

Metal Finishing Pollution Prevention Application

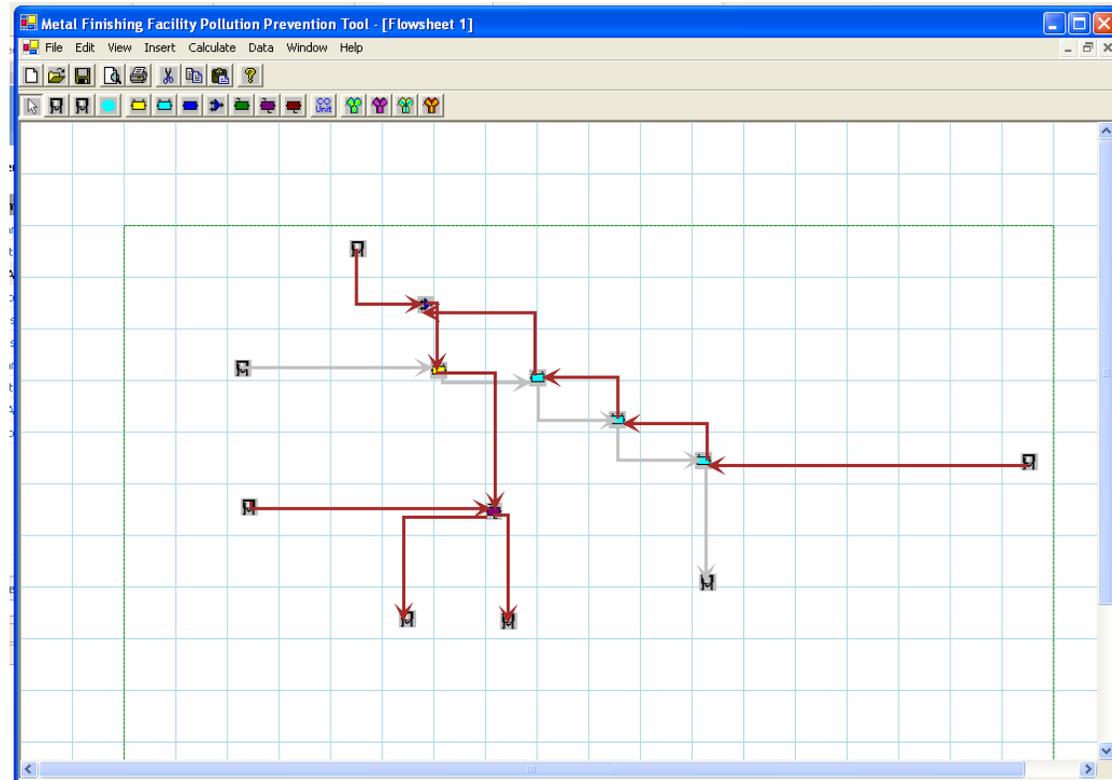
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What is MFFP2T

- Metal Finishing Facility Pollution Prevention Tool
- Currently consists of a process simulator.



Benefits of Pollution Prevention

- Reduce Operational Costs
 - Waste Disposal
 - Waste Treatment
 - Raw Materials (Atom Efficiency)
 - Processing/Labor
- Reduce Environmental Impacts
 - Less Wastewater Discharged
 - Less Hazardous Waste Generated



Common Concerns About Pollution Prevention at Metal Finishing Facilities

- Economic Concerns
 - High Cost of Implementation
 - Other Shops Can Undercut Prices
- Product Quality May Decrease
- Lack Of Employee Participation
- Lack of Knowledge of P2 Technologies
- Lack of Time to Evaluate Options

Source: Schwartz and McBride (1997) , Environmental Engineering Science, 14(4):227



Reasons to Use Process Modeling To Evaluate P2 Options

- Does Not Require Investment In Hardware
- Evaluate Changes In Operating Conditions of Existing Processes Without Interrupting Production
- Evaluate Costs Of Implementation And Return On Investment
- Evaluate Multiple Options Quickly



CAPE-OPEN

- COM and CORBA Interface Specifications for Chemical Process Simulation
- Interfaces available include Unit Operations and Material Objects
- Allows Different Applications to Use Common Process Simulation Components
- Use of CAPE-OPEN interfaces facilitate the use of chemical process simulation to help solve broader problems, such as pollution prevention.



Middleware Specifications

- Microsoft Component Object Model (COM)
 - Primarily Windows-Based
 - An outgrowth of Object Linking and Embedding (OLE)
 - Active X Control
- Object Management Group's (OMG's) Common Object Request Broker Architecture (CORBA)
 - More Common on UNIX Systems
 - Different Object Brokers May Be Incompatible

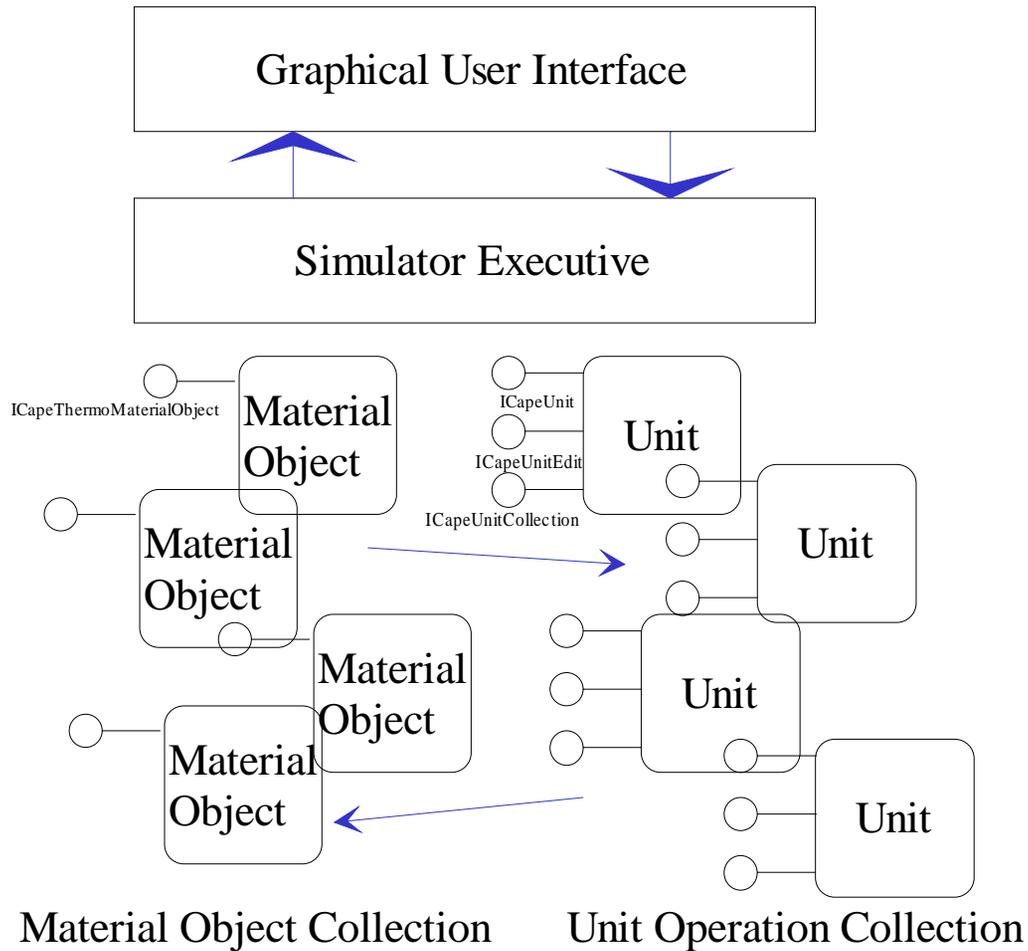


Why .NET?

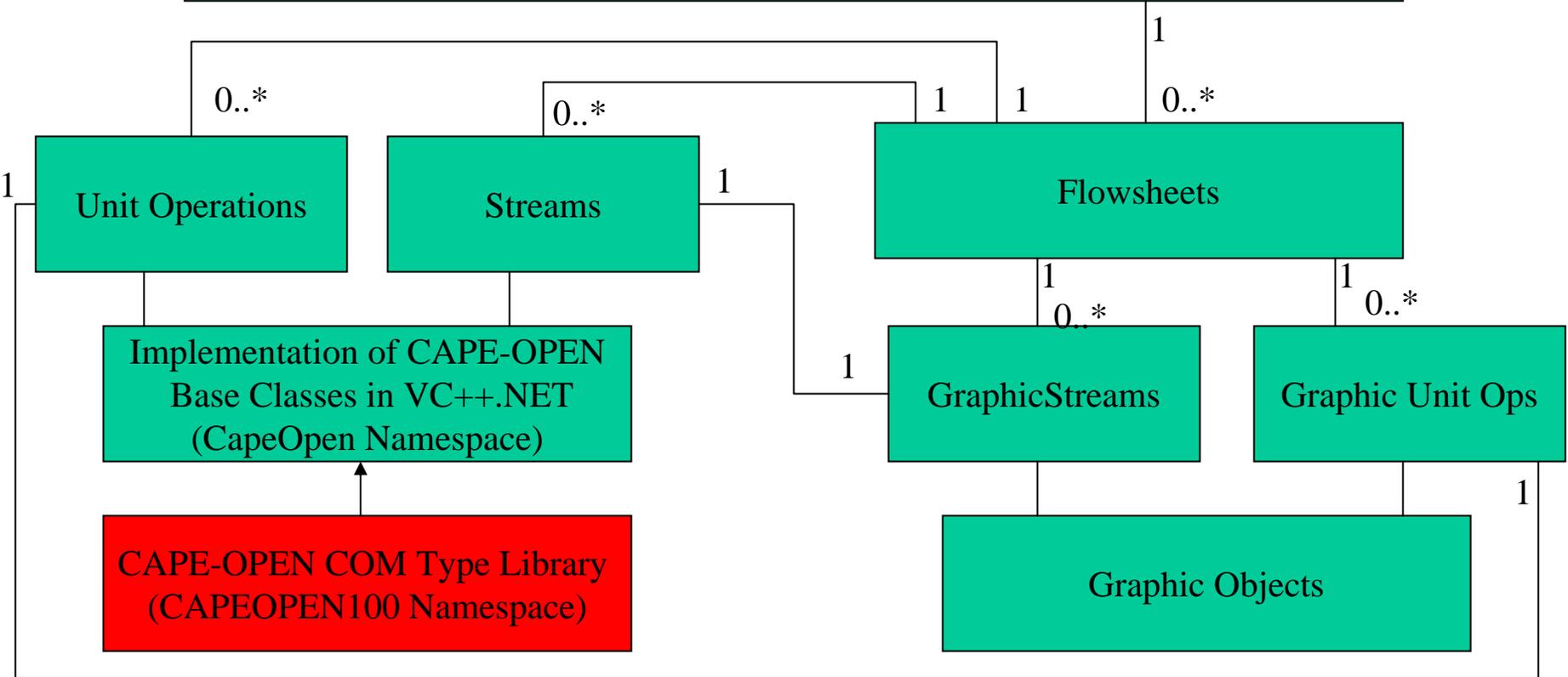
- .NET is essentially COM version 2.
- ECMA/ISO Standards for C#, CLI, and C++/CLI
- COM Interoperation – “It Just Works” or IJW
- Objects are defined by Types, not Interfaces.
- Structured Exceptions, not HRESULTS
- Cross Platform via the Open Source Mono Project which is developing .NET classes and C# compiler for Unix/Linux/Mac OS.
- XML Web Services and SOAP built in.



Simulator Modules and Interfaces



Application Architecture



Unit Operation Objects

- Inherit From CCapeUnit Base Class
 - Implements ICapeUnit, ICapeUtilities, and ICapeIdentification Interfaces Required by CAPE-OPEN.
 - Creates Port and Parameter Collections
- Users only need to implement “Calculate” method.



CCapeThermoMaterialObject

- EPA Implementation of ICapeThermoMaterialObject Interfaces.
- Members: Temperature, Pressure, Flow, Component Data Table.
- Inherited for Implementation of Specialized Material Objects (e.g. CAqueousMaterialObject).
- Refers to a CapeThermoPropertyPackage Object that is a chemical Property Database.



CCapeThermoPropertyPackage

- Chemical Property database implementing ICapeThermoPropertyPackage interface.
- Chemical data stored in data table object.
- Chemical property recovered by name.
- Data is currently at standard state.
- Data is serialized to/from a file as XML.
- The base class must be specialized to include temperature/pressure/concentration dependence and equilibrium calculations.



Current Status of MFFP2T

- EPA is currently testing the simulation package and our metal finishing unit operations against an operating plant.
- Currently updating code to be verifiably type-safe for use over internet.

