CAPE-OPEN in PRO/II

2nd Annual U.S. CAPE-OPEN Meeting

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Agenda

- History of CAPE-OPEN support in PRO/II
- Using software components in PRO/II
- Overview of integration architecture

History of CAPE-OPEN Support in PRO/II

PRO/II 6.0

- First support for CAPE-OPEN interfaces was PRO/II 6.0, released July 2003
- Unit operations interfaces supported (v0.9-3 only)
  - Calculation
  - User Interface
- Allowed PRO/II to call out to third-party CAPE-OPEN unit operations for calculation and GUI.

PRO/II 7.0

- Next phase of CAPE-OPEN support, released July 2004
- Unit operation interfaces supported (v0.9-3 only)
  - Calculation
  - User Interface
- Added support for CAPE-OPEN Property Packages (new)

PRO/II 7.1

- Support for CAPE-OPEN 1.0 standard
- Unit operation interfaces supported (v0.9-3 and v1.0)
  - Calculation
  - User Interface
  - Custom reports (new)
  - COM Persistance (new)
- Support for CAPE-OPEN Property Packages

Property Package Support

- PRO/II can call out to third-party CAPE-OPEN property packages via the Material Object (“stream”)
- Third-party CAPE-OPEN unit operations can use PRO/II thermodynamic systems via the Material Object
- Native PRO/II unit operations can use CAPE-OPEN property packages when performing equilibrium calculations and calculating stream properties

Other features and restrictions

- In-process (dll) and out-of-process (exe) COM-based components are supported.
- COM-based components can be written in many languages, including C++, Visual Basic, and C#.
- CORBA-based components are not supported.

Using CAPE-OPEN Software Components

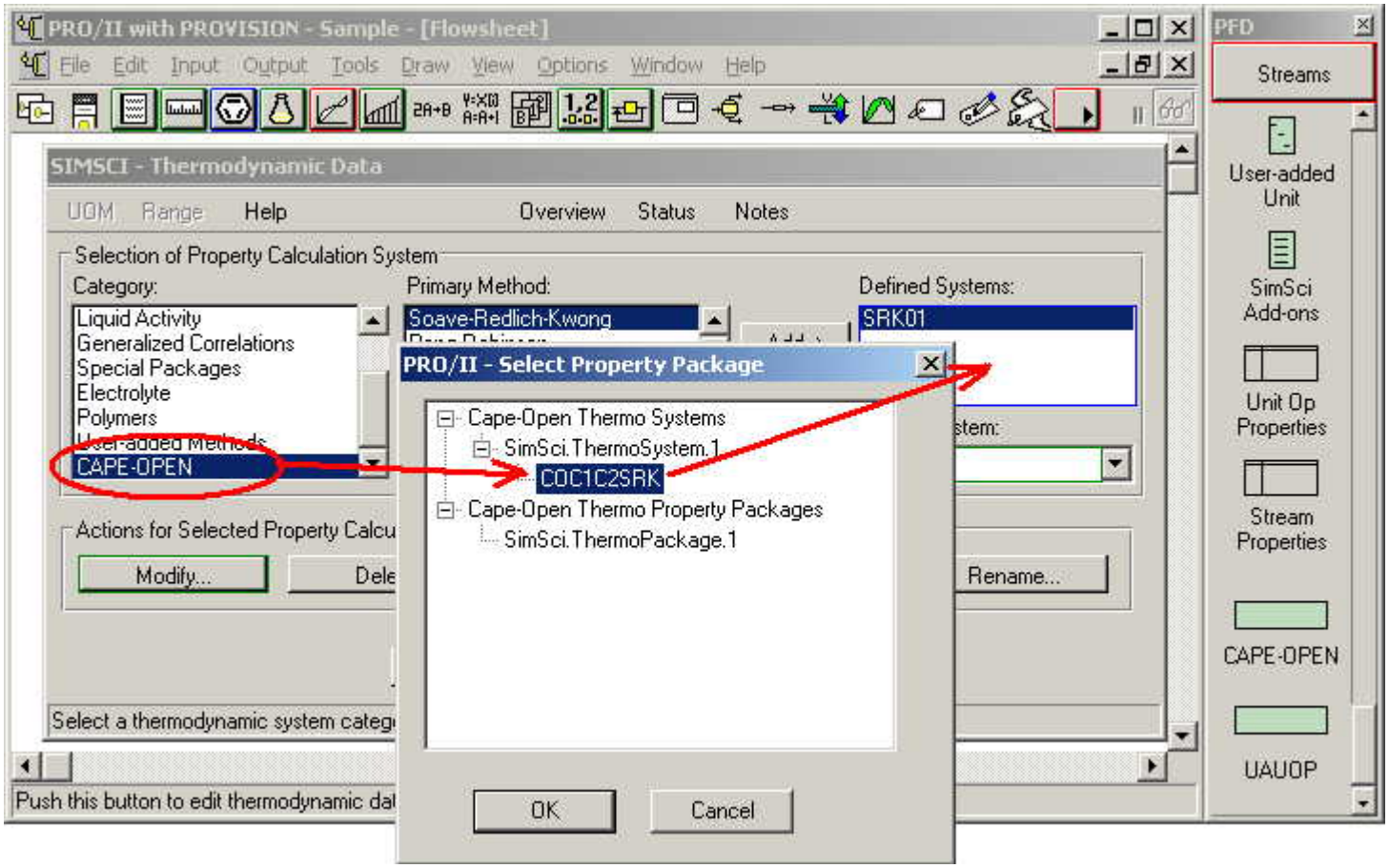
Installing CAPE-OPEN Components

- CAPE-OPEN Components from a Third-party
  - Use vendor-supplied install program
- CAPE-OPEN Components developed in-house
  - Register COM component
  - Register component category
  - Provide additional CAPE-OPEN descriptive information
- At runtime, PRO/II reads the registry for information on installed CAPE-OPEN components – no additional PRO/II setup is required

Selecting a CO Property Package

- From the main menu bar, select “Input/Thermodynamic Data…”. The “Thermodynamic Data” dialog is displayed.
- In the “Category:” list box, scroll to the bottom and click on “CAPE-OPEN”. A tree control is displayed; expand the tree control to display the CAPE-OPEN property packages registered on the machine.
- Select the desired property package and click OK.
- A new thermodynamic system will be added to the “Defined systems:” list box which represents the CAPE-OPEN property package.

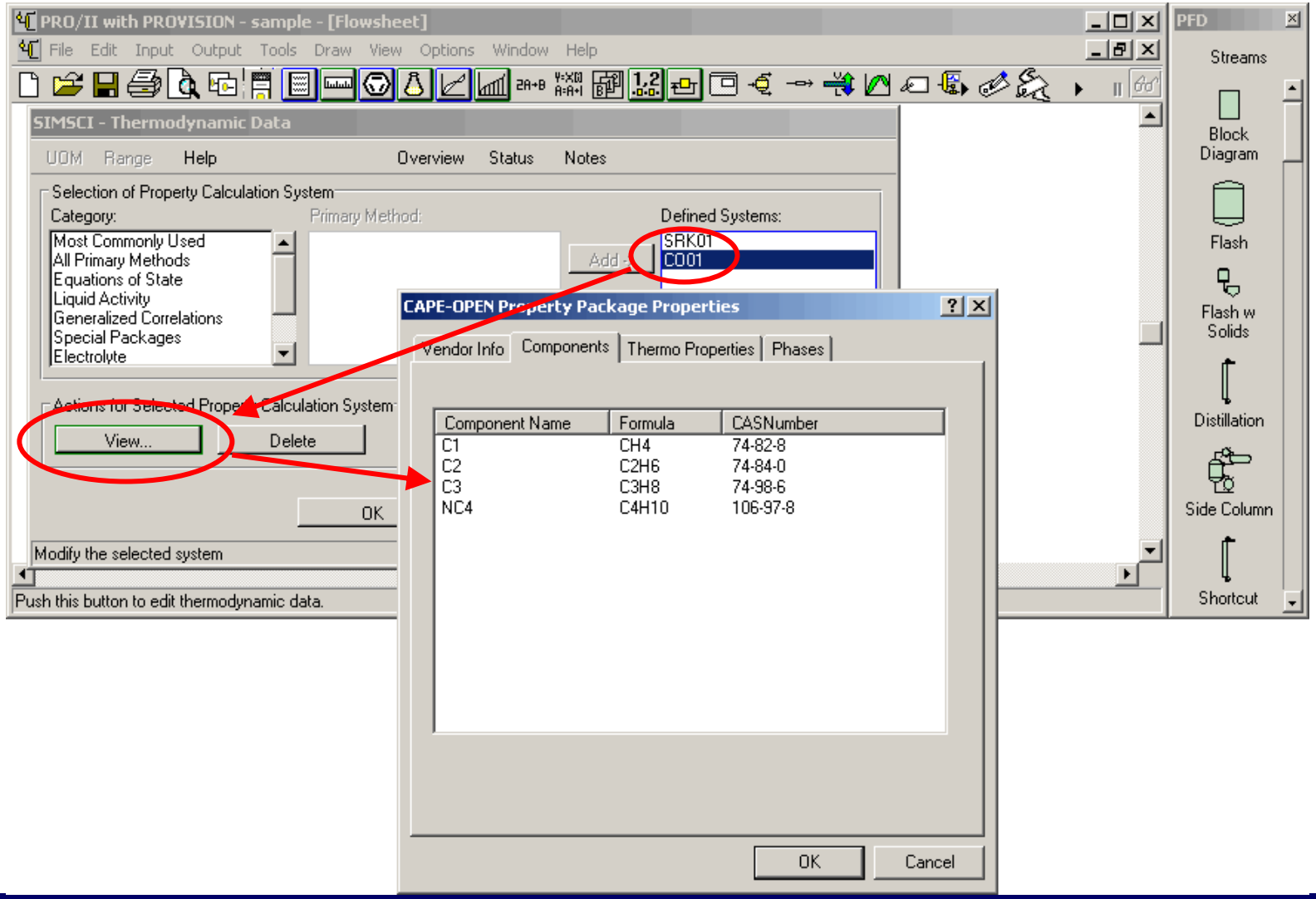
Selecting a CO Property Package



Viewing a Property Package

- Select name of property package
- Click “View…” button
- Tabbed dialog box displayed

Viewing a Property Package



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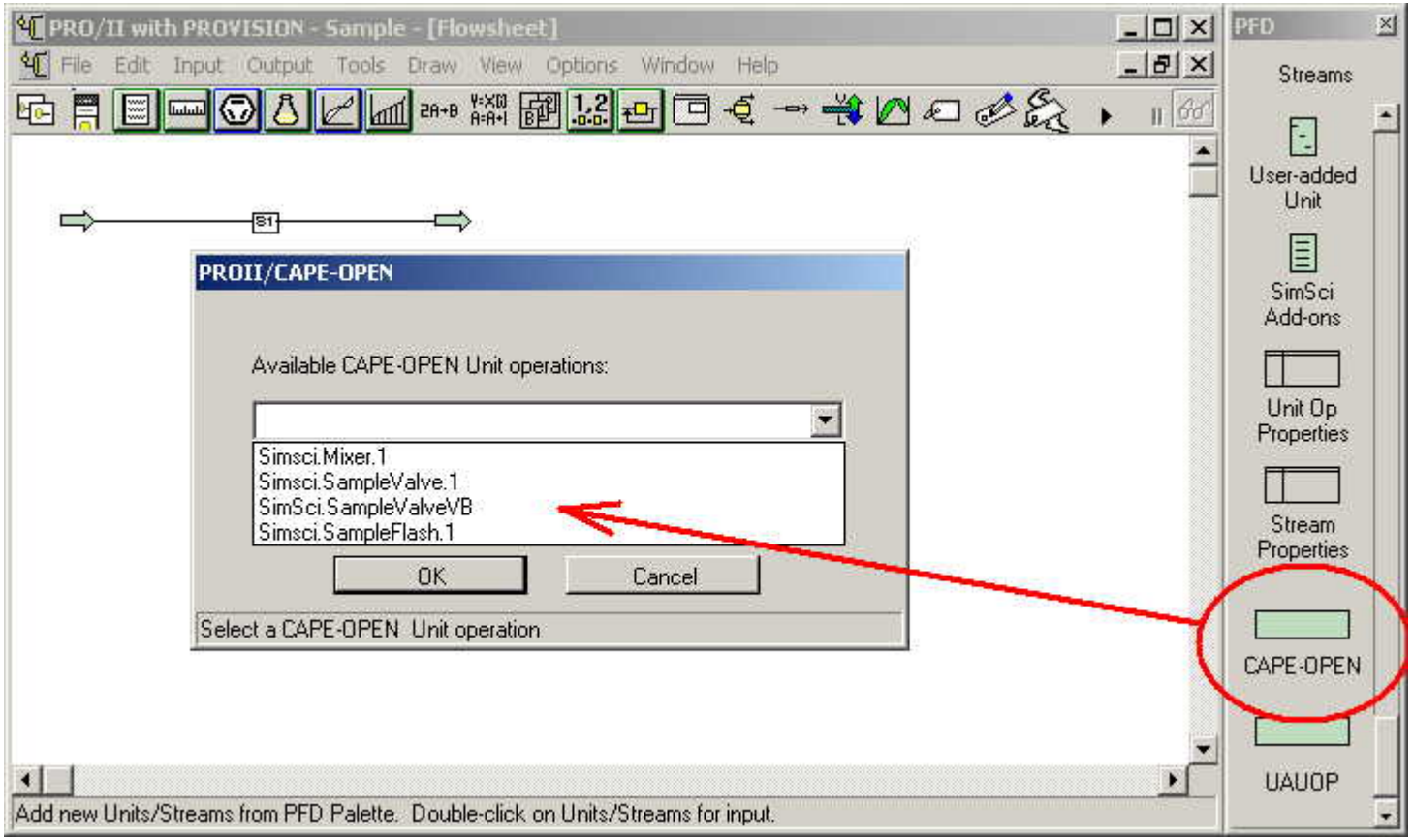
Adding a CO Unit Operation to Flowsheet

- From the PFD icon palette, click the “CAPE-OPEN” button.
- Click on the flowsheet. A dialog will be displayed with a drop-down list box. The list box will display all registered CAPE-OPEN unit operations.
- Select the desired unit operation and click OK.
- The new unit is created on the flowsheet

Adding a CO Unit Operation



Connecting Streams to CO Unit Ops

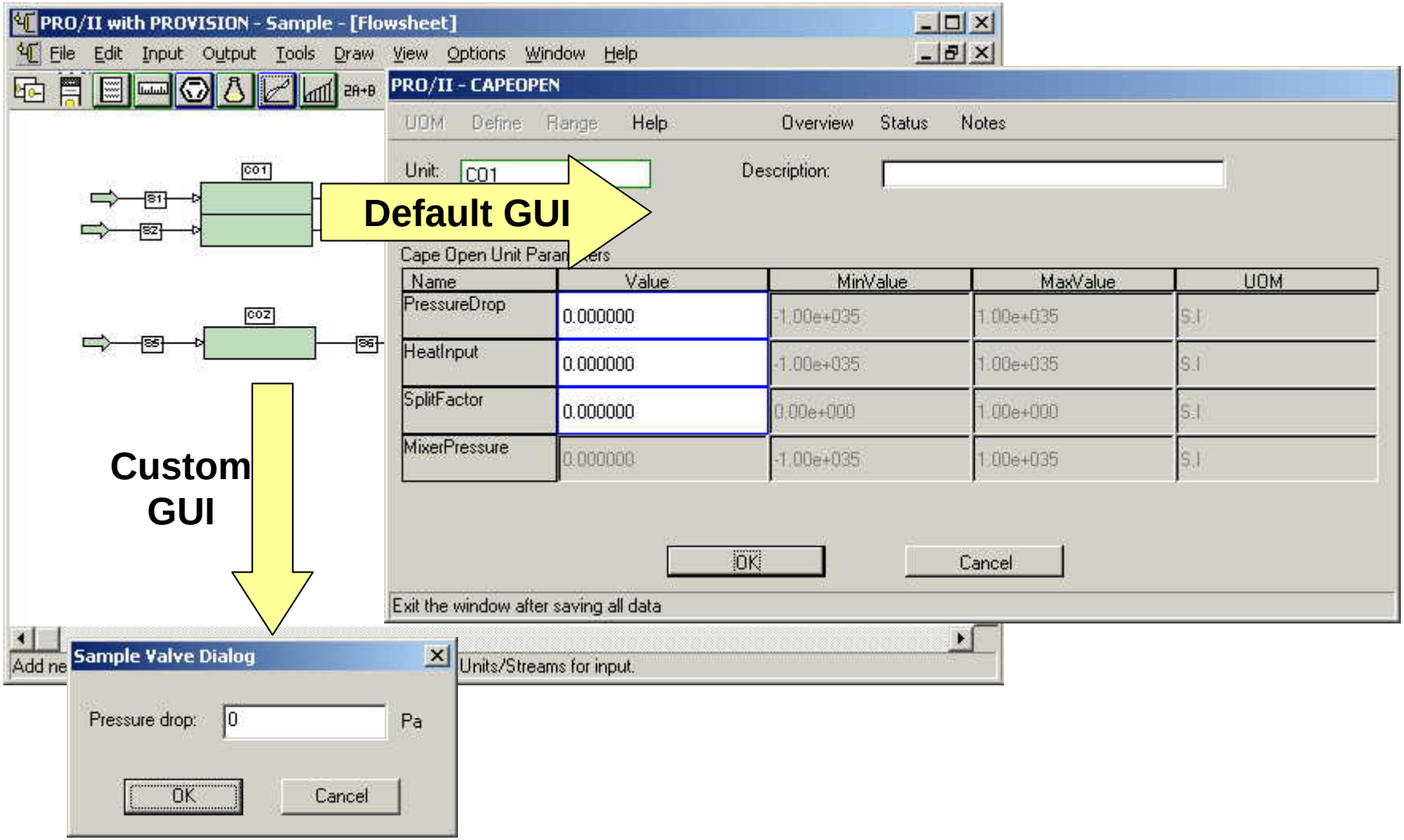
- PRO/II queries the CAPE-OPEN Unit for the number of supported inlet and outlet ports.
- PRO/II adds the required connection ports to the icon on the flowsheet.
- Note: PRO/II does not currently support energy or information connections.

Unit Op GUI Support

- If the CAPE-OPEN Unit operation supports its own custom GUI, then that GUI will be displayed when the user double-clicks on the icon.

- If a custom GUI is not provided, then PRO/II will query the CAPE-OPEN unit for its list of parameters and display them in a table for viewing and modification.

Unit Op GUI Support



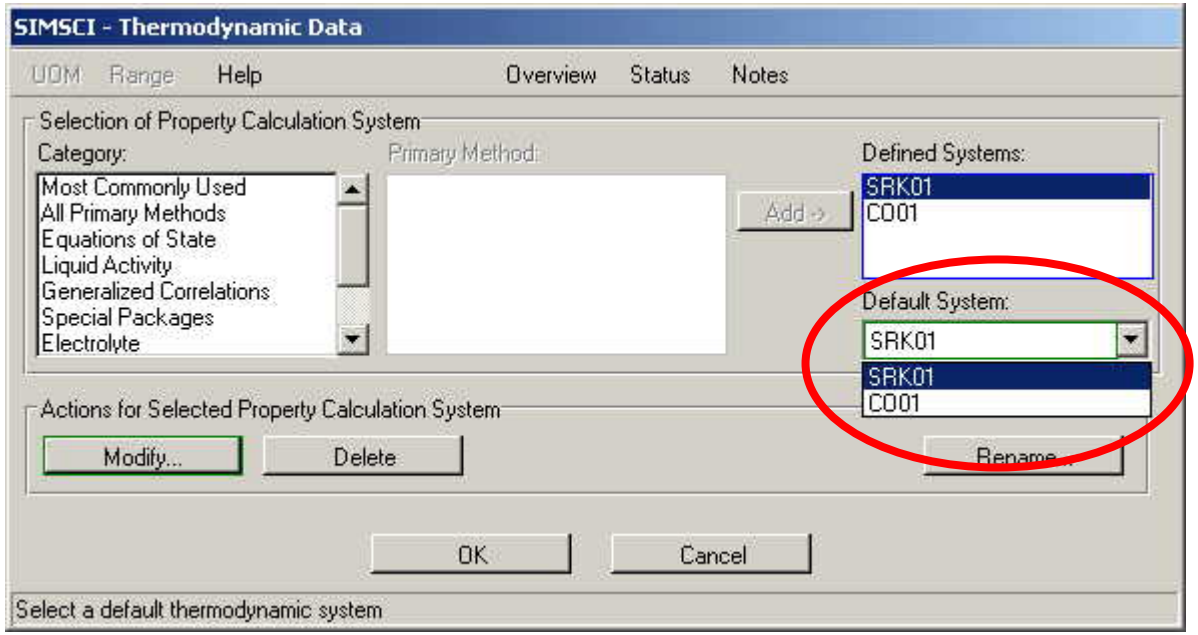
Selecting a CO PP to be used in calculations

- A CAPE-OPEN property package is treated as a PRO/II "thermodynamic system".

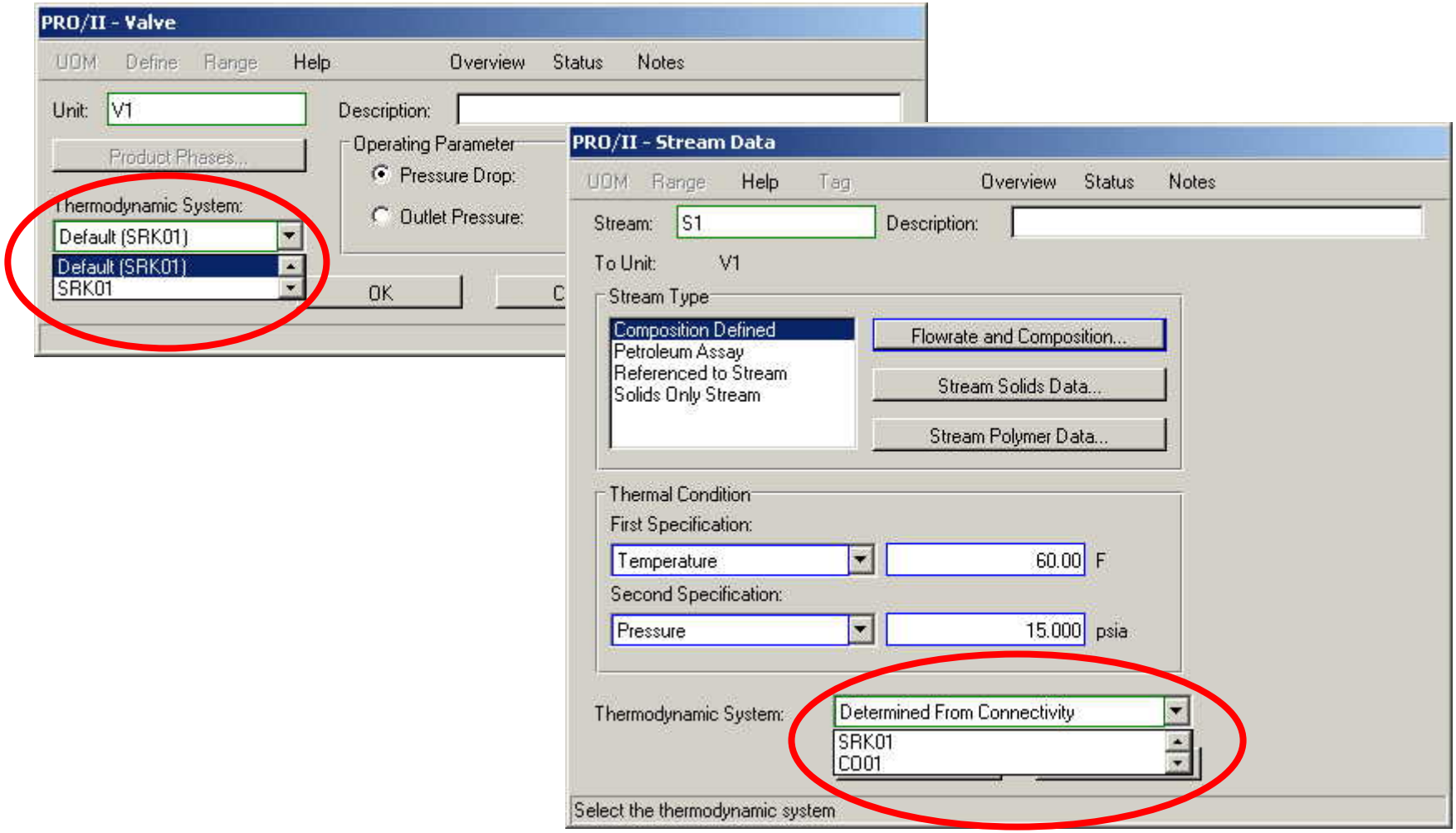
- Wherever the user can select a "thermodynamic system", the user can select a CAPE-OPEN property package
  - Default Thermodynamic System
  - Streams
  - Unit operations

- For a CAPE-OPEN Unit (which may have custom GUI), the "thermodynamic system" option is available on the right-click menu.

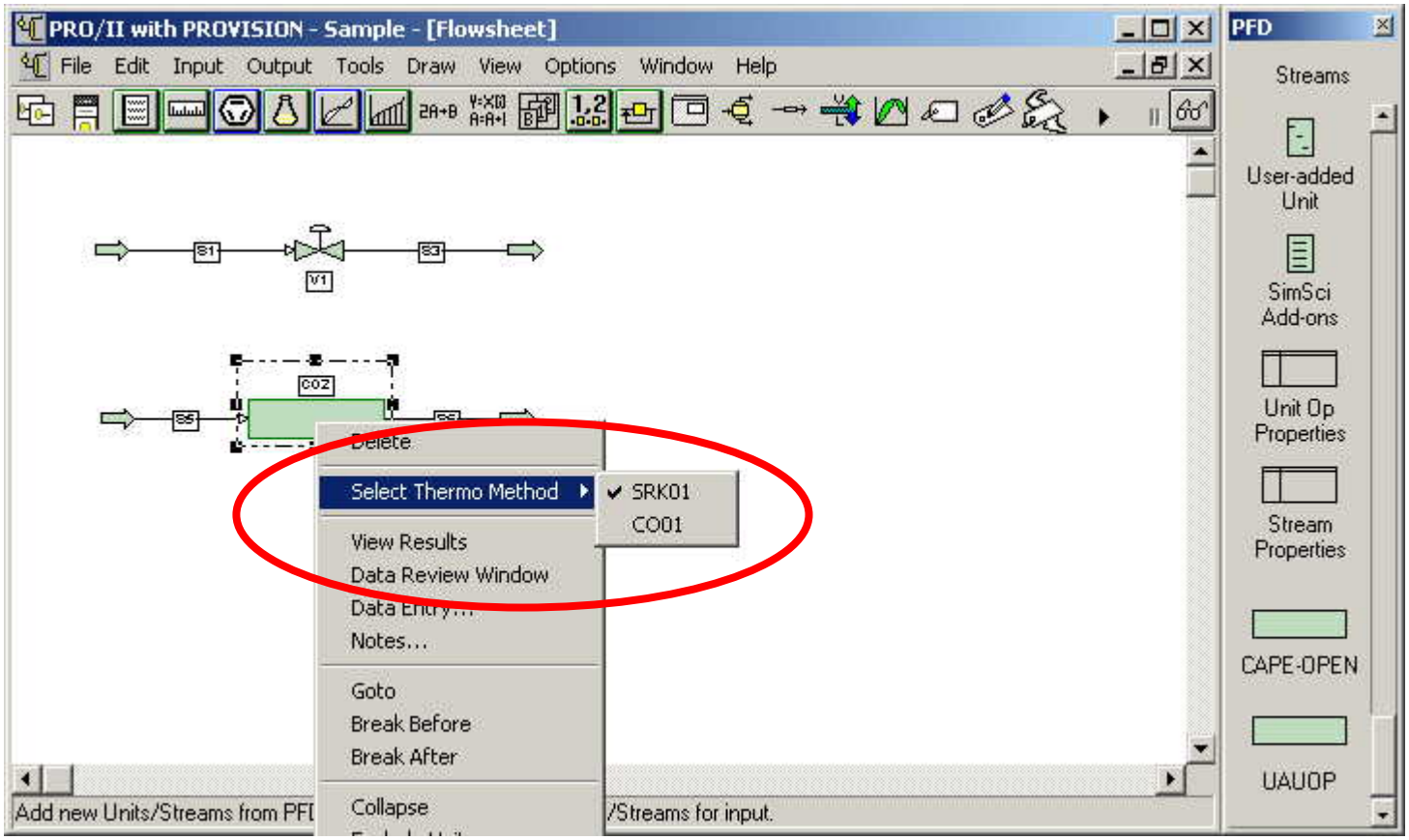
Selecting Default Property Package



Selecting Package for Native Units/Streams



Selecting System for CO Unit



Keyword Support (thermo)

- PRO/II exports and imports CAPE-OPEN software component information

- CAPE-OPEN Property Packages:
  "progid" of Thermo System and name of property package

```
THERMODYNAMIC DATA
  METHOD SYSTEM=SRK, SET=SRK01, DEFAULT
  METHOD SYSTEM=CO, PID=Sample.ThermoSystem.1, &
                    PNAME=COC1C2SRK, SET=CO01
```

Keyword Support (unit operation)

- CAPE-OPEN Unit Operations:
  "progid" of unit operation and persistance file

```
UNIT OPERATIONS
  CAPEOPENUNIT UID=CO1
      PROGID=Sample.Mixer.1
      FEED S1,S2
      PRODUCT S3,S4
      DATAFILE=TEST_CO1.DAT
```

Report Generation

- During report generation, PRO/II prints a table of the values of the CAPE-OPEN unit parameters.

```
SIMULATION SCIENCES INC.          R                                  PAGE P-3
PROJECT                     PRO/II  VERSION 7.1 ELEC V6.6
PROBLEM                                   OUTPUT
                               CAPEOPEN UNIT OP SUMMARY              05/19/05
==============================================================================

                                UNIT 1, 'CO1'

Cape Open Unit Program Id                        Simsci.Mixer.1

Public Unit Parameters                               Values(SI Units)

PRESSUREDROP                                        10000.00
HEATINPUT                                               0.00
SPLITFACTOR                                             0.67
MIXERPRESSURE                                           0.00
```

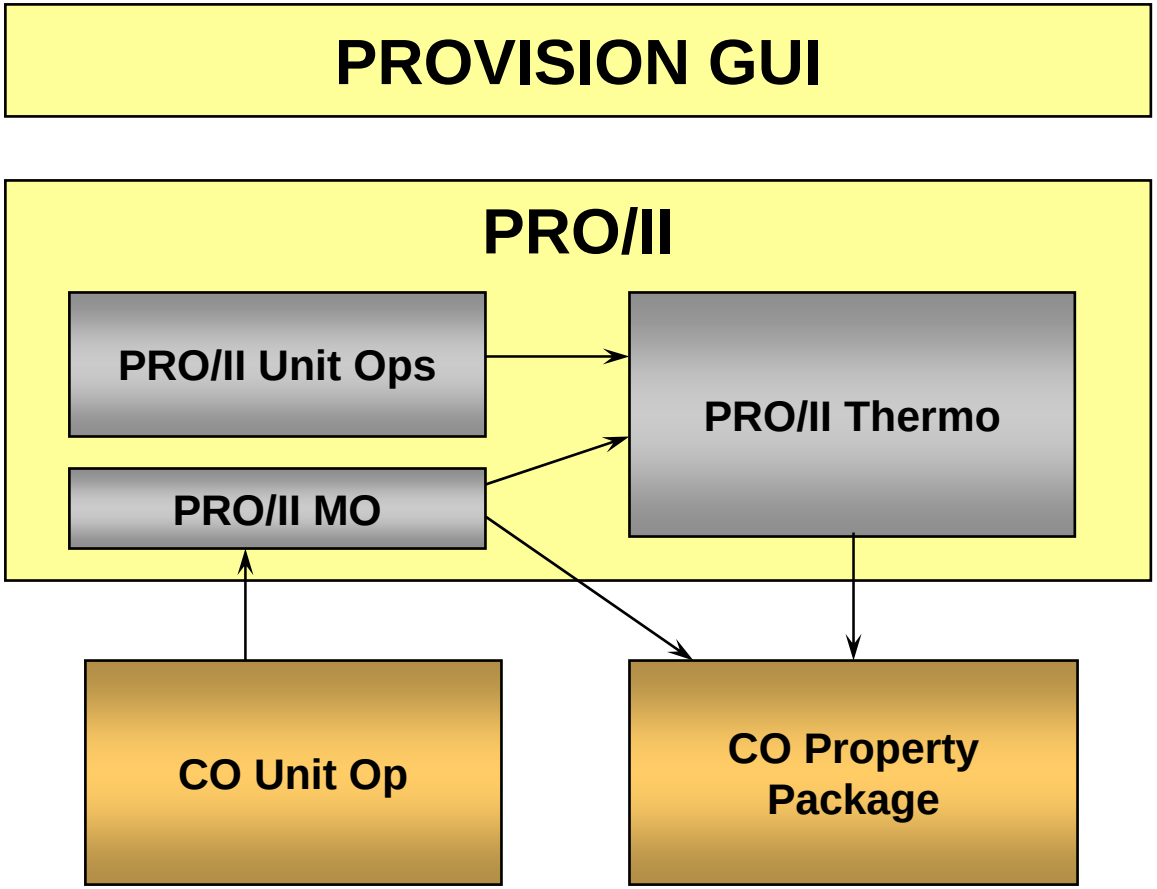
Database Support

- If the CAPE-OPEN Unit operation supports COM Persistence, then PRO/II will save the persisted information into a local file that is zipped up into the “.prz” file.

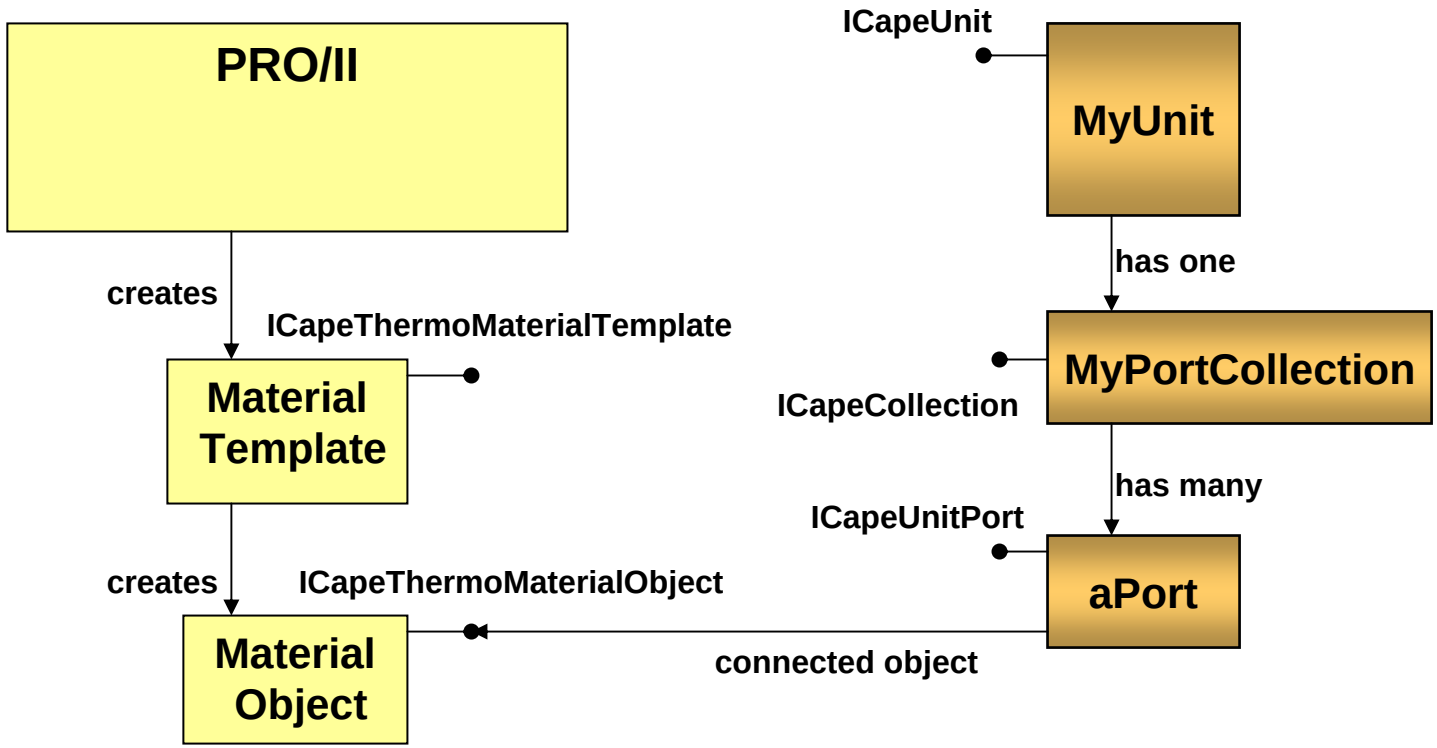
- If the CAPE-OPEN Unit operation does not support COM Persistance, PRO/II retrieves values of all parameters from the CAPE-OPEN unit and saves them in the native PRO/II database.

CAPE-OPEN Architecture in PRO/II

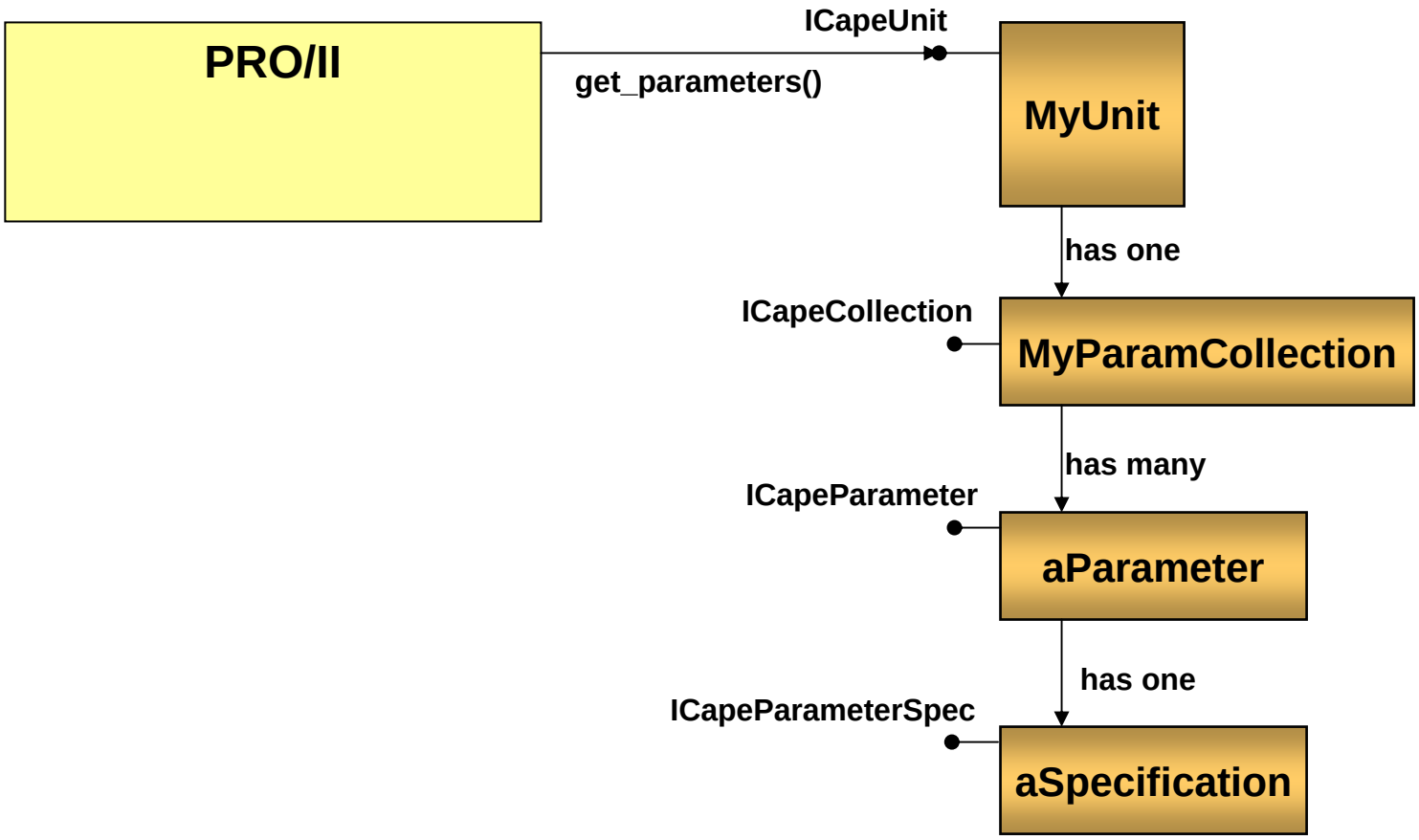
PRO/II-CO Relationships (simplified)



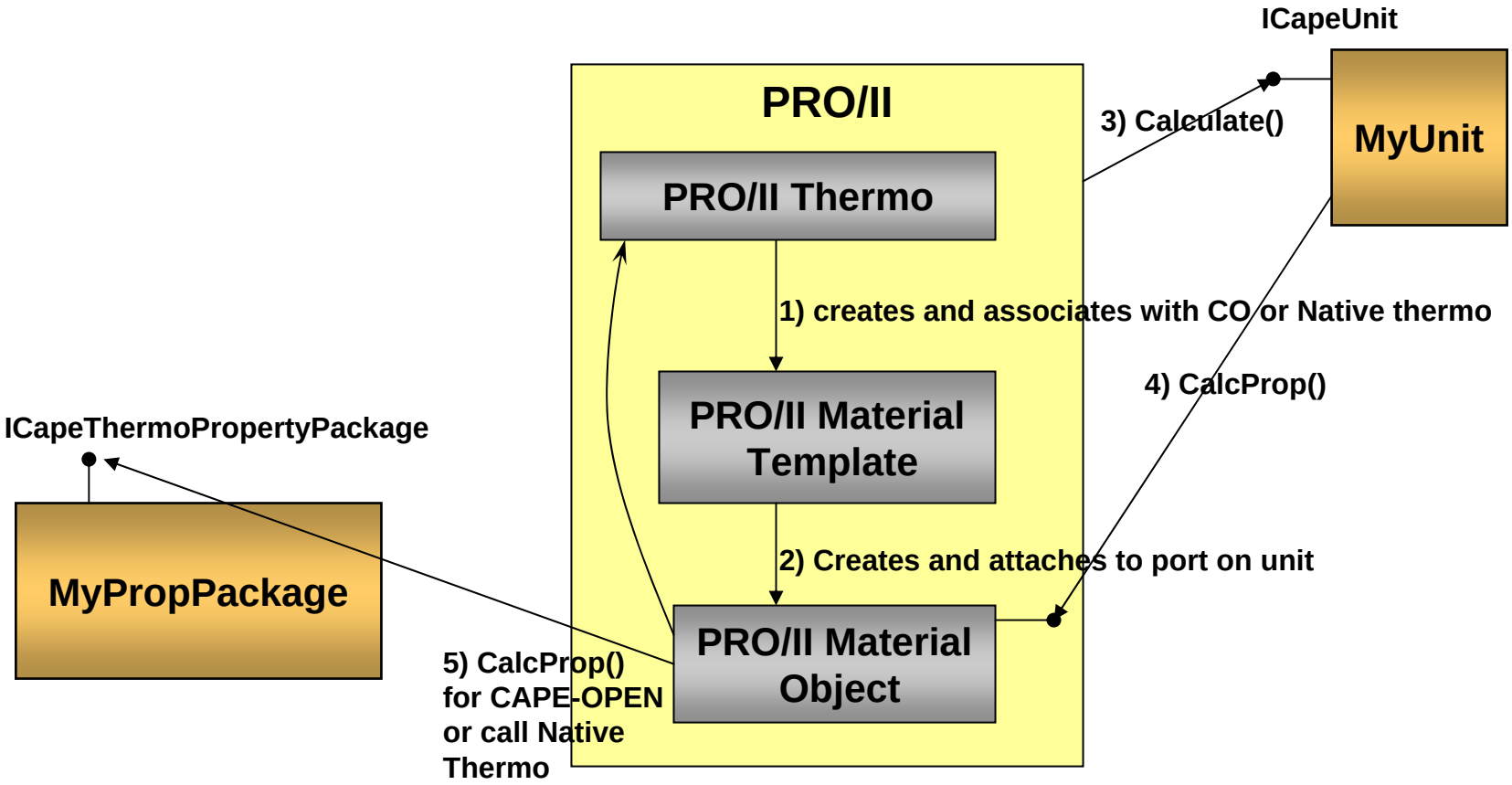
Unit Operations Ports and Streams



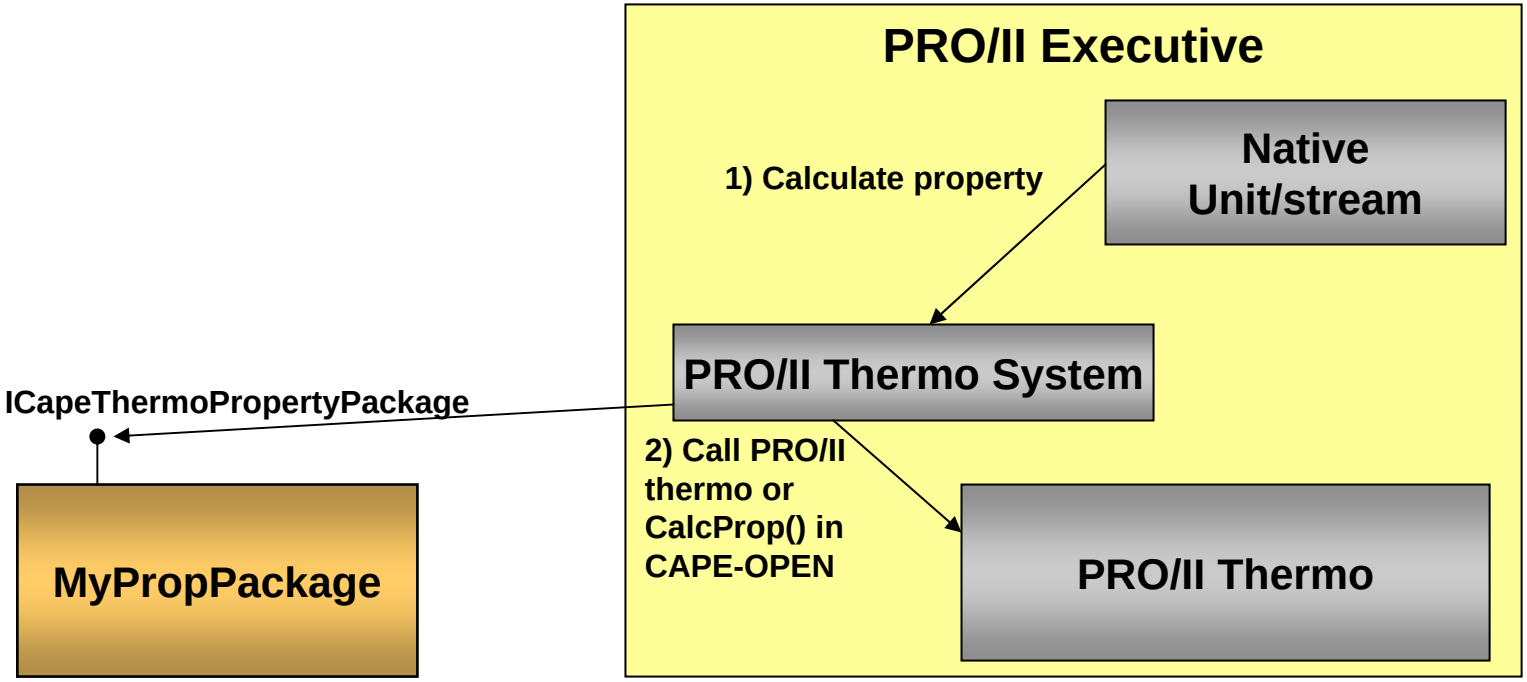
Unit Operation Parameters



Thermo call from CO Unit



Thermo call from PRO/II



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