This article provides basic knowledge about Common Information Model (CIM) and explains how CIM works on IBM® i. It helps you understand CIM and the Web Based Enterprise Management (WBEM) technology, and briefs the relationship between the standardized technology and IBM i.

What is CIM

If you are new to CIM with IBM i knowledge, you are in the right place. CIM provides a standard way to model and expose management information. CIM has been available on IBM i since V5R4 by loading the IBM Universal Manageability Enablement (UME) licensed program, and 5770-UME license program is included in IBM i 6.1 and IBM i 7.1 with enhanced functions. Currently, it is free for use and is mainly used as an agent of IBM Systems Director to retrieve and monitor IBM i resources.

CIM is one of the core standards of WBEM. WBEM is the set of management and Internet standard technologies that defines how data can be exchanged between the ever increasing disparate networks, devices, and applications used in today’s IT environment. The Distributed Management Task Force (DMTF) defines the standards for WBEM, which includes CIM that can promote multivendor interoperability (and this is the base goal of WBEM). On IBM i, CIM is a specific product that is delivered. Combining CIM with the other products that IBM i provides, the complete WBEM solution can be provided. Often, WBEM functions are simply referred to as CIM. An example from Systems Director is CIM monitors. To obtain that CIM information, many of the other standards defined by WBEM are used but the function is referred to as CIM.

CIM or the more global WBEM provides a rich management interface and tasks that IBM i applications can use to resolve management complexity. As today’s IT environment becomes more flexible to meet various business needs, IT management is challenged to protect existing investment and rapidly accommodate change without increasing administrative cost. This complexity and challenge make it easy to overwhelm a system administrator. Figure 1 shows some example tasks that an administrator might be responsible for.
Figure 1. Example of administrator tasks

The work becomes tedious and difficult especially with heterogeneous systems in a data center. All storage, system, networks, printers, desktops, databases, and applications have their own unique interface. This makes it difficult for an administrator to remember or adapt to the differences.

CIM is an object-oriented model which is designed to provide a framework to describe various management data. Managed Object Format (MOF) is used by CIM as the description language to construct the CIM schema. The CIM schema supplies a set of classes with properties and methods to standardize the understanding and transfer of information. The CIM schema categorizes management data into the areas shown in Figure 2. You can always gain the CIM schema information from the DMTF website.
Various heterogeneous systems, such as servers (or desktop, mobile, and so on) produced by different corporations with different architecture can have a uniform format with CIM schema identification. Figure 3 contains an example of a computer and operating system resource model. CIM uses the same expression format as Unified Modeling Language (UML). You can find information about Core Model and System Model (referred in Figure 3) in the DMTF website.

IBM i extends the model by adding IBM i specific properties to the standard CIM_ComputerSystem, CIM_OperatingSystem, and CIM_FileSystem classes. For example, CIM_ComputerSystem defined properties, such as Name, MachineTypeModel, and MachineSerial are the commonly used
logical concept to IBM Power Systems™, IBM System x®, or others. Properties, such as ProcessorCUoD and MemoryCUoD (CUoD means Capacity Upgrade on Demand) that are defined by IBMOS400_ComputerSystem are IBM i specific concept. With these, a user can understand both platform-independent information and IBM i specific concept.

CIM resolves the model issue, while WBEM defines a set of management technology in a distributed environment. WBEM exchanges CIM information by defining protocols, operations and discovery technologies. The protocols, operations, and discovery mechanisms are also platform-independent. In addition to CIM schema and WBEM technology, DMTF also defines a series of profiles and initiatives. A profile is composed of a set of CIM classes, properties, and methods, and is intended to resolve model issues for a specific management domain. For example, the DSP1054 Indication Profile is used to model how to notify a listener that an event had occurred. It includes major CIM classes, such as CIM_Indication, CIM_IndicationSubscription, CIM_IndicationFilter, CIM_ListenerDestination, and so on. The CIM classes, methods, and properties together define the implementation and can be referenced in related use cases. The management initiative is designed to deliver a solution for a specific area of a vertical market. It includes a set of profiles and applicable WBEM specifications. WBEM works with CIM to provide an end-to-end management solution. It is a platform and programming language independent solution with well-defined resource model.

How CIM and WBEM works

Let us first understand the position of CIM and WBEM within IBM i by reviewing Figure 4. CIM and WBEM work as middleware to support some management products. They use CIM and WBEM to retrieve hardware and software inventory information, monitor events, or even change system behavior by CIM service or method.

Figure 4. CIM and WBEM position in IBM i
The CIM and WBEM architecture is shown in Figure 5. The client using the CIM/WBEM technology can communicate with the CIM/WBEM server without a system-dedicated interface to use. The information is exchanged, expressing as a standard-defined data model, and the user does not require focus on the information exchange method as it is also standardized by WBEM. This relieves users from the specific communication method and data model, allowing them to focus on the real management requirements.

**Figure 5. CIM and WBEM high-level architecture**

Benefits of using CIM
Now, let us review the characteristics and benefits of CIM and WBEM. They are summarized in Figure 6.

**Figure 6. Characteristics of CIM and WBEM**

- First of all, **CIM is a standard-based technology**. Considering the CIM characteristic, it is independent of platform, programming language, and information model. If you are going to
manage heterogeneous systems, CIM would benefit you with a consistent and standardized method. As the interface is consistent, an administrator can get rid of the vendor-specific interface.

- **CIM is extensible.** IBM i has extended the DMTF CIM schema, and used it to model the IBM i resources data in a relatively standardized data structure. Using performance metrics as example, the CIM models most of performance metrics with the DSP1053 Base Metric Profile on IBM i. If you can dynamically retrieve these metrics, you need not change anything because the new, supported performance metrics can be monitored automatically. It benefits by time to value, as long as IBM i supports the new capability in the CIM provider.

- **CIM is still in evolution.** You can find many CIM profiles emerging or updating with new versions. The changes reflect various new focus areas (such as cloud computing, virtualization, and so on) in system management area. There are various active discussions on the CIM standard, not only in DMTF, but also among Storage Networking Industry Association (SNIA) and other partners. And, there are various CIM implementations, CIM tools development and CIM-based solutions, such as OpenPegasus and SBLIM. CIM is a technology with full of energy. The evolution of CIM provides a helpful platform for users to realize their new management requirements with the emerging technologies.

- **Currently, CIM on IBM i has already modeled a subset of IBM i resources.** Since UME was initially released, many IBM resources have been added to the model. You can check the following articles and CIM information center to determine if CIM is able to meet your requirements. In situations where CIM is not able to fully meet your requirements, you need to combine other technologies with CIM to complete the solution.

- **On one hand, CIM technology is supported on various platforms,** such as IBM BladeCenter®, IBM System x, IBM z/OS®, IBM z/VM®, IBM AIX®, and IBM storage. On the other hand, while there is no common standardized model in IBM, there are different DMTF profiles supported by different platforms and shipment or installation of CIM/WBEM is of difference. You can build a cross-platform solution for all IBM platforms, but the function covered by each platform depends on the extent of its CIM implementation.

**Conclusion**

CIM and WBEM provide an end-to-end management solution with platform-independence in its nature. It focuses both on how to model resources and exchange information in a platform-independent manner. It is conductive, especially to make management work easier in multi-vendor, multi-platform, and distributed environments. IBM i can integrate CIM and WBEM as a license program into an OS. With more and more IBM i resources modeled into CIM profiles and more CIM technology applied in industry, CIM and WBEM provide you another option to manage your IBM i along with other heterogeneous systems. It helps you with its standardized features, continually enhanced models, and easy-to-extend characteristics. After reading this article, you might now have a basic understanding of CIM and the important role it plays in the enablement of the systems management technology.

Future articles would dig deeper into the CIM interfaces and explain how a customized CIM client can be created and deployed.
References

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