Interoperable Management over Web Services

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Abstract

The era of true in-field interoperability for monitoring, configuring, and controlling computing resources is at hand. It is now practical to management software to discover and manage computing resources as they are added to the network thereby making dynamic computer resource management possible. This session describes how DMTF and SNIA accomplish these ends over web services.
Agenda

- Answer: Why interoperable computer resource management is interesting?
- Building blocks of the standards
- Computer resource management through web services
- WS-Management protocol
Interoperability as NATO defines it

**Interoperability through standardization**: the development and implementation of concepts, doctrines, procedures and designs in order to achieve and maintain the compatibility, interchangeability or commonality which are necessary to attain the required level of interoperability or to optimize the use of resources, in the fields of operations, materiel and administration.
In a context of standards based interaction of computer resources, interoperability means that all that is required for interoperability is for the implementers to implement the standard correctly.

Interoperability is generally the quality a system where components of a system can be replaced with like components and the system continues to function.

Interoperability means for this presentation:
- Normalized Behavior and well understood functionality as defined by DMTF profiles
- Shared Ontology as defined by CIM
- Complex interactions built from simple components as defined by DMTF protocols
Multi-Vendor Utility Computing = Impossible
Plug-n-Play, Multi-Vendor Interoperability
Developer’s Dilemma

Management Application

Integration Infrastructure

Object Model Mapping

Protocol Mapping

Transport Mapping

Discovery Service

Security Service

Device Types

Processor

Application

Array

Many Other

Vendor Unique Object Models

Security

Service

Discovery

Service

Object Model Mapping

Protocol Mapping

Transport Mapping

RPC

Command Line

Telnet

CORBA

C++ Library

C Library

Java Library

SCSI Mode Page

XML DTD

SNMP

FC - GS

TCP/IP Socket
Developer’s Solution

Management Application

Integration Infrastructure
Object Model Mapping – Vendor Unique Features

• Platform Independent
• Distributed
• Automated Discovery
• Security
• Locking
• Object Oriented

CIM
WBEM

Processor
Application
Array
Many Other

Device
Unique Function

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Business motivation for management standards

- Reduce complexity
  - Constraining the products used
  - Implementing best practices
  - Achieving common behavior through standards

- Increase responsiveness to changing business needs
  - Interoperability through common semantics
  - Leverage current processes in different operating environments using multiple products (of same type)

- Streamline development cycle
  - Improve time to market and quality
  - Focus on improved capabilities rather than “plumbing”
First, some concepts defined

- **CIM**
  - Object oriented information model (e.g. classes, instances, properties)
  - Is a ontology for management
  - Used to decompose the devices and applications

- **WBEM**
  - Web based protocols, currently using XML and HTTP
  - CIM elements (e.g. classes and instances) are marshaled into XML and conveyed over TCP/IP

- **Profile**
  - A profile defines the implementation requirements in terms of classes and behaviors
  - Imposes implementations requirements through normative language
  - Designed so that a conformance application and verify the requirements
What does this configuration look like?
Blow-up of end-points

Management Application

WBEM Client

like a WEB Browser

WS-Management

WBEM Server

like a WEB Server

CIMOM

Manged Element

Internal

Blow up of Client

Blow up of Agent
WBEM interaction

Operations sent through messages
Like HTTP GET and Post

Managed Device

get power configuration
set power configuration

Management Application

Applications are expected to use WBEM to manage systems
WS-Enumeration: Enumerating Data Sources

Client

Enumerate
  (Context)

EnumerateResponse

Pull(3)
  PullResponse

Pull(4)
  PullResponse

Release
  ReleaseResponse

Agent

Item Collection
Request Message Contents

- HTTP header
- XML content
  - Soap envelope
    - URIs for standards supported (e.g. SOAP itself)
  - Soap header
    - Feature negotiation (e.g. must understand ResourceURI)
    - WS-MAN selector
  - Soap body
    - Enumeration modes
<HTTP header removed>

<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://www.w3.org/2003/05/soap-envelope"
    xmlns:SOAP-ENC="http://www.w3.org/2003/05/soap-encoding"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:wsmb="http://schemas.dmtf.org/wbem/wsman/1/cimbinding.xsd"
    xmlns:wsman="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd"
    xmlns:tns="http://schemas.microsoft.com/wmx/2005/06"
    xmlns:wsmid="http://schemas.dmtf.org/wbem/wsman/identity/1/wsmanidentity.xsd">

...continued ...

URIs for standards and recommendations supported
<SOAP-ENV:Header>
<wsman:OperationTimeout id="true">
<wsman:ResourceURI SOAP-ENV:mustUnderstand="true">
<wsman:SelectorSet SOAP-ENV:mustUnderstand="true">
<wsman:Selector Name="__cimnamespace">rootcimv2</wsman:Selector>
</wsman:SelectorSet>
<wsa:To>http://10.211.55.6:80/wsman</wsa:To>
<wsa:ReplyTo>
</wsa:ReplyTo>
<wsa:MessageID>uuid:1C06DAC8-B782-0C2A-ACD9-10D63AF141A7</wsa:MessageID>
</SOAP-ENV:Header>
<SOAP-ENV:Body>
<wsen:Enumerate>
<wsman:EnumerationMode>EnumerateObjectAndEPR</wsman:EnumerationMode>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>
Response Message Contents

- Intermediate responses (pull - pull response)
- Pull response (envelope)
  - URI to standards (e.g. WS enumeration)
  - Header
    - Action (e.g. pull response)
    - RelatesToUID (original request ID)
  - Body
    - Enumeration context
    - Items
      - CIM instance
      - Endpoint reference
        » If default address model, instance keys
<HTTP header removed>

```xml
<s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope"
            xmlns:w="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd">
  <s:Header>
    <a:MessageID>uuid:4953B37A-B37B-4BD1-A359-A980E090E30F</a:MessageID>
    <a:To>http://schemas.xmlsoap.org/ws/2004/08/addressing/role/anonymous</a:To>
    <a:RelatesTo>uuid:427C3C55-9898-044D-2F43-56E509FE8ED8</a:RelatesTo>
  </s:Header>
  <s:Body>
    <n:PullResponse>
      <n:EnumerationContext>uuid:B6FACE6F-C24C-4D3D-8DE5-78AB5D9F4590</n:EnumerationContext>
      <n:Items>
        <w:Item xmlns:w="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd">
          <p:Win32_LogicalDisk xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                               xmlns:cim="http://schemas.dmtf.org/wbem/wscim/1/common"
                               xsi:type="p:Win32_LogicalDisk_Type">
            <p:Access xsi:nil="true"/>
            <p:Availability xsi:nil="true"/>
            <p:Caption>A:</p:Caption>
            <p:Compressed xsi:nil="true"/>
            <p:CreationClassName>Win32_LogicalDisk</p:CreationClassName>
            <p:Description>3 1/2 Inch Floppy Drive</p:Description>
            <p:DeviceID>A:</p:DeviceID>
          </p:Win32_LogicalDisk>
          … continued …
        </w:Item>
      </n:Items>
    </n:PullResponse>
  </s:Body>
</s:Envelope>
```

Standards and recommendations this request conforms with

Original message and enumeration response that this response is related to

The context all these operations are related to

CIM instance data
<p:DriveType>2</p:DriveType>
<p:Size xsi:nil="true"/>
<p:Status xsi:nil="true"/>
<p:StatusInfo xsi:nil="true"/>
<p:SupportsDiskQuotas xsi:nil="true"/>
<p:SupportsFileBasedCompression xsi:nil="true"/>
<p:SystemCreationClassName>Win32_ComputerSystem</p:SystemCreationClassName>
<p:SystemName>STEVEHANDC989</p:SystemName>
<p:VolumeDirty xsi:nil="true"/>
<p:VolumeName xsi:nil="true"/>
<p:VolumeSerialNumber xsi:nil="true"/>
<p:Win32_LogicalDisk>
 xmlns:w="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd">
 <a:Address>http://schemas.xmlsoap.org/ws/2004/08/addressing/role/anonymous</a:Address>
 <a:ReferenceParameters>
  <w:SelectorSet>
   <w:Selector Name="DeviceID">A:</w:Selector>
  </w:SelectorSet>
 </a:ReferenceParameters>
</a:EndpointReference>
</p:Win32_LogicalDisk>
</p:Item>
</n:Items>
</n:PullResponse>
</s:Body>
</s:Envelope>
Standard technologies being deployed

- **Distributed Management Task Force (DMTF)**
  - Common Information Model (CIM)
  - Web Based Enterprise Management (WBEM)
    - WS-Management
  - Systems Management Architecture for Server Hardware (SMASH)
  - Desktop and Mobile Architecture for System Hardware (DASH)
  - Host Virtualization (yet to be named)
  - Clustering (HPC and HA)

- **Storage Networking Industry Association (SNIA)**
  - Storage Management Initiative Specification (SMI-S)
  - Other: Multipath API, iSCSI Management API

- All provide for monitoring, configuration, and control
Desktop management standard

- Based heavily on the SMASH work
- Components Instrumented
  - Boot control, fans, sensors, firmware, power, physical asset
- Deployment model
  - Onboard the computer themselves
- Schedule
  - Expect implementations within twelve months
- Example use cases to be supported
  - IT configures TPM and provides disk image for system remotely and through automation
Management Standard Overlap

- SMI-S Storage Networks
- SMASH Servers
- Virtualization (underway)
- Applications (TDB)
- Desktop and Mobile
- Clustering (Underway)
- Common Diagnostic Model
- Interoperability

CIM (Common Information Model) at the center.
WS-MAN Efforts

- **OpenWSMAN** - Open Source Tool
  - Funded by Intel
- **"Wiseman"** - Open Source Tool
  - Started by Sun
- **OpenPegasus** - Open Source WBEM Infrastructure
  - WS-MAN supported
  - Contributed to by HP, IBM, EMC and Symantec
- Microsoft Embedded WS-Management Connector - Vendor Tool
Questions?

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