Conceptual Design Tool (CDT) –

Presentation of an open source framework for multi- disciplinary conceptual aircraft design

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Outline

>> *Tool support for an MDO process*

>> *Conceptual Design Tool (CDT)*

>> *CDT as OSS Software*

>> *OSS community for CDT*

>> *Conclusions*

Multi-disciplinary optimization (MDO)

>> *Developing software tools for an MDO process faces* technical *and* non-technical *challenges*

>> *This definition has two implications, that each pose a challenge for a software tool supporting an MDO process:*
> Integration of several engineering disciplines
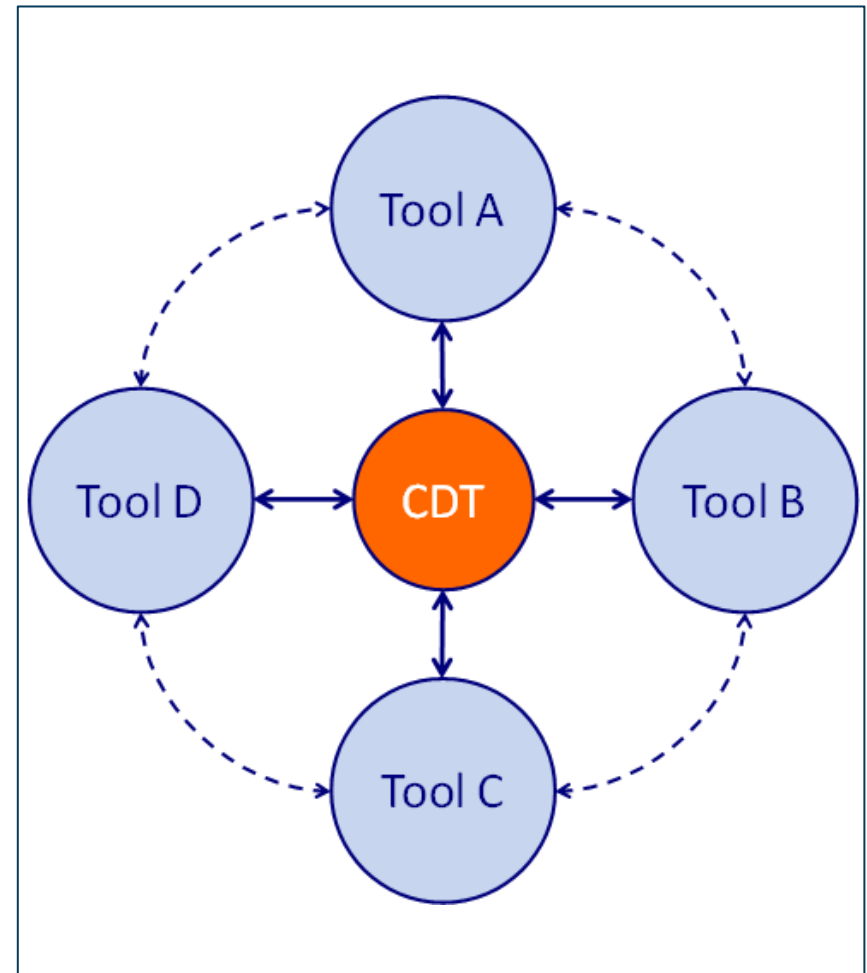> Parallel work of several disciplines/teams (Concurrent Engineering)
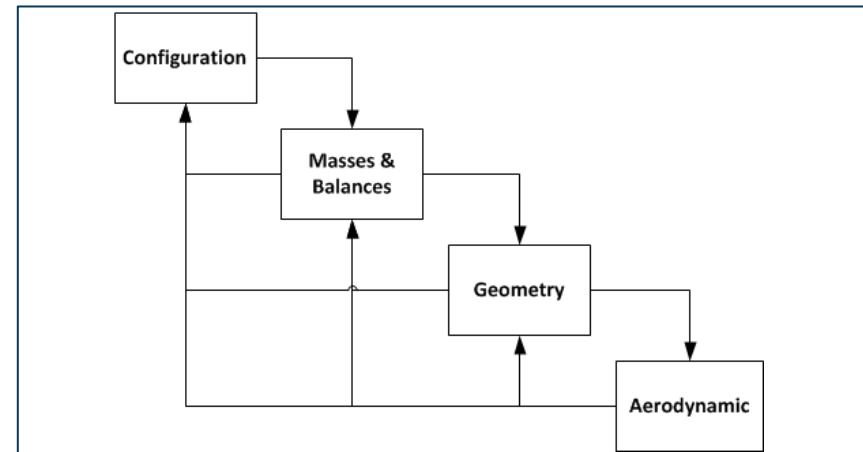
>> *MDO definition:*
> Multi-disciplinary optimization can be defined as *a methodology for the design of systems in which strong interaction between disciplines motivated designers to simultaneously manipulate variables in several disciplines*
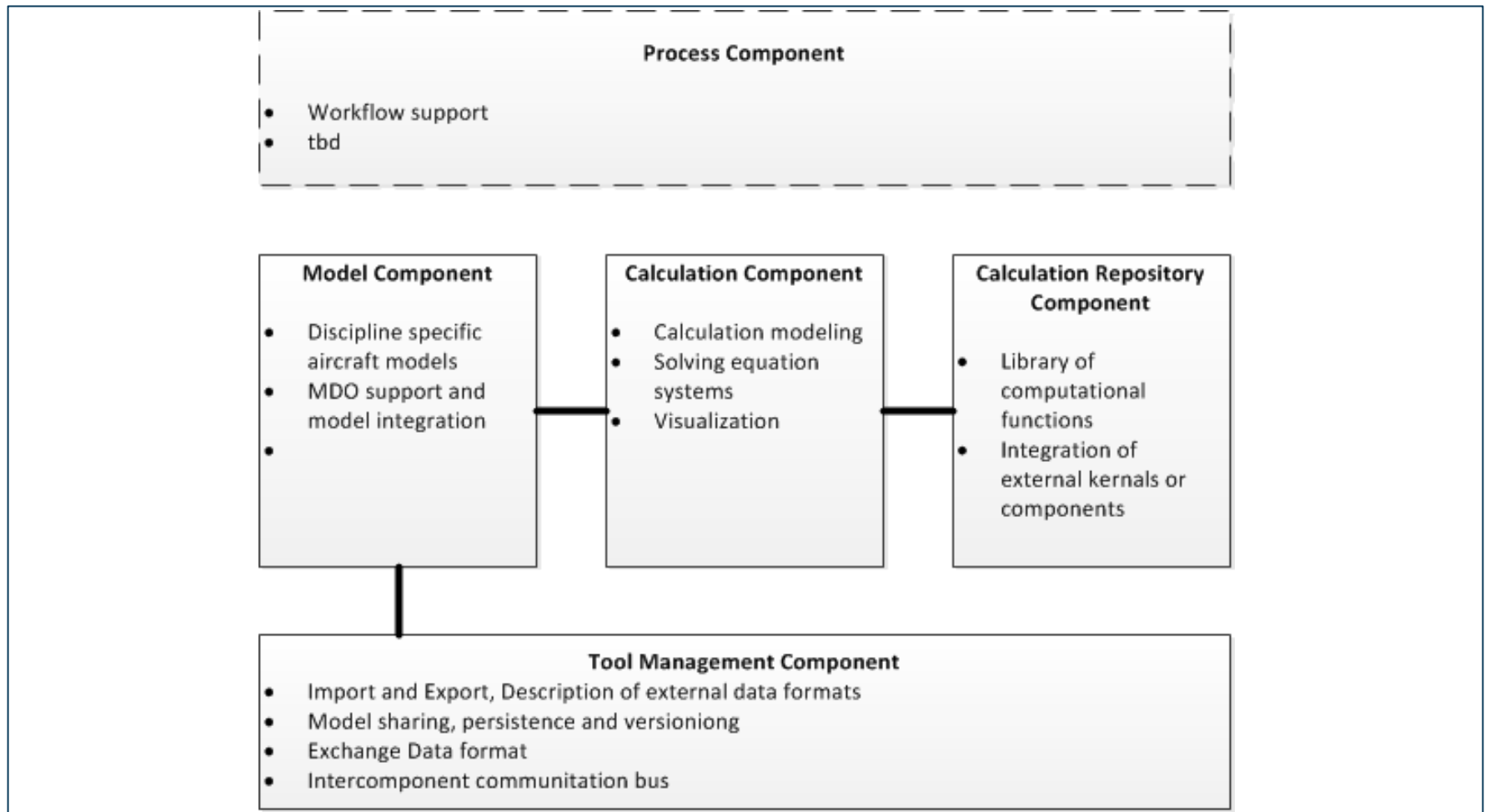
Organizational challenges for an MDO tool

Bauhaus Luftfahrt
Neue Wege.

>> Organizational challenges that come with an MDO approach:

- > Fragmentation of design knowledge and design data
- > Increased need for communication between involved teams

>> Functionality to address these organizational challenges include

- > Integration of data from several tools
- > Bridging different logical representations, structures and fidelities of design data, as well as maintaining consistency between design data
- > Supporting collaboration aspects

HC = Hidden couplings; EC = Explicit coupled; O = Overlapping item;
OI = Orphan item
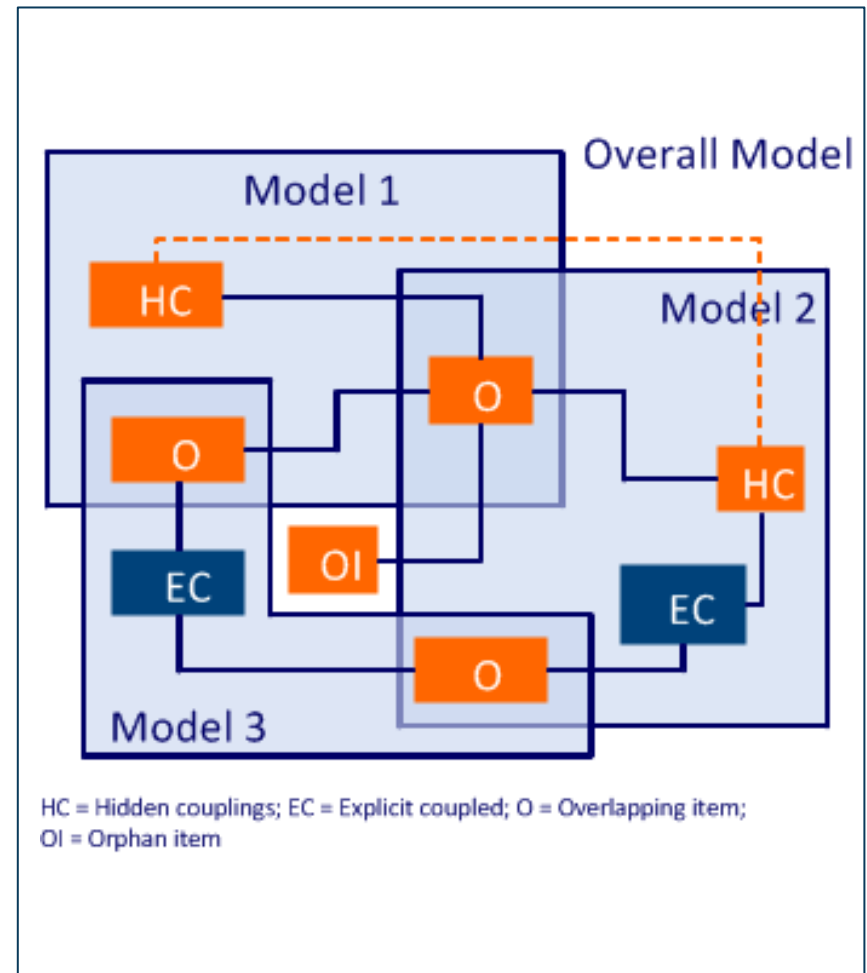
Conceptual Design Tool (CDT)

>> *In order to address these organizational challenges, the Conceptual Design Tool (CDT) is developed at Bauhaus Luftfahrt*

>> *CDT originally developed to study the concepts of open source in the aeronautic industry*

>> *It aims at*

> integrating design data from tools
> maintaining the consistency of data
> supporting collaboration among teams and/or disciplines

CDT Architecture

Process Component

- Workflow support
- tbd

Model Component

- Discipline specific aircraft models
- MDO support and model integration
-

Calculation Component

- Calculation modeling
- Solving equation systems
- Visualization

Calculation Repository Component

- Library of computational functions
- Integration of external kernals or components

Tool Management Component

- Import and Export, Description of external data formats
- Model sharing, persistence and versioniong
- Exchange Data format
- Intercomponent communitation bus

CDT as Open Source Software

>> *CDT will be released under the Eclipse Public License (EPL)*

>> *An open source license grants users the right to*

> read

> execute

> change and

> distribute

the licensed software

>> *CDT's availability is not dependent on the support of a commercial software vendor*
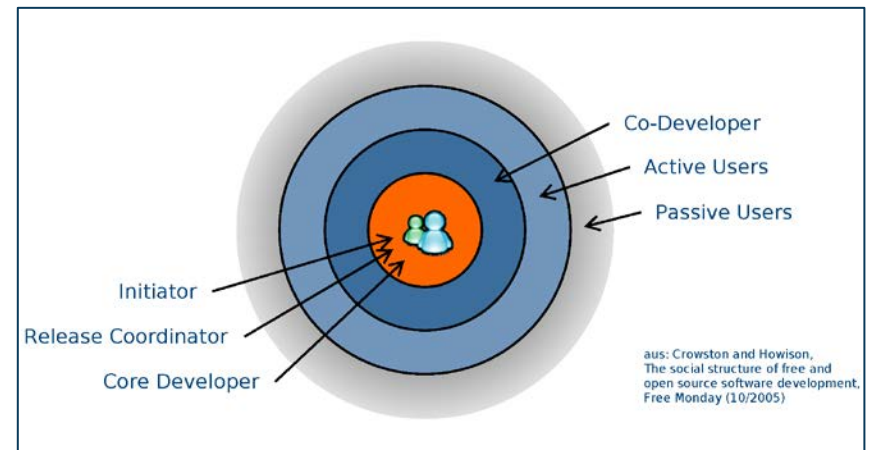
Is there a free lunch?
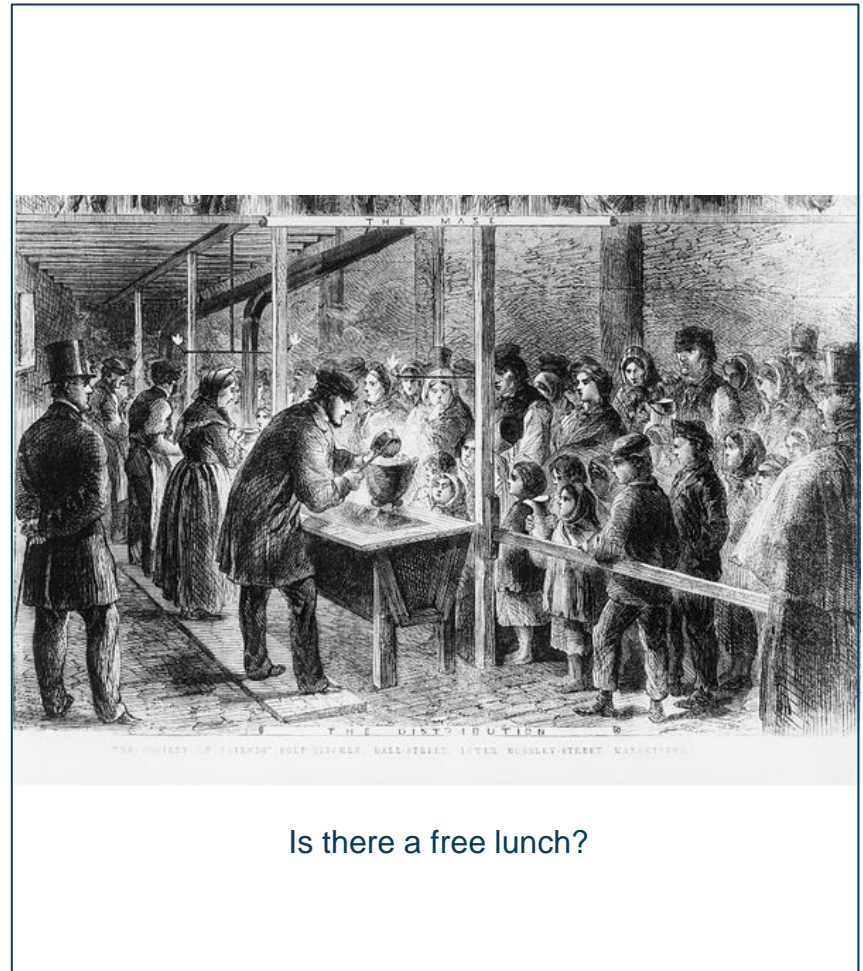
CDT as Open Source Software

>> *Using open-source software is a strategy to avoid legal challenges when cooperating with othe organizations*

> CDT is a common platform that enables cooperation with other universities, research institutes and industry

>> *An important goal for developing CDT as OSS is the establishment of an open source community*

aus: Crowston and Howison, The social structure of free and open source software development, Free Monday (10/2005)

OSS Community for CDT

>> *CDT community*

> Industry

> Academia & Research

>> *Contributions from community*

> Plug-ins for new tools

> Computational resources

> Framework functionality

>> *Collaboration within CDT community*

> Development

> Exchange of design data and design modules

> Collaborative work on computational resources / design methods

Conclusion

>> *CDT is a framework for conceptual aircraft design that will be released under an open source license*

>> *CDT focuses on organizational aspects of an MDO process*

>> *An open and extendable architecture enables users to integrate their design data and software tools*

>> *CDT uses a common "unified" aircraft design data model using a flexible metamodel*

>> *An important goal of CDT is the establishment of an open source community*

Thank you …

**>>** *… for your attention!*

>> *Contact information:*

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CDT Functionality

>> *CDT provides a framework for conceptual aircraft design that*

> enables the integration of design data and functionality from existing software tools

> supports the collaboration between discipline teams

> Is flexible enough to be adapted for designing unconventional aircraft concepts

Functionality: Modeling
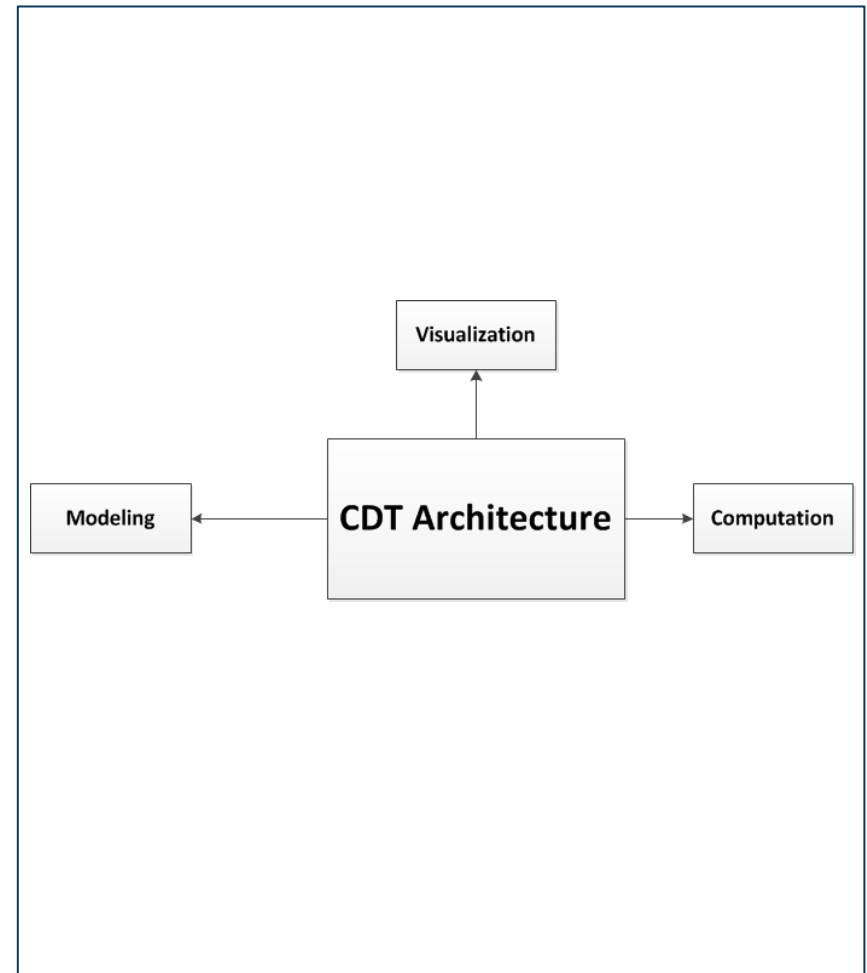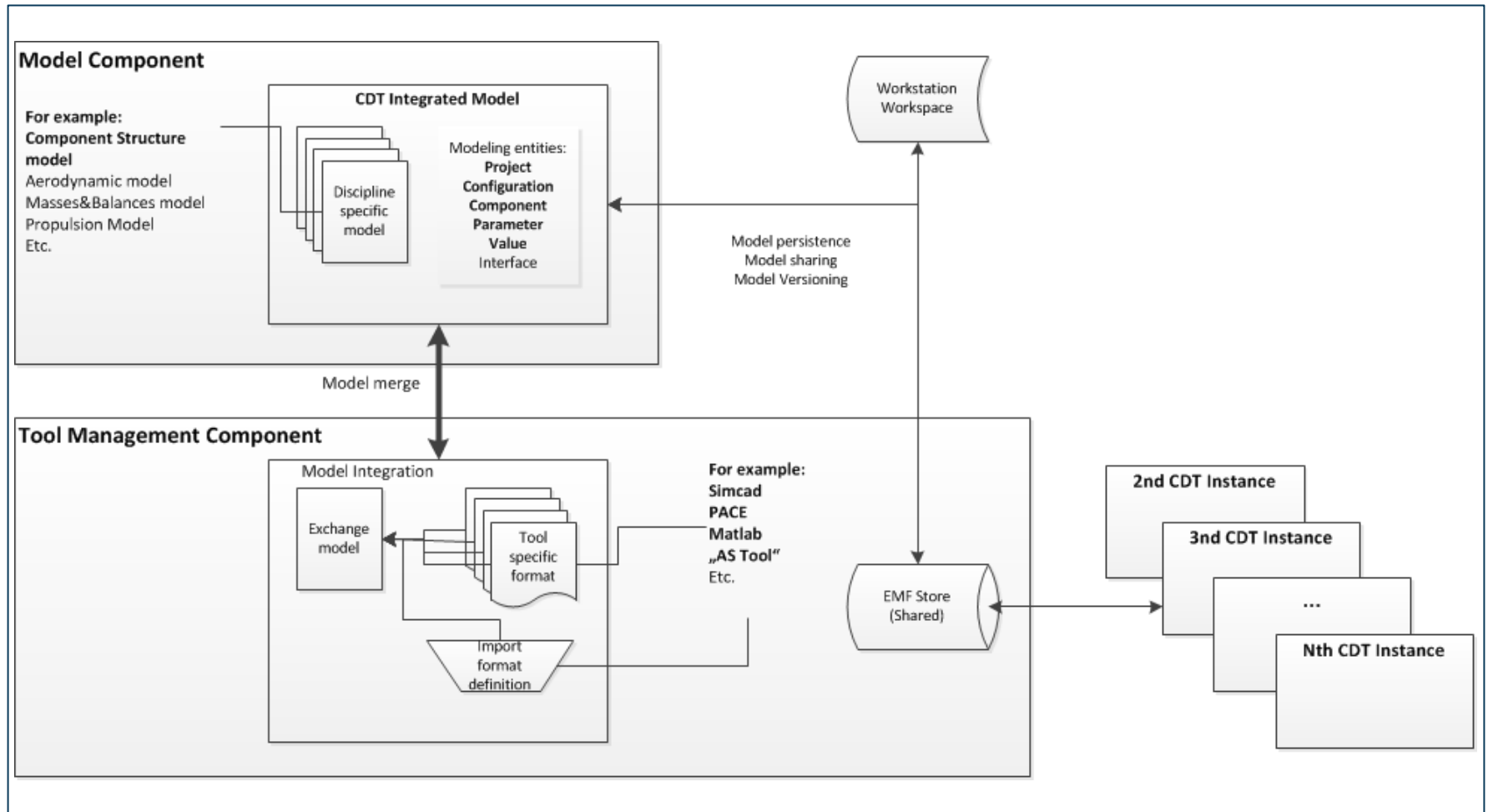
Functionality: Calculation

Future work
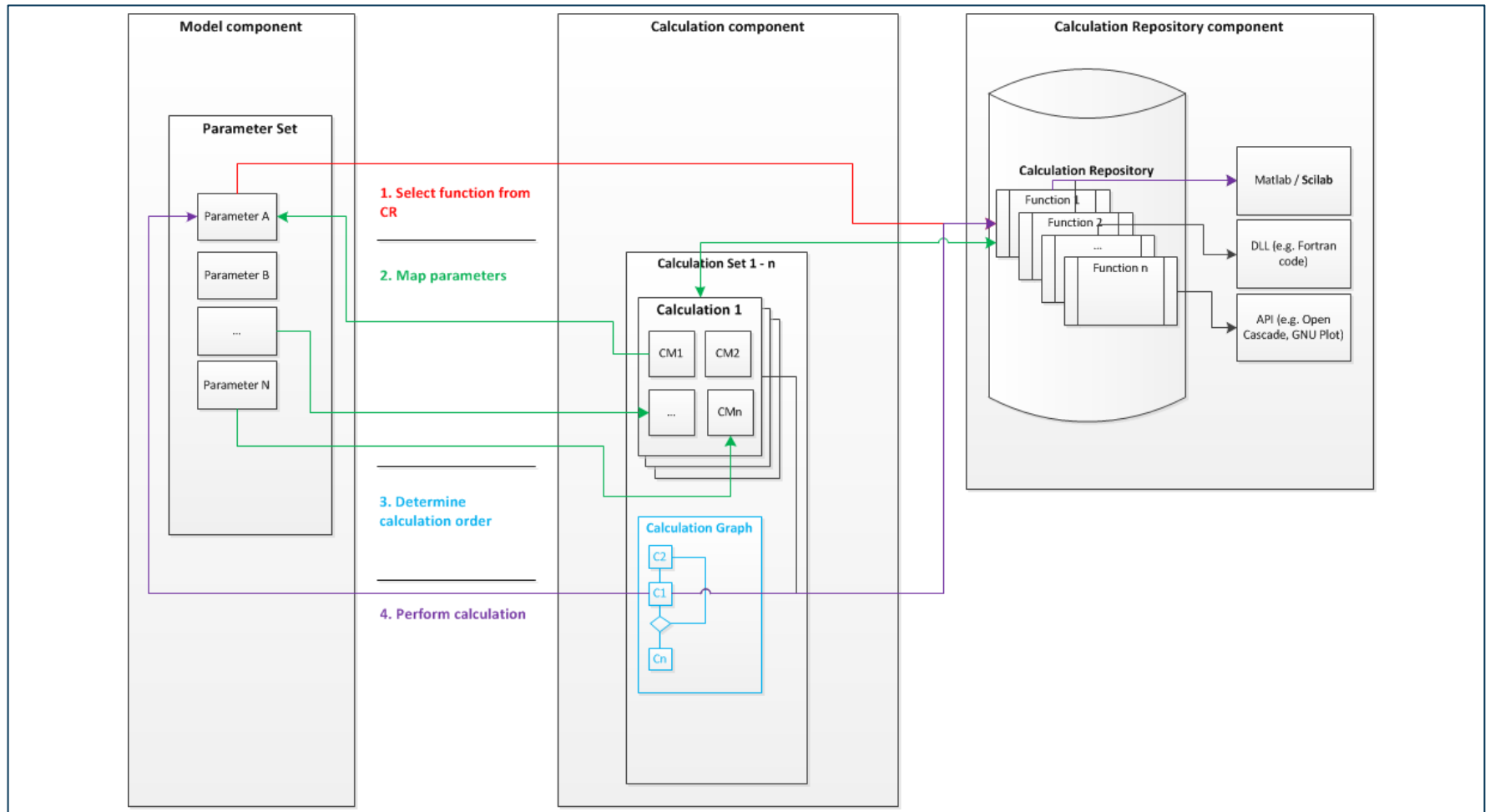
>> *Extending modeling capabilities*

> Multi-discipline models

> Modeling of design knowledge

>> *User Interface*

> Intuitive user interface that helps to manage the complexity of a unfied design model

> Customized presentation for disciplines

>> *Collaboration support*

> Support for decision making

> Coordination support between several teams

Future work

>> *CDT community*

> Going open – releasing the first CDT version

> Establishing community process for open cooperation between individuals and organizations

> Hosting a web portal for CDT extensions that add to CDT's functionality