Development of a Common ChemStation Architecture

The HP CE user interface is based on a common HP ChemStation architecture. The architecture and many software components are shared with ChemStations previously developed for other analytical techniques. For example, because most of the HP CE ChemStation functionality is identical with the high-performance liquid chromatography (HPLC) ChemStation (automation, data acquisition, processing of measured data from the detector, and reporting), about 80% of the HPLC ChemStation code was reused. This article describes the evolution of this common software architecture and the core software components.

The term ChemStation was created to describe the use of a workstation as a tool for an analytical chemist. Independent of the analytical technique, the user works with a ChemStation to control the analysis system, acquire measured data, process the data, and create the analysis report. In addition, these complex functions must be fully automated for unattended operation. As PCs became very popular for the chemist's desk as well as in the analytical laboratory, HP product generation organizations, together with a system development group, defined the following objectives:

- Develop a ChemStation architecture based on the Microsoft® Windows platform.
- Develop reusable components from which various products can be assembled.
- Develop selected architecture-neutral components to be used for other data system platforms (e.g., UNIX® system-based workstations).

The architecture for the ChemStations is based on the available Windows technology. The development environment is based on the Microsoft development tools (C, C++, MS foundation classes, etc.). Both the Windows platform and the environment have evolved significantly during the last couple of years.

Because the common software components were developed by an international team, an appropriate infrastructure was set up to support the engineers working at two sites, one in the U.S.A. at Wilmington, Delaware and one in Waldbronn, Germany. A history management system (HMS), telephone conference equipment, small decision making groups, and system build processes were defined and implemented. The product development program was set up so that the software development groups were not isolated from the instrument development groups.

The infrastructure as it exists today is much different from the way it was defined in the beginning. As we learned how to deal with such a complicated environment, we went through several steps with the infrastructure and the organizational structure to make sure that the various software product generation groups were linked together.

The architecture and the development of the ChemStation products also went through several evolutionary steps. We always focused on clear product examples during the development of the core components. This approach made sure that the software development met the instrument requirements for the various analyical techniques. We also had to maintain the architecture and the core components according to the fast-changing Windows platform technology.

The first step was to introduce software products for HPLC, HPCE, and UV/Vis instruments. All these software products were built on the available common software components. As an example, the analytical language processor, a BASIC-like language, is used in all the products as a common key component. In a second step we went further and built one core software product supporting HPCE, GC, HPLC, and analog-to-digital converters. "Plug and play" modules specific to various instruments and analytical techniques can be added to the core software product. This is the basis for the recently introduced multitechnique ChemStation, which provides control, automation, and data handling for up to four GC, LC, or CE instruments and an optional analog-to-digital interface. This product is always delivered with the core software and an individual module for one specific analytical technique. If the customer wants to add another instrument, either for the same analytical technique or to combine techniques (for example, HPLC with CE), another module can be ordered and installed to work with the core.

This approach is very efficient and highly appreciated by our customers and field people. If the customer knows how to operate one product it is easy to operate the ChemStation for another analytical technique. The customer can concentrate on the analytical technique and always finds the same user interface. Other techniques, such as UV/Vis, SFC, and so on, share all the common components from the core and therefore are on the same architecture.

This approach has resulted in a very high reuse level—between 65% and 85%—and ensures that all the products meet high quality standards with a reasonable amount of testing and software validation effort.

Development of the common ChemStation architecture was only possible through the involvement and cooperation of many people throughout various HP organizations, who deserve a great deal of credit for these achievements.

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