Elements of Windows Management Infrastructure (WMI)

Features of WMI APIs

Starting in Windows 8 and Windows Server 2012, there are the following ways of creating WMI applications, including:

- **Tight alignment with standards**
  - Work across systems using the http-based WS-Man protocol. (DCOM is still supported)
  - Align with the CIM 2.60 Infrastructure specification, including standard Indications (events) and Errors
- **Native-code provider APIs**
  - NO MORE COM CODING REQUIRED! Developers can focus on developing the business logic, rather than the complex COM coding.
  - Providers contain the MOF & MFL, reducing the number of items developers must install.
  - Align with the CIM 2.60 Infrastructure specification, including standard Indications (events) and Errors
- **Provide API support for rich Windows PowerShell semantics, such as PromptUser and WhatIf**
  - Enables WMI Provider developers to improve IT Pro experience when using Windows PowerShell with WMI
  - Provides scripts and client applications improved user experiences
- **Create Windows PowerShell cmdlets from WMI providers by using XML**
  - Developers and advanced IT Pros can use CDXML to wrap existing CIM classes, creating new PS cmdlets without .NET Framework coding.
  - Developers can create cmdlets in native code by implementing a WMI provider, and writing CDXML to go with it.
  - For more information, see the whitepaper, "Using cmdlet definition XML to create Windows PowerShell cmdlets" at http://go.microsoft.com/fwlink/?LinkId=252460.

Other developer tools available in Windows Server 2012, Windows 8, and forward:

- **Convert-MofToProvider:**
  - This is an SDK tool that generates a provider skeleton from a class defined in MOF
- **Register-CimProvider:**
  - This is an in-box tool for registering new WMI providers.
  - Tool also generates the MOF & MFL used in restore situations.

What is CIM/WMI?

CIM: Common Information Model (CIM) is the DMTF standard [DSP0004] for describing the structure and behavior of the managed resources such as storage, network, or software components. For more information, visit http://www.dmtf.org.

WMI: Windows Management Infrastructure (WMI) is a CIM server that implements the CIM standard on Windows.

What are WS-Man and WinRM?

WS-Man: WS-Management (WS-Man) protocol is a SOAP-based, firewall-friendly protocol for management clients to communicate with CIM servers.

WinRM: Windows Remote Management (WinRM) is the Microsoft implementation of the WS-Man protocol on Windows.

What is a WMI Provider?

WMI makes data about Windows manageable objects available through WMI providers. The provider is a DLL or EXE that is installed on a Windows system, and registered with WMI. The provider code exposes a group of supported classes, instances, and events to pass data to WMI. In turn, a management application or script can call provider methods to manipulate provider-supplied data.

A provider retrieves data from hardware, software or system components such as a process, or an instrumented application such as SNMP or IIS, and passes that data via WMI to a management application.

What about compatibility?

WMI maintains full compatibility with the the older Windows Management Instrumentation implementation.

WMI providers work with WMI client applications that were introduced in Windows 8 and Windows Server 2012. Existing client applications work with new and existing WMI providers. Indications and CIM errors are automatically mapped to the older Events & WMI error structures.

The most current version of WMI ships as a downloadable update to Windows 7 SP1 and Windows Server 2008 R2 SP1, as part of Windows Management Framework 4.0 (http://www.microsoft.com/download/details.aspx?id=40855).

What is MOF

Managed Object Format (MOF) is the language used to describe Common Information Model (CIM) classes.
Developers can create a MOF manually, and run Convert-MofToProvider to generate a code skeleton for a provider.

What is Convert-MofToProvider?

Convert-MofToProvider is a command-line tool that generates a new provider code skeleton and project from an existing MOF file. It ships in the Windows Platform SDK. Convert-MofToProvider is stand-alone, and does not require Visual Studio.

What is Register-CimProvider?

Convert-MofToProvider is a command-line tool that works with WMI providers. The providers contain the MOF and MFL files that were shipped separately before the release of Windows 8 and Windows Server 2012. Convert-MofToProvider registers the provider without requiring a MOF. It generates the MOF for restore purposes.

What are rich Windows PowerShell semantics?

WMI APIs provide support for several features of the Windows PowerShell APIs:

- WhatIf /Confirm
  - Allows the user to verify what the results of a cmdlet are without actually running the cmdlet
- WriteWarning/WriteError/WriteMessage/WriteVerbose
  - Allows feedback to be displayed so that IT Pro users control the amount of information about command progress that they are shown in the console.
- Streaming
  - Improves UI responsiveness for client applications by sending data back from a method invocation as a stream, rather than waiting for all instances to be gathered.

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What is a CIM indication?

A CIM indication is a representation of an event in the managed system.

A CIM client can subscribe for receiving indications by providing the indication type and the filtering expression, which selects events that will be delivered to the client.

What is an association

An association represents a relationship between two or more instances of managed resources like disk and volumes or directories and files. Given an instance of a class, a CIM server returns all instances related to the given instance. You can also filter the results by specifying a target class or the name of the association relationship.

What are various CIM operations?

CIM classes implement methods explicitly defined in their specifications (called extrinsic) and a set of standard, predefined methods. The predefined methods are called intrinsic methods, and include:

- Enumerate instances of a class
- Enumerate associated instances
- Get instances by executing a query on server.
- Get a specific instance of a class
- Create a new instance of class
- Modify an instance of a class
- Delete instance of a class
- Invoke extrinsic method on a class or instance
- Enumerate Classes in a namespace
- Get class schema
- Subscribe for indications
- Unsubscribe from indications. CIM cmdlets are modeled on CIM operations.

Creating CIM-based cmdlets

Developers and advanced IT Pros can use CDXML to wrap existing CIM classes to provide a more PS friendly task abstraction. For more information, see the whitepaper, “Using cmdlet definition XML to create Windows PowerShell cmdlets” at http://go.microsoft.com/fwlink/?LinkId=252460.

More information

WMI Blog: http://blogs.msdn.com/b/wmi/
Windows PowerShell Blog:
http://blogs.msdn.com/b/powershell/
Script Center:
http://technet.microsoft.com/scriptcenter/bb410849
Scripting Guys: http://blogs.technet.com/b/heyscriptingguy/
WS-Man Cmdlet Help:
http://technet.microsoft.com/library/hh849876.aspx
Get-WmiObject Help:
http://technet.microsoft.com/library/hh849824.aspx
Invoke-WmiMethod Help:
http://technet.microsoft.com/library/hh849748.aspx
Register-WmiEvent Help:
http://technet.microsoft.com/library/hh849840.aspx
Remove-WmiObject Help:
http://technet.microsoft.com/library/hh849820.aspx
Set-WmiInstance Help:
http://technet.microsoft.com/library/hh849833.aspx