Methods and Tools
Special Interest Group Report
October 2020 – September 2021

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Disclaimer

The views expressed in this presentation are those of the author and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.

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SIG Membership

Bill Barrett

US EPA

Jasper van Baten

AmsterCHEM

Michael Hlavinka

Bryan Research & Engineering, LLC

If you are interested in joining, please contact either SIG Leader or CTO
- **Bill Barrett – barrett.williamm@epa.gov**
- **Michel Pons - technologyofficer@colan.org**

M&T SIG Ongoing Activities

♦ **Typically, four conference calls per month. Calls are held on Tuesdays at 1600 CET, 1000 US Eastern Time, 0900 US Central Time.**

♦ **Joint Conference call with Interop SIG, typically 3rd Wednesday of the month at 1700 CET, 1600 London Time, 1100 US Eastern Time, 1000 US Central Time.**

M&T SIG Charter

♦ **Improve integration and expand utilization of Computer-Aided Process Engineering (CAPE) applications within the enterprise through identification and resolution of existing cross-cutting issues with the CAPE-OPEN platform, develop mechanisms for use of CAPE within other application domains, and incorporate advances in information technology into the CAPE-OPEN platform.**

♦ **Key responsibilities**
  ➲ **Resolve issues with the common interface specifications.**
  ➲ **Develop and maintain standards and protocols for CAPE-OPEN implementations.**
  ➲ **Incorporate advances in information technology into the CAPE-OPEN protocols.**
  ➲ **Identify novel uses of CAPE and provide standards for utilizing CAPE within these applications.**

No change to vision and responsibilities.

M&T SIG 2021/2022 Summary of Activities

- ♦ **COBIA Maintenance, Development, and Testing**
  - ➲ **Maintenance Releases of COBIA Phase II**
  - ➲ **Scoped and supervised COBIA Phase III Development**

- ♦ **Interaction with Interop SIG**
  - ➲ **Support for distribution of CO-LaN products**

- ♦ **Design/Maintenance of Common Interface Specifications**
  - ➲ **Persistence Interfaces**
  - ➲ **Parameter Interfaces**
  - ➲ **Economics/Currency Interfaces**
  - ➲ **Reporting Interface**
  - ➲ **Manager Interfaces**

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Flowsheet Monitoring Interface

♦ **Revision of Flowsheet Monitoring Textual Specification**
  ➲ Added *FlowsheetValidationStateChanged* Event enumeration value.
  ➲ Updates the *ICapeFlowsheetMonitoringEventSink* interface to use the actual interface type as method arguments in the specification of interface methods instead of *CapeInterface* data type.

♦ **Version 2.1.2 of the TLB/PIA contain these revisions.**

♦ **Flowsheet Monitoring has been implemented in AmsterCHEM's COCO Simulator.**

COBIA Project Roadmap

- ♦ **Phase I – Proof of Concept** **Completed**
  - ♦ **Core technical components**
  - ♦ **Demonstrate COM/COBIA interoperability with Thermo 1.1 interface set**
- ♦ **Phase II – Full Windows Native** **Completed**
  - ♦ **Expanding COBIA to all interfaces of business value**
  - ♦ **Support for C/C++ development.**
  - ♦ **Allow development of fully functional COBIA-based PMEs and PMCs**
- ♦ **Release of Phase II –** **In Use / Active Maintenance**
- ♦ **Phase III – Interoperability** **In-Progress**
- ♦ **Phase IV – Documentation**

COBIA Timeline

- **October 2016 - Phase I (Proof of concept) completed**

- **October 2017 – Phase II (C/C++ Application Framework) status presented and demonstrated**

- **October 2018 – Early adopter's version of COBIA**
  - COBIA Training
  - Testing, bug fixes and third-party use of COBIA

- **April 2019 – MB support for KBC and HTRI development**

- **September 2020 – Release of COBIA Phase II Runtime and SDK for application development**

- **Spring/Summer 2021– Release of Commercial Packages Using COBIA**

- **CURRENT:**
  - Maintenance Releases of COBIA Phase II
  - Phase III Development

2020/2021 COBIA Phase II Activities

♦ **Currently Used By:**

➲ **April 2021: AmsterCHEM Python Unit Operation**

➲ **July 2021: KBC released Multiflash® version 7.2**

➲ **August 2021: HTRI released Xfh® Ultra 3.0**

➲ **Shell Heavy Paraffin Conversion Model**

♦ **Active Maintenance**

➲ **October 2020: Initial release of Phase II (version 1.2.0.0)**

➲ **February 2021: Version 1.2.0.1**

➲ **…**

➲ **October 2021: Version 1.2.0.8**

♦ **Updated Symbol Server @ https://symbols.colan.org**

COBIA Phase III Work Packages

♦ **M&T SIG defined scoping of COBIA Phase III under four Work Packages. The last three work packages build Work Package 1 (Marshaler) and can be performed concurrently, with concurrent deliverables. The Work Packages are:**

  ➲ **Marshaler Work Package (Jasper to present)**

  ➲ **Language Binding Work Package**

  ➲ **Remote Computing Work Package**

  ➲ **Logging Work Package**

♦ **Initiated Phase III Development**

  ➲ **Jasper to present Marshaling and Threading Models**

COBIA Phase III Language Binding Work Package

- ♦ **Code generators**
  - ⮩ **Distributed through the COBIA Software Development Kit**
  - ⮩ **Adapts the COBIA runtime to the targeted languages**
  - ⮩ **Supports COBIA development and execution of COBIA based applications in the target language.**
- ♦ **Deliverables:**
  - ⮩ **COBIA runtime**
  - ⮩ **COBIA SDK support for targeted programming languages.**
- ♦ **This Work Package builds upon the Marshaler Work Package.**

♦ **The M&T SIG conducted a suitability analysis of candidate programming languages considering:**

➮ **Applicability of the programming language to computer-aided process engineering (CAPE)**

➮ **Ease of developing and maintaining the language binding.**

➮ **Feedback from the attendees of the CAPE-OPEN 2020 Annual Meeting.**

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COBIA Phase III Language Bindings (2 of 2)

♦ **C Application Binary Interface (ABI) (9)**
  ➲ **Low-level binary/native interfaces**
  ➲ **May serve as a basis for Python and FORTRAN bindings**

♦ **Python (15)**
  ➲ **User familiarity - Widely used in scientific/engineering computing**
  ➲ **Extensive ecosystem of mathematical libraries and scientific packages**
  ➲ **Possible use as a common prototyping/scripting language**

♦ **FORTRAN (10)**
  ➲ **Significant number of legacy CAPE applications are written in FORTRAN**
  ➲ **Language bindings to FORTRAN-90 will enable continued use of these libraries**

♦ **Microsoft .NET (5)**
  ➲ **Used for the development process simulation software**
  ➲ **Primary languages used for .NET development are C# and Visual Basic.**
  ➲ **Provides support for all .NET languages.**

Number of CO-LaN members supporting the choice is listed in parentheses by each programming language.

COBIA Phase III Remote Computing and Logging Work Packages

♦ **Remote Computing Work Package**

➲ **Extends the marshalers to access objects on remote computers either within an enterprise network or cloud computing environments.**

♦ **Logging Work Package**

➲ **Allows logging calls over the COBIA pipeline.**

➲ **Enables CO-LaN to develop a logging application that can identify and subscribe to desired log-able events.**

Anticipated 2021/2022 Activities

♦ **Maintenance of COBIA Phase II**

♦ **COBIA III Work Packages**
  - ⊃ **Scope Work Package Requirements**
  - ⊃ **Supervise COBIA Development**
  - ⊃ **Review COBIA Work Package Products**
  - ⊃ **Advise Management Board on Development**

♦ **COBIA IV Documentation**
  - ⊃ **Developer's Guide**
  - ⊃ **Technical Specification**

♦ **Interface Specifications**
  - ⊃ **Persistence**
  - ⊃ **Parameters**
  - ⊃ **Reporting**
  - ⊃ **Managers**

♦ **Work with Interop SIG**
  - ⊃ **Protocols for Testing and Evaluation of COBIA**
  - ⊃ **Advise on the Design of Certification Tools**
  - ⊃ **Support for Development of Installation Packages**

♦ **Any Questions?**