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A .NET Interface for Channel Access

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Motivation

CA clients for the commissioning of ALICE and MICE are currently hosted on Linux PC consoles running a Scientific Linux operating system.

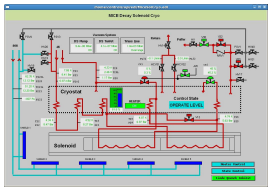

Figure 1: EDM screen from the MICE control system

We will be migrating to the Microsoft Windows platform for ALICE operations and for the later phases of the MICE project. The EMMA non-scaling Fast Field Alternating Gradient (FFAG) accelerator currently under construction at Daresbury will also be integrated into the ALICE control system and utilise CA client software on the Windows platform.

Microsoft .NET Framework

The Microsoft .NET Framework is a software technology that is available with several Microsoft Windows operating systems. It includes a large library of pre-coded solutions to common programming needs and a virtual machine that manages the execution of programs written specifically for the framework.

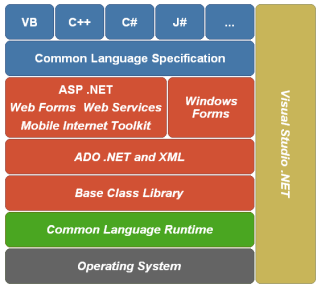

Figure 2: Diagram of the Microsoft .NET Framework

Applications developed using the .NET Framework execute in a software environment that manages the application's runtime requirements. Also part of the .NET Framework, this runtime environment is known as the Common Language Runtime (CLR). The CLR provides the appearance of an application virtual machine so that programmers need not consider the capabilities of the specific CPU that will execute the program. The CLR also provides other important services such as security, memory management, and exception handling. The class library and the CLR together compose the .NET Framework.

Architecture

Creating the .NET Channel Access interface using the Platform Invocation Services provided by the Microsoft .NET Framework allows managed code within .NET applications to call unmanaged code within the native CA libraries. Following this approach allows the .NET CA implementation to be divorced from the internal implementation of CA within EPICS base.

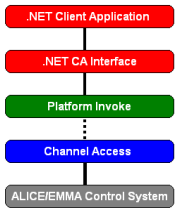

Figure 3: Architecture of a .NET CA client application

Platform Invocation Services

Platform Invocation Services, commonly referred to as just P/Invoke, is a feature of Common Language Infrastructure implementations, like Microsoft's CLR, that enables managed code to call native code in DLLs.

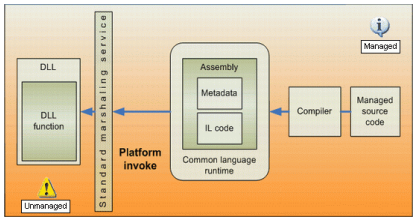

Figure 4: Diagram of .NET Platform Invocation Services

P/Invoke has been used to create a comprehensive CA implementation for the .NET platform. The .NET CA interface makes use of function calls to the EPICS 3.14 implementation of CA.

Provided the interface exposed by the CA implementation of future versions of EPICS base remains consistent, then the .NET CA interface can be built and run against any 3.14 or above version of EPICS. This approach also enables the .NET CA interface to be independent of any changes to the internal implementation of CA in EPICS base. Any improvements or bug fixes applied to the CA libraries of EPICS base libraries can immediately be taken advantage of by linking the .NET CA interface against the new version of the CA libraries.

Applications

The .NET CA interface with a class library and components built on top of it are currently being used to generate client applications for the ALICE control system. In the future it is intended to develop more generic Windows applications for EPICS using the .NET CA interface. These would include applications for alarm handling, archive data retrieval and real-time plotting, backup and restore tools etc.

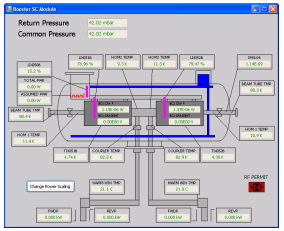

Figure 5: An example of an ALICE client created using the .NET CA interface

ALICE & EMMA

Accelerators and Lasers In Combined Experiments (ALICE), is a 35 MeV superconducting energy recovery linac currently being commissioned at Daresbury Laboratory. ALICE will be extended by adding a 19-cavity accelerating non-scaling FFAG ring, known as Electron Machine with Many Applications (EMMA).

The control system for ALICE uses the Experimental Physics and Industrial Control System (EPICS) and vxWorks on VME64x. This control system will be extended to include EMMA and the .NET CA interface used to build applications for the operation of both accelerators.

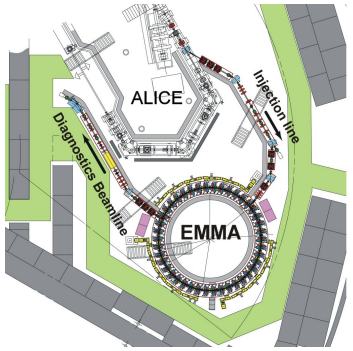

Figure 6: EMMA extension to ALICE