

Example code of CAPE-OPEN Unit Operation socket

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Missions of CO-LaN

- User priorities for CAPE-OPEN standards:
 - clarify user priorities for PMC/PME interoperability
 - promote commercially valuable interoperability
- Exploitation and dissemination:
 - promote the CAPE-OPEN standard
- CAPE-OPEN interface specifications life cycle management:
 - organize maintenance and evolution specifications
- Testing and interoperability facilitation:
 - supply compliance testers
 - organize interoperability tests
- **Training and migration facilitation:**
 - **ensure that training modules and tools to facilitate component wrapping are developed and available**

Ways to help in migrating to CAPE-OPEN

- **Wizards**
 - Unit Operation in Visual Basic 6.
 - In other programming languages by 3rd parties.
- **Example codes (Visual Basic 6 / C++)**
 - Unit Operation, Thermo System, Property Package, Property Package Manager.
- **Consultancy Service Scheme**
 - Recognizes the need for expert advice in implementing CAPE-OPEN interfaces.
 - Scheme set up first in Y03 (till Y06) and again in Y13.

Purposes of Consultancy Service Scheme

- **Provide assistance**
 - in the development of new CAPE-OPEN interfaces
 - or the improvement of existing interface implementations
- **Give access to a specialist consultant**
 - **AmsterCHEM** in most cases
- **Provide funding up to 80 man-hours of consultant**
- **Encourage the full implementation of efficient and error free interfaces**
- **Increase the uptake and seamless usage of the CAPE-OPEN interfaces**

Recent Consultancy Scheme activities

- **Honeywell Process Solutions**
Unit Operation socket in UniSim Design (improv.)
- **VORtech**
Thermodynamic socket in Modelica (advice)
- **Virtual Materials Group, Inc.**
Unit Operation socket in VMGSim (devlp.)
- **AspenTech**
Implementation of Thermo 1.1 in Aspen Plus (testing)
- **ChemSep**
Wrapping of Property Package (devlp.)
- **Intelligen, Inc.**
Unit Operation socket for SuperPro Designer (devlp.)

Objectives

- **Intelligen's**
 - **Support external CAPE-OPEN Unit Operations in SuperPro Designer**
 - **Using thermodynamic server embedded in SuperPro Designer (*no CAPE-OPEN thermodynamic socket*)**

- **CO-LaN's**
 - **Widen and support the CAPE-OPEN community**
 - **Give access to the code delivered for Intelligen**
 - **Get software developers actively involved in developing their own CAPE-OPEN sockets and plugs**
 - **Provide a modifiable code example**

Deliverables by AmsterCHEM

- **A stand-alone Unit Operation (UO) socket (a DLL):**
 - enumerate UOs; instantiates a UO, connects/disconnects Material Objects to Ports, etc...
 - interfaced with external CAPE-OPEN UOs on one side and the driver application on the other side.
- **A driver application (command line type) that serves for:**
 - testing
 - demonstrating how to implement it.
- **Implementation of a Thermo socket:**
 - based on the Ideal Gas example
 - previously released by CO-LaN
 - shows how to provide internal thermodynamic system to the socket

To be done by PME vendor

- Dynamically link the UO socket DLL to PME
- Adapt and include the driver application in PME code
- Develop GUI part to insert a CAPE-OPEN UO in a Flowsheet
 - Enumeration of CAPE-OPEN UOs is provided by the UO socket
- Develop a graphical representation of CAPE-OPEN UOs in Flowsheet
 - The driver application gives access to the Port Collection of a UO
- Enable access for the end-user to *ICapeUtilities::Edit* within UO socket
 - In order to let the end-user configure the CAPE-OPEN UOs inserted in the Flowsheet
- Provide for display and access to Parameters handed out by the socket
- Adapt the thermo socket implementation to PME specifics
- Save and load the data of the CAPE-OPEN UOs in whatever persistence scheme used by PME
- Include validate and calculate of CAPE-OPEN UOs in the calculation scheme of the PME

Project status

- **Example code delivered to Intelligen and CO-LaN**
 - **Early January 2018: two projects in C++**
 - Unit Operation socket
 - PME basic application implementing provided sockets
- **Integration under way at Intelligen**
 - No issue mentioned so far
 - **Jim PRENTZAS, May 30, 2018**“The delivered project is satisfactory. Seems to cover all SuperPro needs and more”
 - **Two-year guaranty provided by AmsterCHEM**
- **Developer Guide by CO-LaN (to be completed)**
 - **Minor modifications brought to code**

Code licensing to be chosen

- **Intelligen**
 - retains all rights on its copy of the code
 - has agreed for the full code to be part of example
- **CO-Lan holds copyright of the code**
- **Possible aspects of licensing by CO-LaN**
 - **Permissive license**
 - **Simple to read and apply**
 - **Licensed works, modifications, and larger works may be distributed under different terms and without source code.**
- **Candidate: MIT/X11 license**

Code contents

- **CAPE-OPEN Wizard (AmsterCHEM)**
 - **Code library used and re-used in various projects**
 - COM related code (Variant, ...)
 - General utilities (String hashing, ...)
 - CAPE-OPEN classes
 - Material Object, Base CAPE-OPEN class, error handling, Simulation Context
- **Code specifically developed for the Unit Operation socket**
- **Ideal Gas Property Package**
 - **Previously made available as code example**

Conclusion

- **CO-LaN provides an additional code example**
 - **This time for PME side**
- **Example code being used in commercial implementation**
 - **SuperPro Designer from Intelligen**
- **Remaining steps**
 - **License scheme**
 - **Developer Guide**