New Elements of Windows Management Infrastructure (WMI)

What changed for WMI APIs?

Windows 8 and Windows Server 2012 have added new 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
- **New native-code provider APIs**
  - NO MORE COM CODING REQUIRED! Developers can focus on developing the business logic, rather than the complex COM coding.
  - New 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
- **Provide new approach to creating Windows PowerShell cmdlets from WMI providers using XML**
  - Developers and advanced IT Pros can use CDXML to wrap existing CIM classes, creating new PS cmdlets without .Net coding.
  - Developers can create cmdlets in native code by implementing a WMI provider, and writing CDXML to go with it
  - See **http://go.microsoft.com/fwlink/?LinkId=252460** for details

What else is new for WMI?

New developer tools include:

- **CIM IDE**
  - The CIM IDE is Visual Studio plug-in for designing & developing new WMI providers, and the accompanying cdxml for a CIM-Based cmdlet.
- **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 **www.dmtf.org**.

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

What is WS-Man/WinRM?

WS-Man: WS-Management (WS-Man) protocol is a SOAP-based, firewall-friendly protocol for the 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?

The new version of WMI maintains full compatibility with the the older Windows Management Instrumentation implementation.

Both new and existing WMI providers work with the new WMI client applications. Existing client applications work with new and existing WMI providers. The new Indications and CIM Errors are mapped to the older Events & WMI error structures automatically.

The new version of WMI ships as a downloadable update to Windows 7, Windows Server 2008 R2, and Windows Server 2008, as part of the Windows Management Framework 3.0 (http://www.microsoft.com/en-us/download/details.aspx?id=34595).

What is MOF

Managed Object Format (MOF) is the language used to describe Common Information Model (CIM) classes.

Developer may create a MOF by hand and use convert-moftoprovider to generate a code skeleton for a provider, or use the CIM IDE to design the MOF and generate the code skeleton.

What is the CIM IDE?

The CIM IDE is Visual Studio plug-in for designing & developing new WMI providers. The advantage to the CIM IDE over Convert-MofToProvider is that it includes MOF design and cdxml generation, in addition to the generation of the provider code skeleton.

- **Design new CIM/WMI Classes**
  - Provides straightforward UI for creating classes from existing CIM/WMI classes, and generates a MOF for the new class.
  - The CIM IDE shows clearly the elements and associations that are inherited, and avoids common design-time issues.
- **Generate provide skeleton from class definition**
  - Using the new class, it generates a new provider code skeleton & project. The skeleton includes schema and stub methods for each element in the MOF.
  - The developer can focus on adding business logic to the generated code.
- **Generate CIM-Based cmdlet from MOF**
  - Using a MOF created above, or from any existing WMI provider, generate the cdxml mapping for a new CIM-based cmdlet.
- **Free download available from:** http://archive.msdn.microsoft.com/cimide

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.

The advantage to Convert-MofToProvider over the CIM IDE is that it is stand-alone, and does not require Visual Studio.

What is Register-CimProvider?

Convert-MofToProvider is a command-line tool that works with the new WMI providers. The new providers contain the MOF and MFL files previously shipped separately. Convert-MofToProvider registers the provider without requiring a MOF. It will generate the MOF for restore purposes.

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What are Rich Windows PowerShell Semantics?

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

- WhatIf /Confirm
  - Allows the user to check what will happen without taking the action in the cmdlet

- WriteWarning/WriteError/WriteMessage/WriteVerbose
  - Allows feedback given such that the the IT-Pro user controls the amount of information they receive.

- 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.

What is a CIM Indication?

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 should 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 You will notice that 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.
See **http://go.microsoft.com/fwlink/?LinkId=252460** for details.

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/en-us/scriptcenter/bb410849
Scripting Guys : http://blogs.technet.com/b/heyscriptingguy/