Microsoft SMI-S Roadmap Update

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- Unless otherwise specified, the information included here refers to a pre-release version of the product known as "Windows Server 8" Developer Preview.
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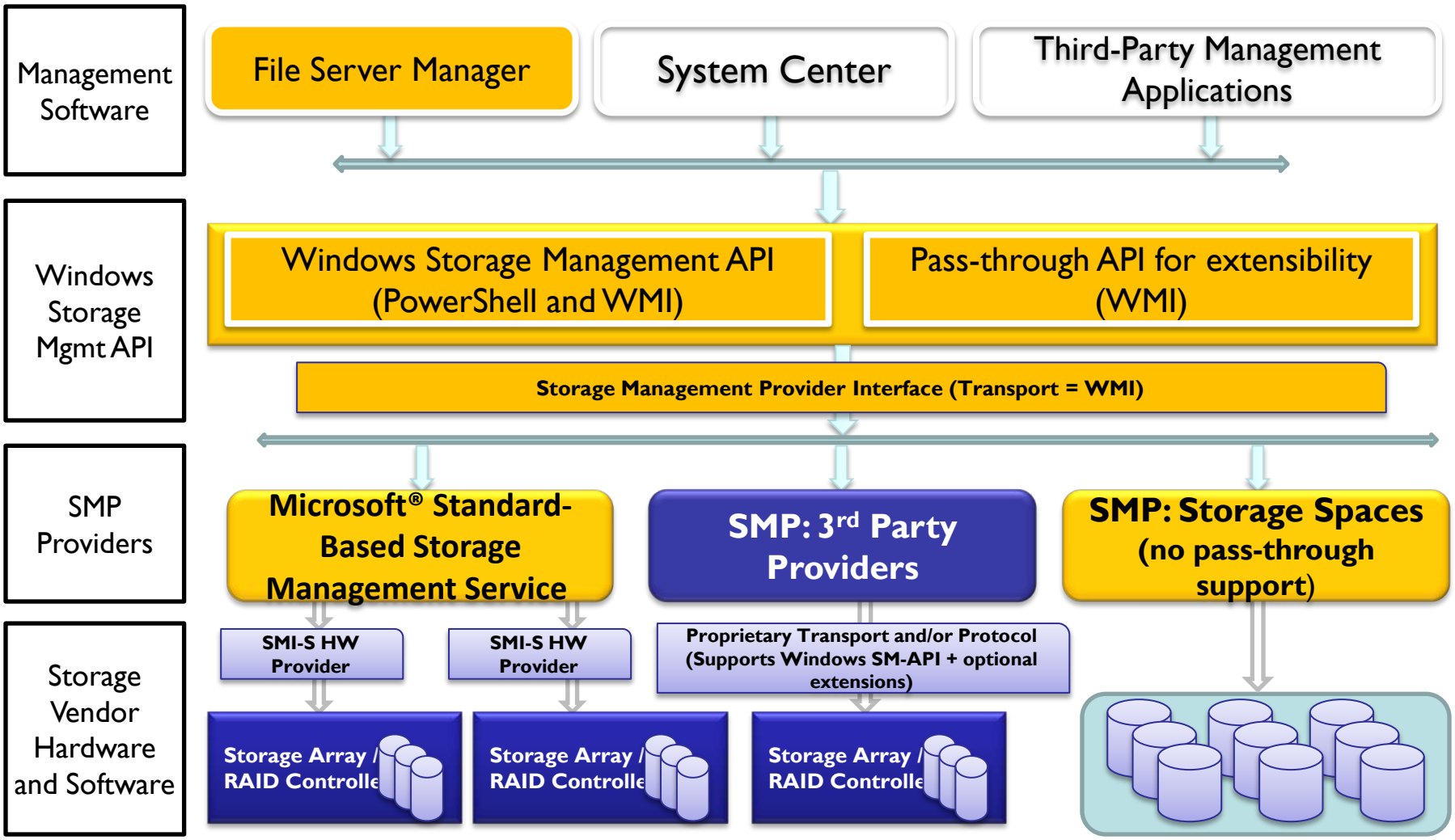
Agenda

- Overview of the new storage management improvements in Windows Server 8
- Deep dive on Microsoft Standard-Based Storage Management Service
  - Architecture
  - Storage Service
  - Use of SMI-S
  - Things you need to know about providers
- System Center Virtual Machine Manager 2012
- More about Windows Server 8

Comprehensive Storage Management

- Windows Server 8 will contain a Storage Management API for all Windows-Based Management Applications
  - WMI Programmatic Interfaces
  - PowerShell For Scripting and Remote Access
- Common Interfaces for IHVs – Multi-Vendor Interoperability
  - Microsoft Standard-Based Storage Management Service enables broad interoperability with existing SMI-S capable storage products
  - Storage Management Provider Interface
- All new Windows in-box applications moving to new API
  - File server manager UI
  - Legacy applications being removed or not being updated

Windows 8 Storage Management



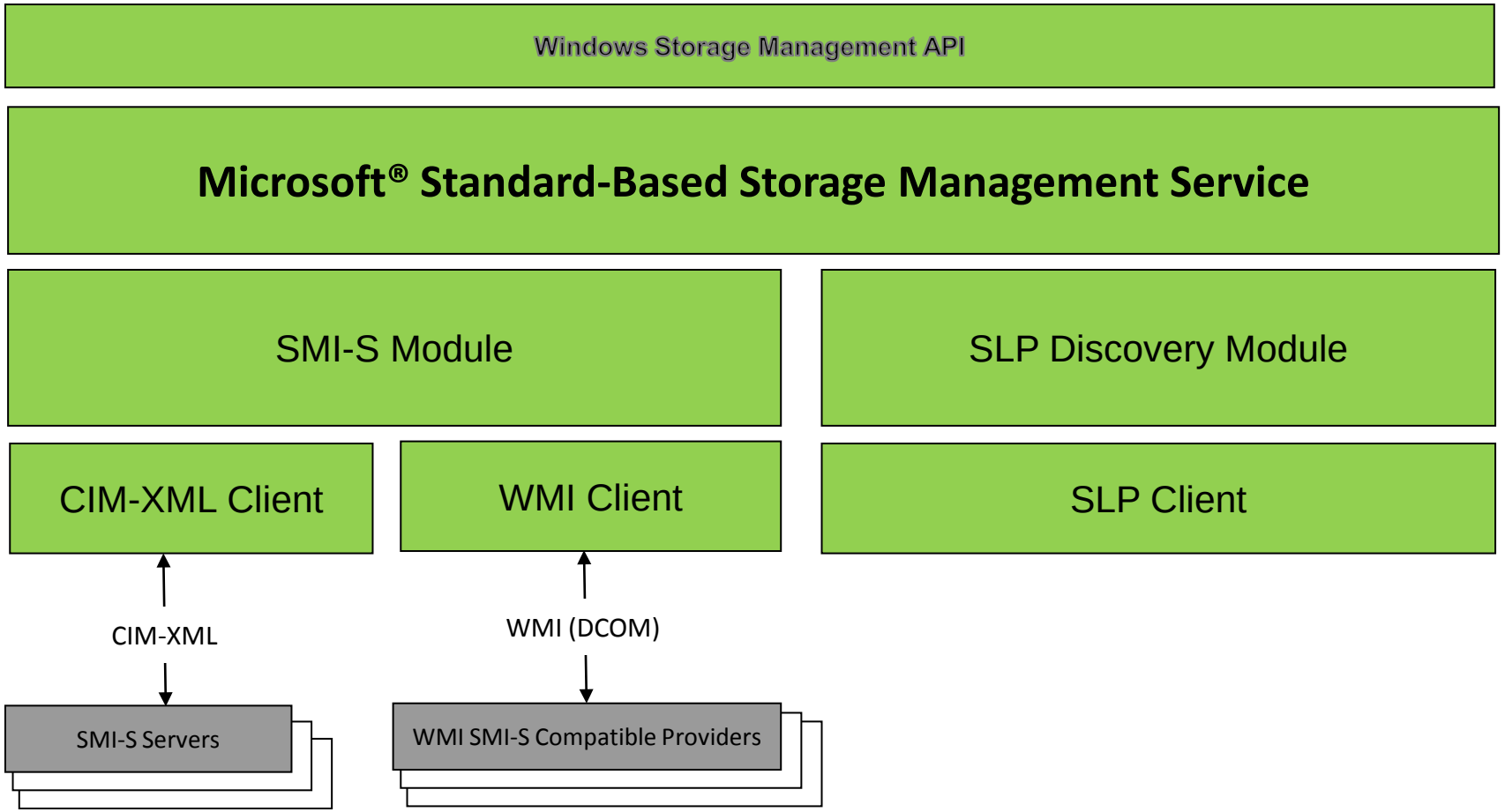
SMP provider API

- Storage Management API and Passthrough Providers both communicate through the SMP schema
  - Layer is implemented as WMIv2 (new!) providers
    - Most CommandLets are auto-generated from the MOF
  - Replaces VDS interfaces for hardware and OS objects
  - Abstracts classes from SMI-S
    - Most SMP classes are aggregated by traversing associations and combining properties from multiple CIM classes
  - Vendors can implement a "native" SMP provider to this same schema
    - Must write a WMIv2 provider
    - Has access to the same functionality including "passthrough"
  - The Standard-based Storage Management Service maps the SMP schema to industry standard SMI-S
    - Provides extensive discovery, security, caching and other services
    - Allows the use of off-the-shelf providers using CIM-XML or WMI transports
    - Array, Virtualizer and Host Hardware RAID Controller profiles are surfaced all the way through the stack
    - Other profiles (e.g., Fabric) can be accessed using "passthrough" capability
- Grammar matching required
  - Microsoft "nouns" versus SMI-S definitions, e.g.
    - VirtualDisk = StorageVolume
    - PhysicalDrive = DiskDrive

Microsoft Standard-Based Storage Management Service

- Microsoft Standard-Based Storage Management Service is an SMI-S client
  - Manages a wide range of storage arrays through the following standards:
    - Storage Management Initiative - Specification (SMI-S)
    - Common Information Model (CIM)
    - Service Location Protocol (SLP)
  - Optional component on Server product (not Windows client)
    - Installed through Server Manager's "Add Roles and Features"
- Allows the ***Microsoft Storage Management API*** layer to communicate with SMI-S compliant servers
  - Application writers will not require extensive SMI-S knowledge
    - But can leverage the full range of functionality if they do have this
  - Higher level unified interface
- Supports Discovery, Provisioning, Monitoring (through Indications)

Microsoft® Standard-Based Storage Management Service



Functionality

- Manages **SMI-S servers** on behalf of *Microsoft Storage Management API* Layer
  - Discovery
  - Provisioning
  - Monitoring
- Services client requests per the SMP schema
  - Enumeration (of discovered objects)
  - Association (of discovered associators)
  - Intrinsic Methods (Get, Modify and Delete instances)
  - Extrinsic Methods (Discover, Mask, Map, etc.)
  - Job control
  - Extensive error-checking
    - Returns normalized errors
    - *Also returns error information directly from the provider*
- Event logging
- Event tracing
- Logging of CIMXML

Operations

- Discovery
  - Search for SMI-S agents via SLP or manually configure
    - Credentials are securely cached
    - Maps Windows users to SMI-S provider creds
  - Arrays (Subsystems, Pools, Volumes, etc.)
- Provisioning
  - Creation/Deletion/Modification of Storage pools
  - Creation/Deletion/Modification of Storage Volumes
  - Masking/Unmasking/Mapping of logical units
- Replication
  - Snapshots
  - Clones
- Monitoring (through indications and polling of health properties)
  - Performance (through passthrough)
  - Instance lifecycle changes (create, modify, delete)
- Passthrough for operations not covered by the SMP schema
  - This is WMI (CIM) based

Basic Requirements for an SMI-S provider

- Basic compatibility requirements for SMI-S providers:
  - Communicate with the managed objects, e.g., a storage array including addresses of the devices, credentials for the devices, etc.
  - Protocol selection
    - CIM-XML: HTTPS (preferred) or HTTP (not recommended)
    - WMI
  - User credentials for the SMI-S provider itself (the Microsoft Standard-based Management Storage Service will need this information)
  - All providers must support the interop namespace. This is used to locate supported profiles, and from there, discovery of the vendor-specific namespaces(s) can be performed – Please refer to Profile Registration Profile and Server Profile in SMI-S
  - Providers are responsible for configuring managed devices

Required profiles

- Profile Registration Profile (must use interop!!)
- SMI-S
- Computer System Profile (Multicomputer System Profile)
- Server Profile
- Health Package
- Access Points Subprofile
- Software Subprofile
- Job Control Subprofile
- Indication Profile
- Array, Storage Virtualizer or Host Hardware RAID Controller Profile
- Block Services Package
- Masking and Mapping (or Group M/M)
- FC Target Ports/iSCSI Target Ports
- Replication (preferred) / Copy Services
- Physical Package Package
- Disk Drive Lite

Provider Operations

- **Search** operation can be used to locate SMI-S providers through SLPv2
  - *Search-SMISProvider* CommandLet
  - Searches local subnet through multicast and/or broadcast
  - Discovery Agents can be specified to cross subnet boundaries
  - Discovery Scopes supported
  - Search does *not* imply Registration
- **Registration**
  - *Register-SMISProvider* CommandLet
  - Used to create a secure store of providers and credentials
  - Certificate handling
  - Additonal Windows users can be specified at registration time
  - Normalized behavior between SMP provider and SMI-S
  - Explicit use of username & password can override registered credentials
- **Deregistration**

Discovery Operations

- Discovery acquires information about selected CIM objects from the providers
  - Three-level discovery model
    - Level 0 – Subsystem only
    - Level 1 – Pools
    - Level 2 – Storage Volumes
  - Discovery can be full or partial
    - Allows selective update following a particular object path
  - Discovery information is cached for greater scalability
  - Automatic discovery when the service starts or when a new provider is registered
    - Typically only Level 0 (can be overridden)
  - Relevant associations are followed where necessary
- Caching of data speeds up operations
  - Cached data is automatically updated when the service performs operations
  - Cache is protected – user must have permissions (credentials for the provider)
  - Cached data can be updated through indications
  - Refresh of the cache for a provider can be forced at any time

Provisioning

- Supported Profiles
  - Block Services Package
  - Thin Provisioning Profile
- Pool Operations
  - Creation of new pools from unused disk drives
  - Pools can be extended by adding more drives
  - Pools can be deleted
  - Extent-based pool creation not exposed at this time
- Storage Volume Operations
  - Volumes can be created from Concrete Pools
    - Different RAID policies may be applied if the pool allows
  - Size may be modified – Extend or Shrink
  - Volumes can be deleted
- Thin Provisioning is supported
  - Thin *volumes* from thin *pools*

Mapping/Masking

- Supported Profiles
  - Masking and Mapping
  - Group Masking and Mapping (optional)
  - No support for Block Storage Views at this time
- Operations
  - Volumes may be exposed to one or more hosts
    - Subject to capabilities
  - Host type (Client Setting) can be applied
  - Volumes may be exposed as readonly or read/write
  - LUN may be specified
  - Unused initiators can be cleaned up
- For Group Masking
  - Target Port Groups are not created

Replication

- Supported Profiles
  - Copy Services
  - Replication
- Operations
  - Snapshot (UnSyncAssoc)
  - Clone (UnSyncUnAssoc)
    - Preference will be for "quick cloning" operations
  - Local operations only at this time
- What will limit usability in certain environments
  - Number of snapshots per source, per subsystem
  - Efficiency/Speed of operation

Security Requirements

- Username/Passwords
  - Used with the Registration function to persist credentials (Windows only)
  - Persistently stored, ACLed
  - Can override stored credentials by specifying (most operations)
- HTTPS strongly preferred for client operations
  - Registration allows certificate installation
- HTTPS (only) for indications
  - Issues with mutual authentication
  - Still a hassle setting this up

Indications

- Life-cycle indications
  - Subsystems, StorageVolumes, Pools
- Alert indications
  - TBD
- HTTPS *only*
- Challenges with mutual authentication and certificates
  - Very difficult to configure
  - Make sure the user can obtain the CIM Server certificate to use for mutual authentication

SMI-S Versions

- No support for providers <1.3
- Using 1.4, 1.5, 1.6 features
  - You are encouraged to keep providers up-to-date
  - *There are many obsolete providers being downloaded by customers!!*

Additional Considerations

- Use of interop namespace is mandatory
  - Profiles must have ElementConformsToProfile associations to link from the profile (in interop) to the managed element (in vendor namespace)
  - Indication subscriptions require creation of filters in the interop namespace
- Vendor namespaces must include the name of the vendor and not use common namespaces like CIMv2
- Names
  - Follow all the rules – no extraneous postfixes
  - Uniqueness required for "Name" property
  - Per subsystem uniqueness for *ID properties
- Correlatable and Durable Names (Architecture Book)
  - Matching identifiers per SCSI Primary Commands-3
  - Strict adoption of VPD Page 83 Type 3 [2]
    - Other identifiers are allowed but you must supply Page 83 Type 3 (NAA)
  - How the OS sees this
    - Logical Units' INQUIRY VPD must report Page 83 Type 3 [2] identifiers
    - Used internally to provide positive unique identifiers
- "Required" optional SMI-S classes
  - StoragePool.Usage
  - ClientSettingData

Other gotchas

- Scale is important
  - Support parallel operations
- Associations are important
  - Please optimize!!
  - Don't return from an operation until all the associations are in place!!
- CTP is not enough
  - Does not thoroughly check all the functionality we use
  - Does not check returned values for correct format (e.g., names)
  - Does not check for all mandatory classes/properties
  - Allows readonly implementations; not very useful for Windows and SC Virtual Machine Manager features
- Host Types, i.e., ClientSettingData
  - Windows (15) should refer to current versions (Windows 2003 and later) – SPC-3/SBC compliance and support for Persistent Reservations
- Vendor Unique items are not interpreted
  - No support for per vendor extensions on exposed management classes but…
  - Passthrough support allows full exposure

System Center Virtual Machine Manager 2012

- Uses an earlier standalone version of the service
- Only supports SMI-S providers for new features
  - Legacy VDS providers have been deprecated and used only for backwards compatibility (not new features)
  - Makes extensive use of concurrent operations
  - Requires support of Copy Services or Replication Services for Rapid Provisioning features
  - Pool provisioning is not supported (or used)
- Credential management handled by VMM
- No support for SLP

VMM 2012 Usage Scenarios

- End-to-end Mapping
  - Reconcile data from Hyper-V and storage arrays to create associations
  - Identify storage consumed by VM, host, cluster
- Host and Cluster Storage Capacity Management
  - Adding storage to a host or cluster includes unmasking, initialization, partitioning, formatting, and CSV cluster resource creation (in shared storage case)
  - New cluster creation also includes adding storage capacity
- Rapid Provisioning
  - Creation of new VMs leveraging the SAN to copy the VHD
  - Relies on SMI-S Copy Services and Replication profiles
  - Deploy to host or cluster at scale (limited by the capabilities of the array)

Windows Server 8 Functionality

- Multiple storage management components make up the Windows Storage Management API layer (SPM)
  - WMIv2 interface layer for client applications
  - PowerShell for scripting and client applications
- Support for multiple provider models
  - SMI-S is supported through an optional component
    - "Windows Standard-based Storage Management"
    - Server SKUs only
  - SMP providers (WMI providers not conforming to SMI-S)
  - No support for VDS through the new API
- Pool provisioning
- Indications
- Passthrough
- SLP for locating providers, querying interop namespace and supported protocols

Sample PowerShell CommandLets

- $Url = Search-SmisProvider
- Register-SmisProvider -ConnectionUri https://SMISERVER:5989
- Get-StorageSubsystem

- New-VirtualDisk -FriendlyName "SQLData“ -StoragePoolID $DemoPool.ID -StorageAttributesName Mirror -ProvisioningScheme Sparse -Size 42TB

- $SQLDataV = Get-VirtualDisk -FriendlyName "SQLData"
- $SQLDataDisk = Get-VirtualDisk -VirtualDisk $SQLDataV
- Initialize-Disk -InputObject $SQLDataDisk

- New-Partition -InputObject $SQLDataDisk

- $SQLDataPartiton = Get-Partition -DiskId $SQLDataDisk.Id | **Where-Object** {$_.Type -ne "Reserved"}
- ($SQLDataPartiton | Format-Volume -NewFileSystemLabel "SQLDATA“ -Confirm:$False)

- Get-Volume -FileSystemLabel "SQLData" | Get-Partition | Add-PartitionAccessPath -AccessPath N:\

Using WMI directly

- Brief diversion into WMIv2 vs. WMIv1
- Namespaces
  - Root\Microsoft\Windows\Storage
- Passthrough
  - Available for SMP or SMI-S providers
  - Allows access to all CIM classes exposed by providers
    - Full classes as exposed by the providers
    - Private classes
    - Private properties
  - Provides mapping of external namespaces into WMI
    - Root\Microsoft\Windows\Storage\PT
  - Uses our CIMXML transport layer

Writing SMI-S providers

- Off-the-shelf 1.4 and later providers supported – no need to write something special for Windows!
  - OpenPegasus or Proprietary Proxy CIMOMs
  - Embedded
- Using Windows as a CIMOM
  - WMIv1 providers can be used
    - Not easy to develop
    - Cross namespace hassles
  - WMIv2 provides an easier model for creating WMI providers
    - Automatic generation of CommandLets
  - CIMXML is possible (via WMI-Mapper open source project)

What's not in the plan

- WS-Management transport for providers ☹
- SMI-S compliant Host Resources not available
  - Some downlevel CIMv2 classes, not updated
- Available through passthrough
  - Fabric classes
  - NAS classes
  - Performance classes

Additional Resources

- Available materials
  - Other Microsoft SDC presentations
  - SCVMM 2012 RC

    http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=27252
- Distribution of early releases of Windows Server 8
- For SMI-S specific info: smisvend@microsoft.com