CHAPTER 2: CIM ARCHITECTURE

2.1 CIM Architecture Overview

To develop a comprehensive CIM strategy and solutions, an enterprise must begin with solid foundations such as CIM architecture. A CIM architecture is an information systems structure that enables industrial enterprises integrate information and business processes. It accomplishes this first by establishing the direction integration will take; and second, by defining the interfaces between the users and the providers of this integration function.

The chart (Figure 2.1) illustrates how a CIM architecture answers the enterprise’s integration needs. As you can see here, a CIM architecture provides a core of common services. These services support every other area of the enterprise—from its common support functions to its highly specialized business processes.

2.1.1 Three key building blocks

The information environment of an industrial enterprise is subject to frequent changes in systems configuration and technologies. A CIM architecture can offer a flexible structure that enables it to react to these changes. This structure relies on a number of modular elements that allow systems to change more easily to grow along with enterprise needs.

And as you can see from the chart on the facing page, the modular elements that give a CIM architecture its flexible structure are based on three key building blocks:

• *Communications*—the communication and distribution of data.

• *Data management*—the definition, storage and use of data

• *Presentation*—the presentation of this data to people and devices throughout the enterprise
Utilizing these building blocks, a CIM architecture can provide a consistent base for integrating the enterprise’s product, processes and business data. It can define the structure of the hardware, software and services required to support the enterprise’s complex requirements. And it can translate this information into a form that can be used by the enterprise’s people, devices and applications. In the following sections we will examine the advantages each of these building blocks brings to the CIM environment.
2.2 Communications in the CIM environment

Communications or the delivery of enterprise data to people, systems and devices is a critical aspect of a CIM architecture. This is because today’s industrial environment brings together a wide range of computer systems, technologies, system architectures, operating systems and applications. This range makes it increasingly difficult for people and machines to communicate with each other especially when they describe and format data differently.

IBM has long recognized this need to communicate data across multiple environments. Our first response was developing Systems Network Architecture (SNA) in the 1970’s. SNA supports communication among different IBM systems, and over the years it has become the standard for host communications in many industrial companies. However, in the CIM environment communications must be even more integrated. It must expand beyond individual areas, throughout the entire enterprise, and beyond—to customers...to vendors...and to sub-contractors.

Communications in the CIM environment will involve a wide range of data transfer, from large batches of engineering or planning data to single-bit messages from a plant floor device. Many connectivity types and protocols must be supported to enable the enterprise’s people, systems and devices to communicate. This is especially true in cases where response time is critical, such as during process alerts.
Figure 2.2: Communications in the CIM environment
2.3 Plant floor communications

Let’s examine one area where communications can be extremely challenging the plant floor. This is due to the wide range of manufacturing and computer equipment that has been used to manage the various production tasks over the decades.

IBM solution for communicating across these systems is the IBM Plant Floor Series, a set of software products. One of these products, Distributed Automation Edition (DAE), is a systems enabler designed to provide communications functions that can be utilized by plant floor applications. These functions include:

- Defining and managing networks
- Making logical device assignments
- Managing a program library
- Queuing and routing messages
- Establishing alert procedures
- Monitoring work-cell status

These functions enable Distributed Automation Edition to assist manufacturing engineers as they select or develop application programs to control work-cell operations and provide communications capabilities between area- and plant-level systems.

DAE supports several communications protocols to meet the needs of a variety of enterprises. For example, it supports SNA for connections to plant host systems and the IBM PC-Network as well as the IBM Token- Ring protocol and Manufacturing Automated Protocol (MAP) for plant floor communications. MAP is the evolving plant floor communications industry standard, adopted by the International Standards Organization (ISO) for communications among systems provided by different vendors.
Figure 2.3: Plant Floor Communications
2.4 Managing data in the CIM environment

The second building block of a CIM architecture is data management. This includes how data is defined, how different data elements are related, where data is stored, and who has access to that data. Data management is particularly critical in today’s industrial environment, since there are so many different data bases, formats, and storage and access techniques.

Standards are evolving. For example, Structured Query Language (SQL) provides a consistent way for relational data base applications and users to access a data base. Unfortunately, there is a significant amount of data that exists today in other data base technologies that is not accessible by current standards that where data management within a CIM architecture can help.

Data management defines and records the location of the data created and used by the enterprise’s business functions. Data management also means enabling users to get the data they need—with out having to know where this data is located.

Relationships among several data elements must be known if data is to be shared by users and applications. In addition, other data attributes are important when sharing data. These include the type of data (text, graphics, image), its business status (working, review, completed), and the source of this data (person, application, or machine).

In a CIM architecture, data management can be accomplished through three individual storage functions:

- The data repository
- The enterprise data store
- The local data files

Some of the key data management functions—the repository, for example—are already being implemented by the Consolidated Design File (CDF) established through the IBM Data Communication Service (DCS).

The Consolidated Design File operates on a relational data base and is built on SQL. One example of its use is as an engineering data base to integrate CAD/CAM applications with the business needs of the engineering management function. In this environment, IBM’s DCS/CDF provides the following repository functions:

- Transforming data to a user-selected format
- Storing CAD/CAM data
- Adding attributes to CAD/CAM data
- Enabling users to query data and attributes

DCS/CDF also provides communications functions in order to transfer data between the repository and CAD/CAM applications.
Figure 2.4: Managing Data in CIM Environment
2.5 Presentation in the CIM environment

Presentation in the CIM environment means providing data to and accepting data from people and devices. Of course, this data must assume appropriate data definitions and screen formats to be usable.

Because today’s industrial enterprise contains such a wide array of devices and information needs, it must have a consistent way to distribute and present information to people at terminals or workstations, machine tools, robots, sensors, bar code readers, automated guided vehicles, and parts storage and retrieval systems. The range of this information covers everything from simple messages between people to large data arrays for engineering design applications. It may originate from a CIM user in one functional area of the enterprise and be delivered to a CIM user or device in another area.

In today’s environment, presentation occurs on displays that utilize different technologies. Some are non-programmable terminals, some are programmable workstations, and are uniquely implemented for each application. As a result, the same information is often treated differently by individual applications.

For example, the same manufactured part may be referred to as a part number in a bill of material application in Production Planning...as a drawing in Engineering’s CAD application...and as a routing in a paperless shop order application from Plant Operations. As data is shared across the enterprise, it must be transformed into definitions and formats that support the needs of each individual user and application. And applications must be able to access shared data, collect the required information, and then format that information for delivery.
Figure 2.5: Presentation in the CIM Environment