Open Software Architecture for Process Simulation: the current status of the CAPE-OPEN standard

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Overview

- Introduction

- CAPE-OPEN Laboratories Network

- CAPE-OPEN Technology

- Delivering software components

- Conclusion
Introduction

- Process simulators: limited interoperability, reuse of third-party models or developments

- CAPE-OPEN is a standardisation process for achieving true plug and play of process industry simulation software components

- Relies on proven information technology:
  - Unified Modelling Language (UML)
  - Object-oriented approach
  - Distributed component architecture
  - COM and CORBA middleware
CAPE-OPEN supports all combinations of components

Aspen Plus Simulation Executive

Hysys Simulation Executive

PRO/II Simulation Executive

CO Simulation Executive

PRO/II Unit Op

AspenTech Unit Op

ATOFINA Unit Op

AspenTech Thermo

INPT Solver

Hyprotech Thermo

CO

UO

CO

Thermo

AspenTech Thermo

Hyprotech Unit Op

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## CAPE-OPEN Projects

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### Users
- IFP
- TotalFinaElf
- BP
- Bayer AG
- Dow
- BASF AG
- DuPont
- Norsk Hydro

### Suppliers
- Honeywell
- AEA
- Aspentech
- SimSci
- QuantiSci
- RSI
- ProSim SA
- Infochem
- PSEnterprise
- BELSIM SA
- Dechema e.V.
- Protesoft

### Academics
- INPT
- DTU
- RWTH.LPT
- RWTH.I5
- Imperial Coll.
- NTNU
- Univ. Virginia
- CMU
- Kyoto Univ.
- UMass
- MIT

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Overview

- Introduction

- CAPE-OPEN Laboratories Network
  - A not for profit organization driven by industrial end-users

- CAPE-OPEN Technology

- Delivering software components

- Conclusion
CO-LaN missions

CAPE-OPEN Laboratories Network

1. User priorities for CO standards:
   - work with software vendors to clarify user priorities for process modelling software component/environment interoperability
   - promote communication and cooperation among CAPE software vendors to insure that the CO standards actually translate into commercially valuable interoperability

2. Dissemination and exploitation:
   - distribute CO information and technology internationally
     - Web portal: www.colan.org
CO-LaN missions

CAPE-OPEN Laboratories Network

3. CAPE-OPEN specifications life cycling management:
   - organise the maintenance, evolution, and expansion of the specifications

4. Software component testing:
   - manage the process as well as the testing steps
     - deliver testing software
     - publicize compliant components

5. Training facilitation:
   - ensure training modules are developed and available
Overview

- Introduction
- CAPE-OPEN Laboratories Network
- CAPE-OPEN Technology
- Delivering software components
- Conclusion
CAPE-OPEN Technology

- **Business interfaces**
  - These interfaces are domain-specific interfaces for the CAPE application domain. They define interfaces to CO components involved in a CO process simulation application.

- **CAPE-OPEN Simulator Executives (COSE) Interfaces**
  - They are interfaces for CO simulator executives. Within this category, services of general use are defined such as diagnostics and material systems in order to be called by any CO component.

- **Common interfaces**
  - Specifications for handling services that may be required by any Business and COSE interfaces. They support basic functions and are always independent of Business and COSE Interfaces.

- **Implementation specifications**
  - COM
  - CORBA
Overview

- Introduction

- CAPE-OPEN Laboratories Network

- CAPE-OPEN Technology

- Delivering software components
  - Major suppliers are proposing CO compliant tools

- Conclusion
Delivering interoperable software components

- Many combinations tested (not all)
- As well with some operating companies legacy software
- Almost no performance degradation in best case
<table>
<thead>
<tr>
<th>Supplier</th>
<th>Software</th>
<th>Interfaces</th>
<th>Technology</th>
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<td>Aspen Plus 11.1</td>
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<td>gPROMS</td>
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<td>COM (COM/CORBA bridge)</td>
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<td>DECHEMA</td>
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<td>RWTH.I5</td>
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<td>Java Unit Skeleton Java Material Object Skeleton</td>
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<td>UPC</td>
<td>MOPEDR MOPP</td>
<td>CORBA</td>
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<td><a href="http://www.upc.es/eq/">www.upc.es/eq/</a></td>
<td>PEDR Prototype Planning and Scheduling Package</td>
<td>CORBA</td>
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Conclusion

- Significant results obtained
- Commercial implementations available
- Proven technology
- Major benefits already from Unit and Thermo
Benefits from CAPE-OPEN standard

- **Benefits for suppliers**
  - Increased usage of CAPE tools
  - Reduced development costs

- **Benefits for users**
  - Develop once, run everywhere
  - Access to best-in-class solutions

- **Benefits for academics**
  - Improved dissemination of research results
  - Better adaptation to industrial needs

Use the CAPE-OPEN standard for your benefit!
Thank you for your attention

Questions and comments welcome!