



Getting Up and Running with Web Services

Steve Hand

MDC

December 2007



Agenda

- Background
- What is WS-MAN?
- Why should you care?
- What does web services mean to storage management?
- Demonstrations
 - .Net, CLI and C++
 - portable C++



Web Services is and isn't

- The Web Services standards
 - define a remote API mechanism
 - do not include an information model
 - do not define standard interfaces that could be called through web services that accomplish concrete tasks
 - are generally a framework with which concrete applications applications could be built to affect a SOA application



Why am I talking to you today?

- Although the technologies build on web services are easily accessible, how on could affectively use this technology is the subject of debate and with different, sometimes conflicting points of view.
- After much research, it is not clear to me how would use the WS implementations to write useful and resilient code.
- It is especially opaque how one would manage devices and applications through web services.
- The revolution is coming, you ought to be prepared.



Background

- Storage Management (SMI-S)
 - Deployed today with CIM-XML
 - Part of larger ecosystem including hosts
 - Includes beginnings of support of WS-MAN
- SMI-S management through WS-Management at last two Storage Networking World Conferences
 - Arrays from Microsoft, HP, and Sun ('06)
 - Clients from Microsoft and Symantec ('06)

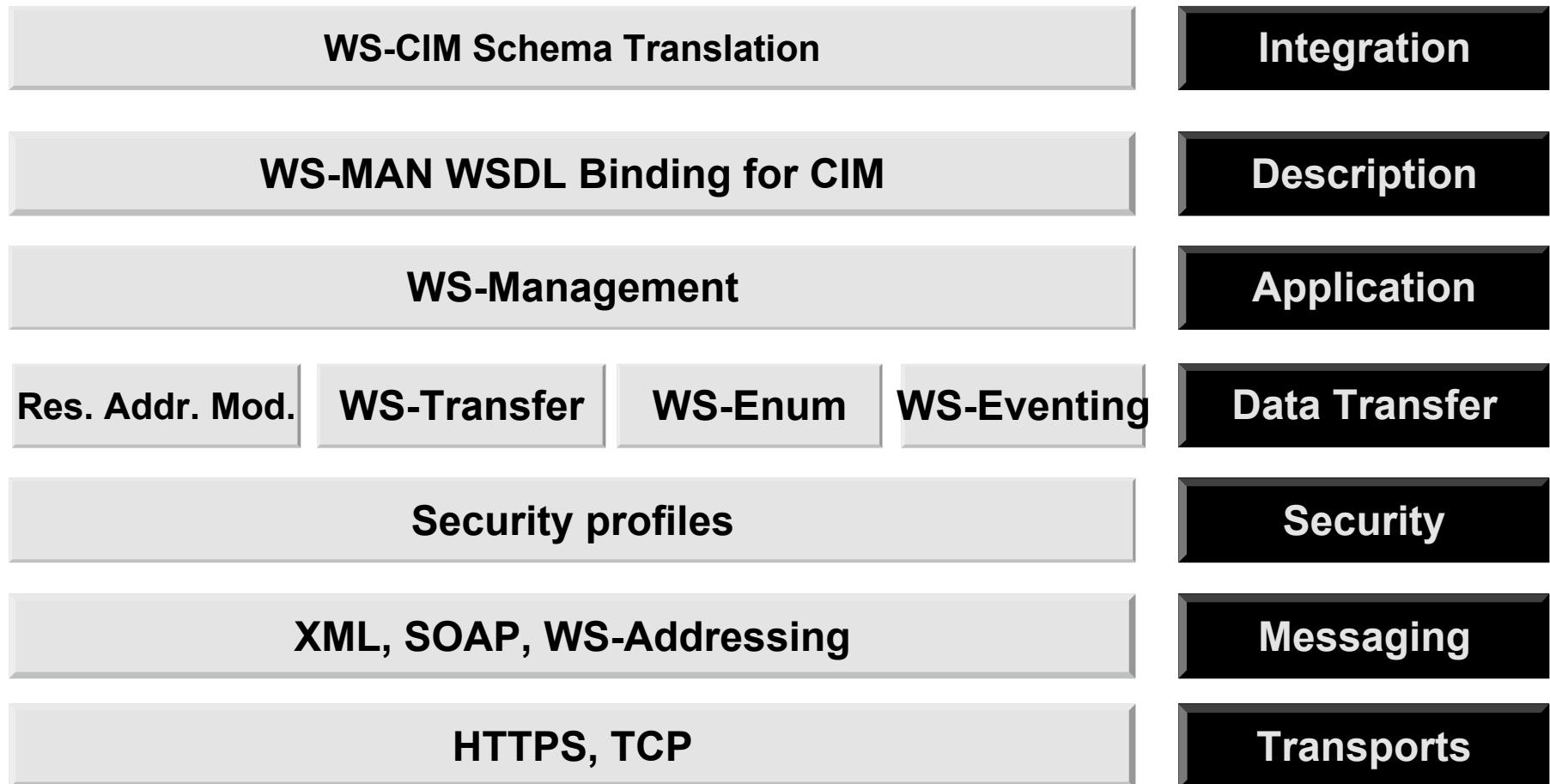


What is WS-Management?

- Management protocol developed within the Distributed Management Task Force (DMTF)
 - DMTF also developed CIM-XML
- To be used in server, desktop, and host virtualization management instead of CIM-XML
- WS-MAN is a web service protocol based on standards like WS-Addressing and WS-Enumeration that is used to access CIM instances.



Protocol Composition





Why is WS-MAN interesting?

- Web services has wide adoption as a means to instrument applications
- Development tools enable easier development of Web Service implementation
 - IDEs have wizards, pre-built libraries and other means to ease the development of web services
- New MS Windows has native WS-MAN support
- With DMTF SMASH and DASH standards the use of WS-MAN to management storage gets interesting



IDE WS integration

- Eclipse IDE (Java, Java platform)
 - Web Tool Project (WTP): Web Standard Tools (WST)
- Visual Studio IDE (many languages, Windows)
 - Native support for web services
- Xcode (many languages, Mac OS X)
 - Built-in web services explorer
- oXygen (XML, XSD, Xpath, Xquery, Java Platf.)
 - Built-in web services explorer



Other WS-MAN events going on

- Windows Vista ships with WS-MAN support as part of Windows Remote Management (WinRM)
- New Windows Server is to also ship with support of WS-MAN
- DASH 1.0 conformant desktop and laptops to ship next year.
- SMASH 2.0 conformant servers are to ship soon thereafter.



Why WS-MAN for storage and hosts?

- Storage is part of the larger IT administrator ecosystem
- App developers, wouldn't you want to use one client API to development your management applications
- Instrumentation developers, wouldn't you want to settle a single WBEM infrastructure attracting both SMI-S but other management developers as well?



WS-CIM

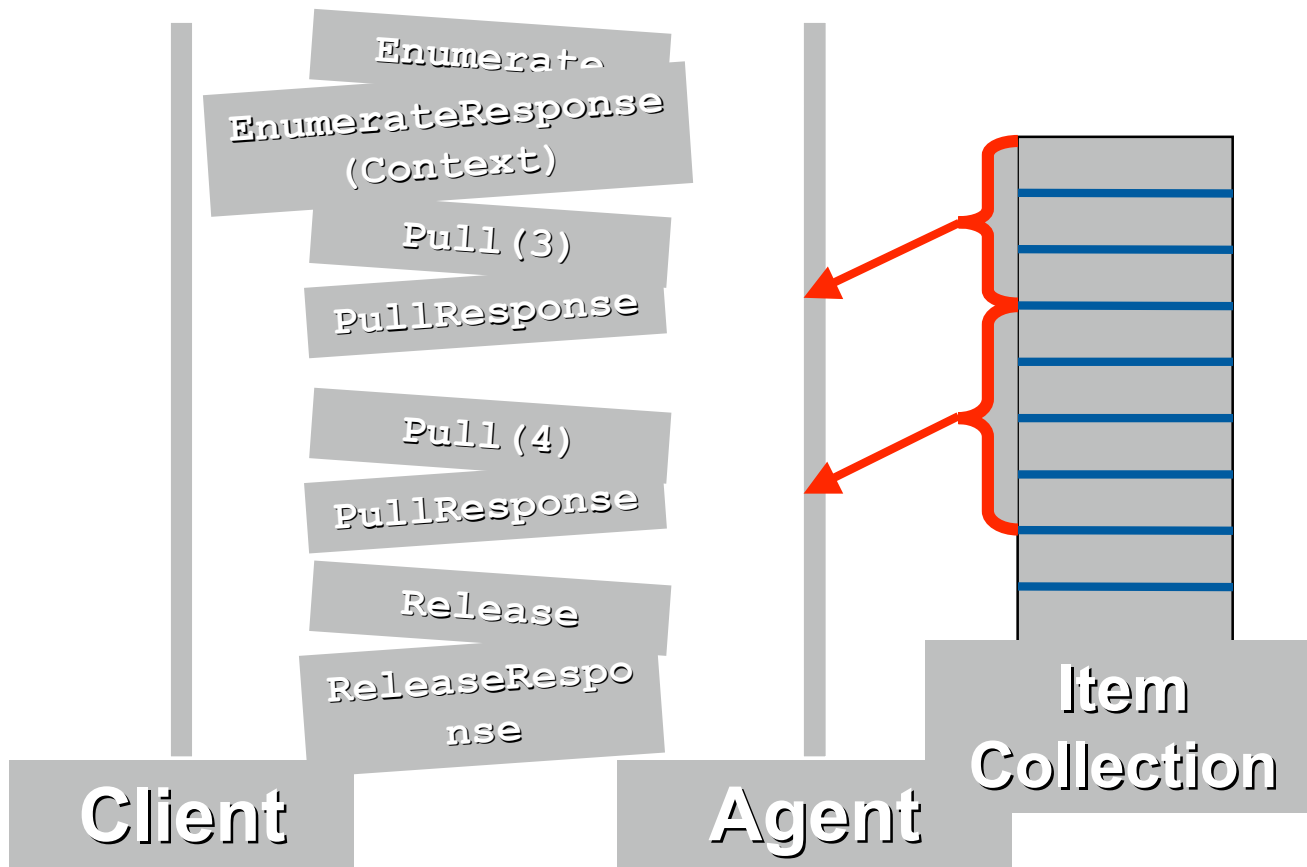
- WS-MAN is network protocol agnostic
 - It can be run over other protocols other than HTTP, that HTTP is normally used
- WS-MAN is model agnostic (like parent WS-* specs)
 - WS-CIM defines how CIM instances and classes are represented on the wire
 - WS-CIM defined how CIM classes are represented as XML Schema
- DMTF only defines WBEM management through CIM. There the rest of the presentation is on WS-MAN and WS-CIM



Other details

- Each profile defines model and behavior
 - CIM model is graph of instances
 - Instances and associations
- WS-MAN/WS-CIM supports
 - Enumerating instances
 - Getting, modifying, creating deleting instances
 - Associations (starting a given instances in the graph)
 - Getting references to associated instances
 - Getting associated instances
 - Getting references to association instances
 - Getting association instances
- **The rest of this presentation concentrates on enumeration**

WS-Enumeration: Enumerating Data Sources





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



WS-MAN Example Sent Part 1

<HTTP header removed>

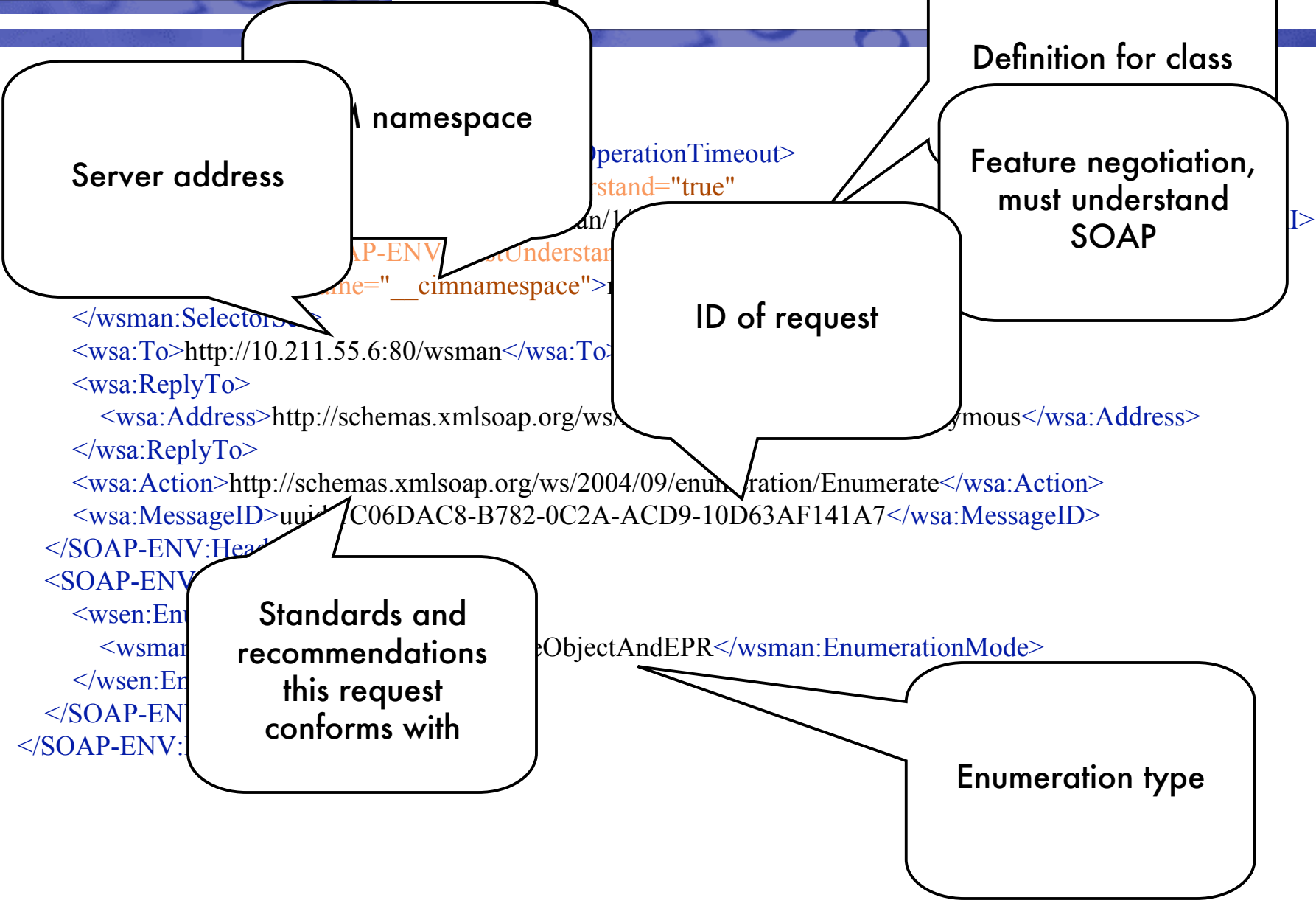
<?xml version="1.0" encoding="UTF-8"?>

```
<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:wsmc="http://schemas.dmtf.org/wbem/wsman/1/cimbinding.xsd"
  xmlns:wsmc="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd"
  xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing"
  xmlns:wxf="http://schemas.xmlsoap.org/ws/2004/09/transfer"
  xmlns:wse="http://schemas.xmlsoap.org/ws/2004/09/enumeration"
  xmlns:tns="http://schemas.microsoft.com/wmx/2005/06"
  xmlns:wse="http://schemas.xmlsoap.org/ws/2004/08/eventing"
  xmlns:wsmid="http://schemas.dmtf.org/wbem/wsman/identity/1/wsmanidentity.xsd">
```

URLs for standards
and
recommendations
supported

...continued ...

WS-MAN Example Sent



Server address

namespace

ID of request

Definition for class

Feature negotiation, must understand SOAP

Standards and recommendations this request conforms with

Enumeration type

```

</wsman:Selector>
<SOAP-ENV:Header>
  <wsa:To>http://10.211.55.6:80/wsman</wsa:To>
  <wsa:ReplyTo>
    <wsa:Address>http://schemas.xmlsoap.org/wsman/anonymous</wsa:Address>
  </wsa:ReplyTo>
  <wsa:Action>http://schemas.xmlsoap.org/ws/2004/09/enumeration/Enumerate</wsa:Action>
  <wsa:MessageID>urn:uuid:C06DAC8-B782-0C2A-ACD9-10D63AF141A7</wsa:MessageID>
</SOAP-ENV:Header>
<SOAP-ENV:Body>
  <wsen:EnumerationMode>
    <wsman:EnumerationMode>ObjectAndEPR</wsman:EnumerationMode>
  </wsen: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



WS-MAN Example Received

Part 1

<HTTP header removed>

```
<s:Envelope xml:lang="en-US" xmlns:s="http://www.w3.org/2003/05/soap-envelope"
  xmlns:a="http://schemas.xmlsoap.org/ws/2004/08/addressing"
  xmlns:n="http://schemas.xmlsoap.org/ws/2004/09/enumeration"
  xmlns:w="http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd">
  <s:Header>
    <a:Action>http://schemas.xmlsoap.org/ws/2004/09/enumeration/PullResponse</a:Action>
    <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:p="http://schemas.microsoft.com/wbem/wsman/1/wmi/root/cimv2/Win32_LogicalDisk"
            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>
```

... continued ...

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



WS-MAN Example Received

Part 2

```
<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>
<a:EndpointReference xmlns:a="http://schemas.xmlsoap.org/ws/2004/08/addressing"
  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:ResourceURI>http://schemas.microsoft.com/wbem/wsman/1/wmi/root/cimv2/Win32_LogicalDisk</w:ResourceURI>
    <w:SelectorSet>
      <w:Selector Name="DeviceID">A:</w:Selector>
    </w:SelectorSet>
  </a:ReferenceParameters>
</a:EndpointReference>
</w:Item>
</n:Items>
</n:PullResponse>
</s:Body>
</s:Envelope>
```

more CIM instance data

End Point Reference
Class name and keys



Special Developer Considerations

- Authentication model to be employed?
 - Basic, digest, Kerberos, Generic Security Services Application Program Interface
- What is the target or server platform?
 - What is the target WBEM infrastructure for client or server development?
- Developers will have to be aware what initiative they are supporting (SMI-S, DASH, or SMASH)
 - They will need to be aware of the profile support they need and what profile support is offered



Special Developer Considerations

- Object Identification consists of
 - ResourceURI
 - The URI for the where class is defined
 - Selector
 - If default address model, then this contains, CIM namespace, CIM classname and keys
 - If not, who knows
- Web Services does define how the resources served by a service are identifier.
 - WS-MAN/WS-CIM does.

Demonstrations

Storage Management
through SMI, but
using WS





WS on Windows (.Net)

- WinRM CLI
 - Configuration
 - Getting instances from host with WinRM
- Visual Basic .Net Application
 - Getting instances from host
 - Getting instances from SMI-S
 - Take a peek at the code



WS through C++

- OpenWSMan on Linux
 - Background
 - Getting instances from Vista server
- OpenPegasus on Mac OS X
 - Background
 - Getting instances from SMI-S implementations
 - Take a peek at the code

Questions?



Special thanks to Steve Peters of HP for making this demonstration possible