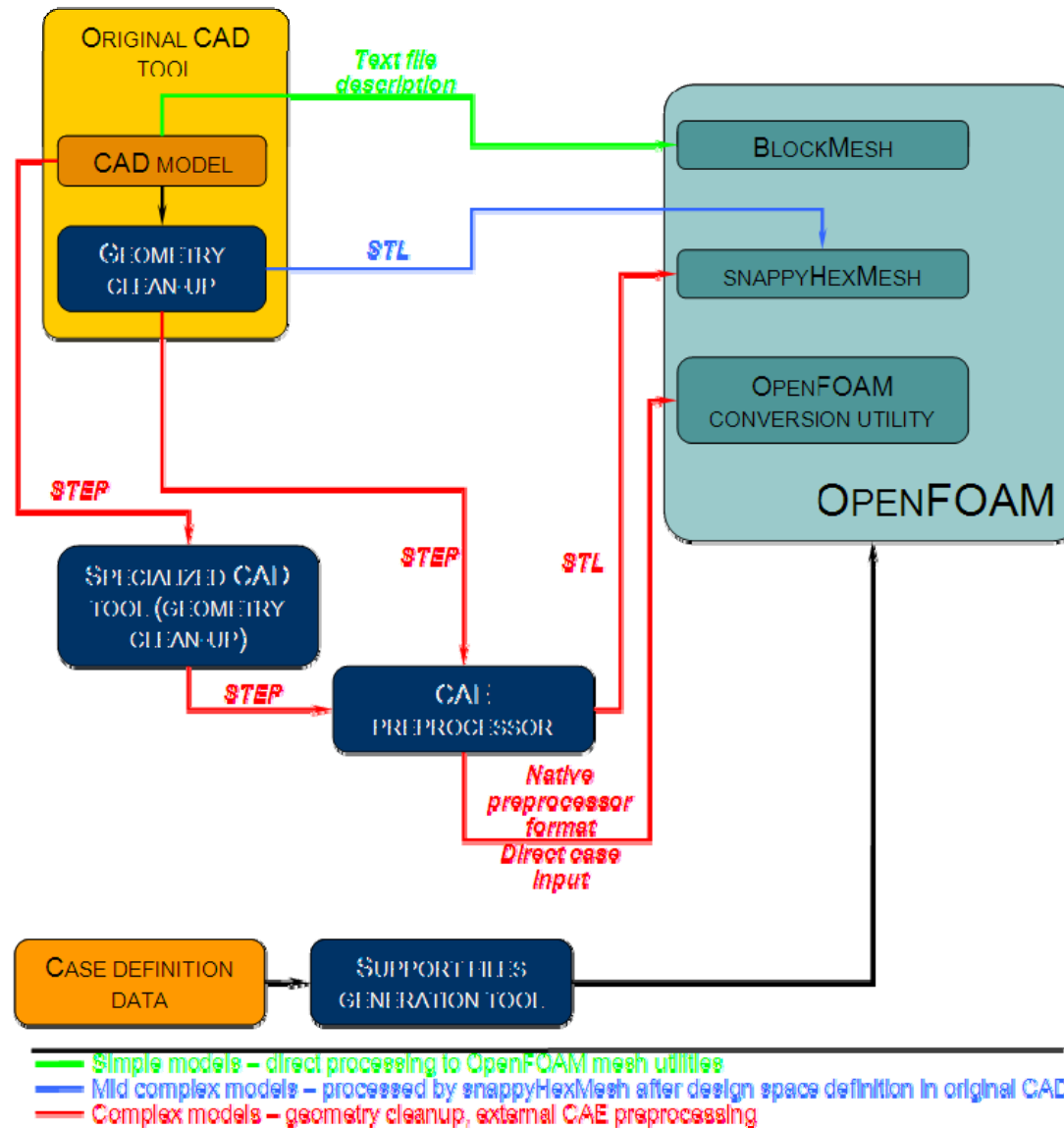
Interface Preprocessing → optimisation module (OpenFOAM)



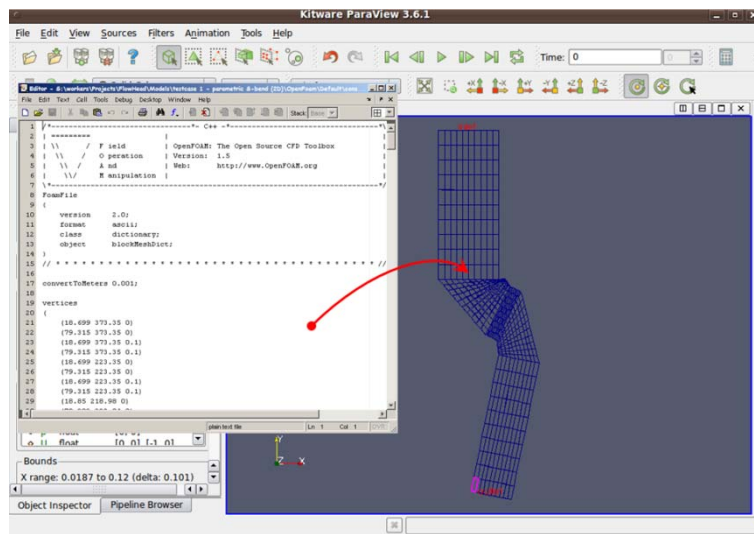
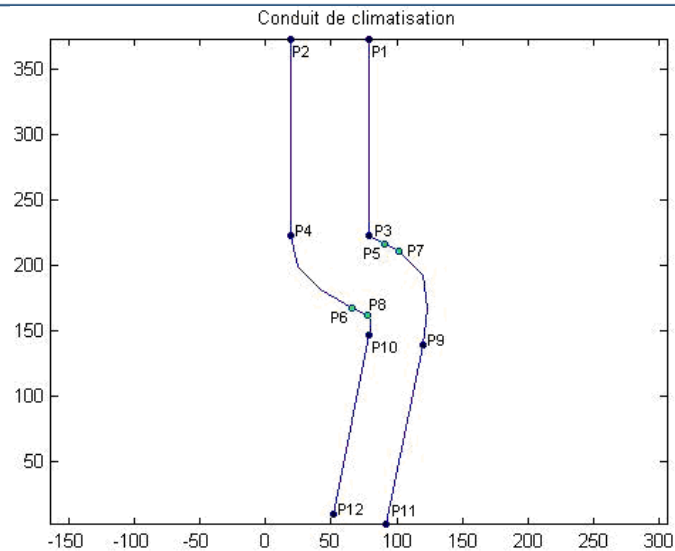
Approaches for CFD optimisation module input

Type	CAD input	Used utility	Notes
Using OpenFOAM utilities	STL, Text description	BlockMesh snappyHexMesh	Good application for simple geometry; Requires CAD or CAE tool for complex geometry preparation
Using Opensource utilities	All exchange formats (STL, STEP, IGES, etc.)	Blender BRL-CAD Netgen Gmsh	Open source tools are used; 4 stages modeling – geometry export from original CAD system, geometry preparation in CAD open source utility, mesh generation and export to OpenFOAM
Using Commercial applications		STAR-CD ANSYS / Fluent Gambit ANSA	Simpler data processing - export from original CAD system, geometry/mesh preprocessing in CAE software, import in OpenFOAM Direct OpenFOAM case definition (ANSA)
Combined approach	STEP, STL	ANSA STAR-Design BlockMesh snappyHexMesh	Flexible approach, involving geometry data preparation in original CAD system, surface mesh generation in commercial preprocessor (ANSA or STAR-Design), import in OpenFOAM and volume meshing

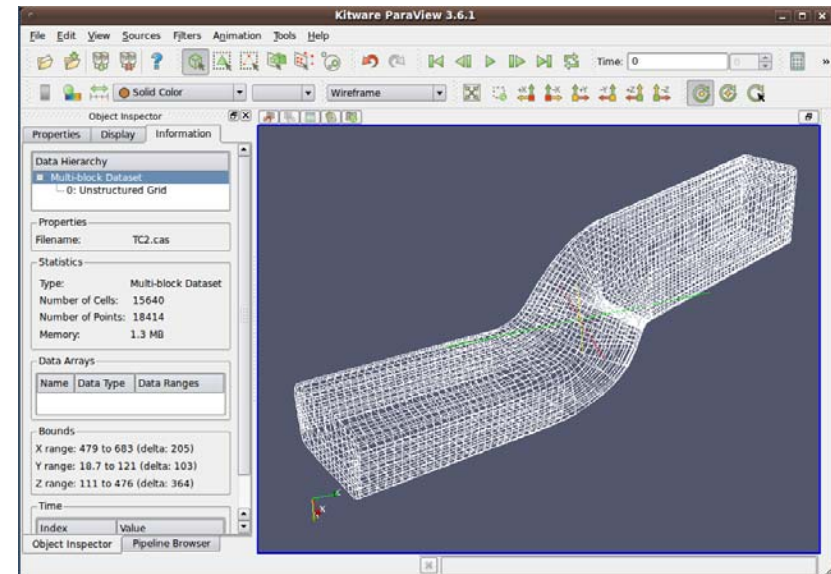
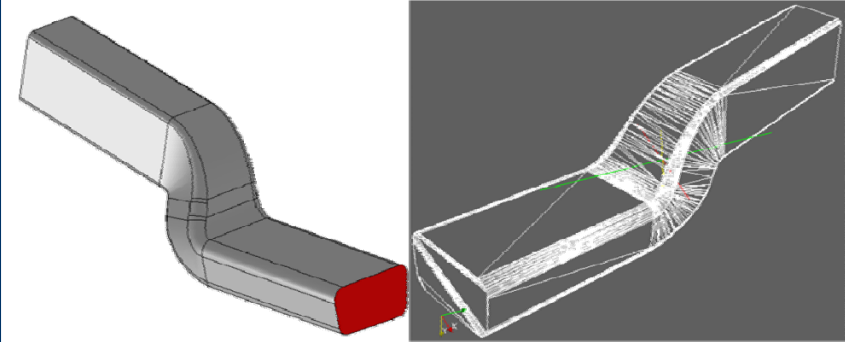
Combined approach for data interfaces



Interface to optimisation module – Demonstration cases



Air duct – 2D



Air duct – 3D

**THANK YOU FOR YOUR
ATTENTION**