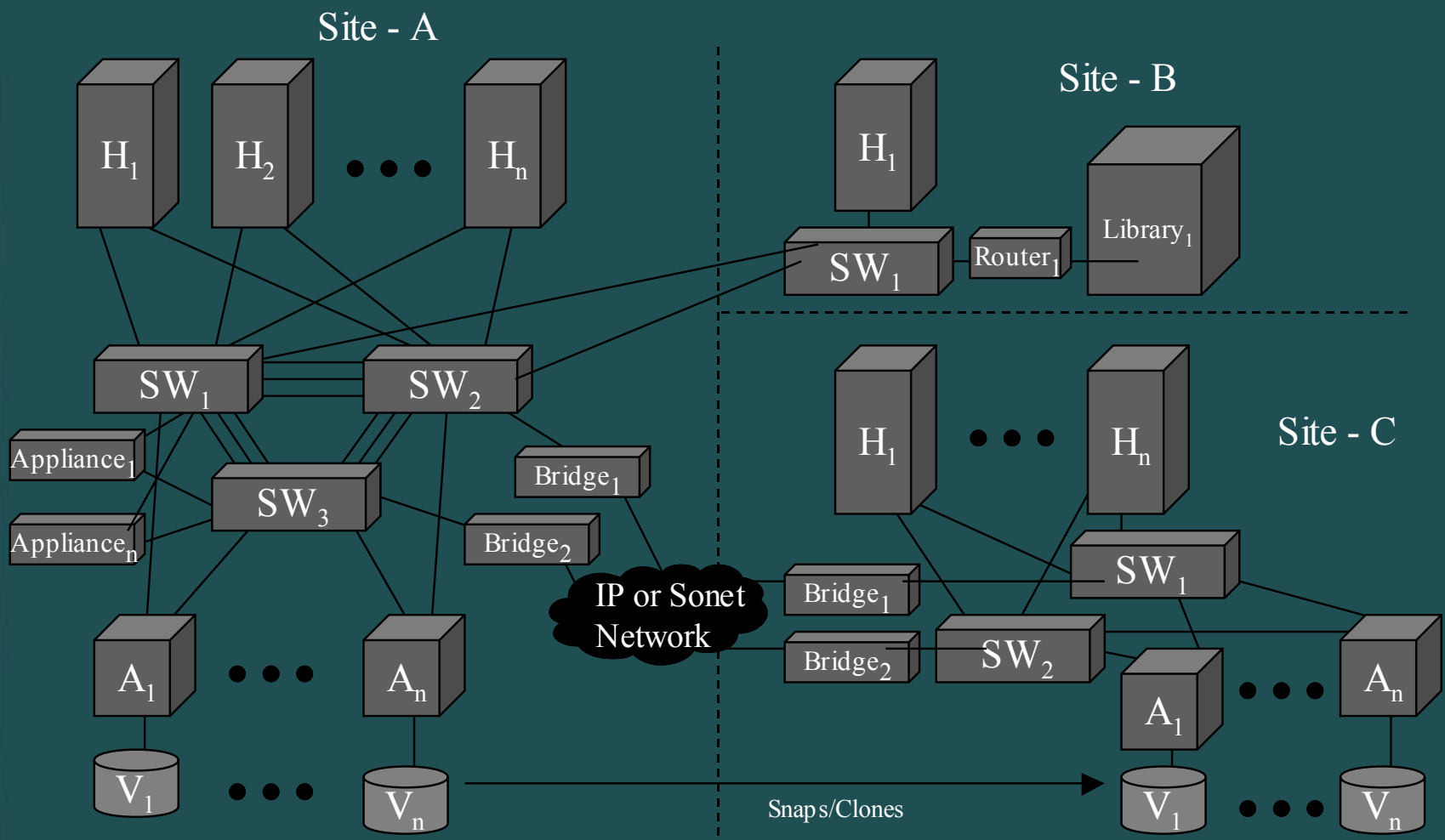
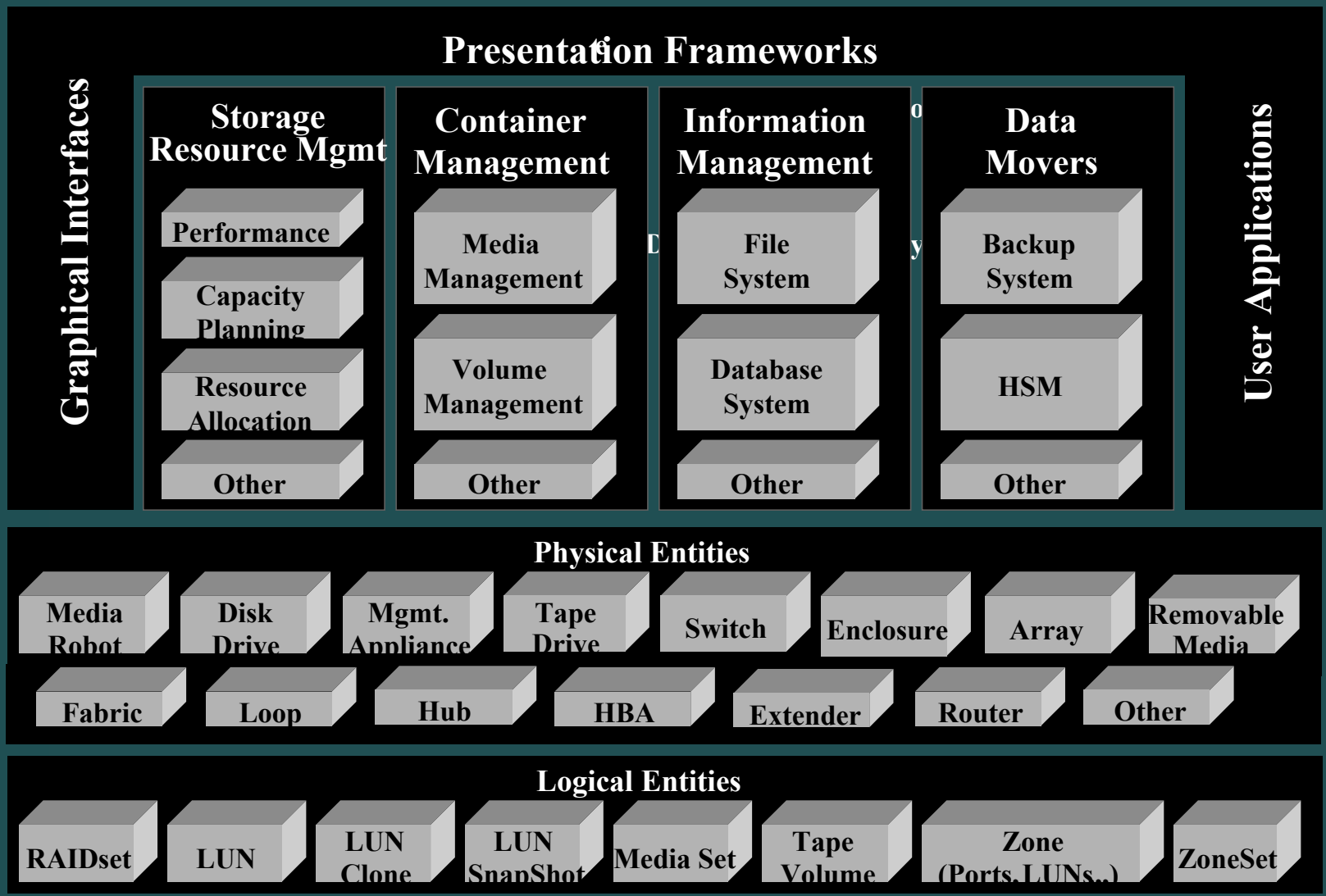
Interoperability in Storage Management Systems

IEEE 2003

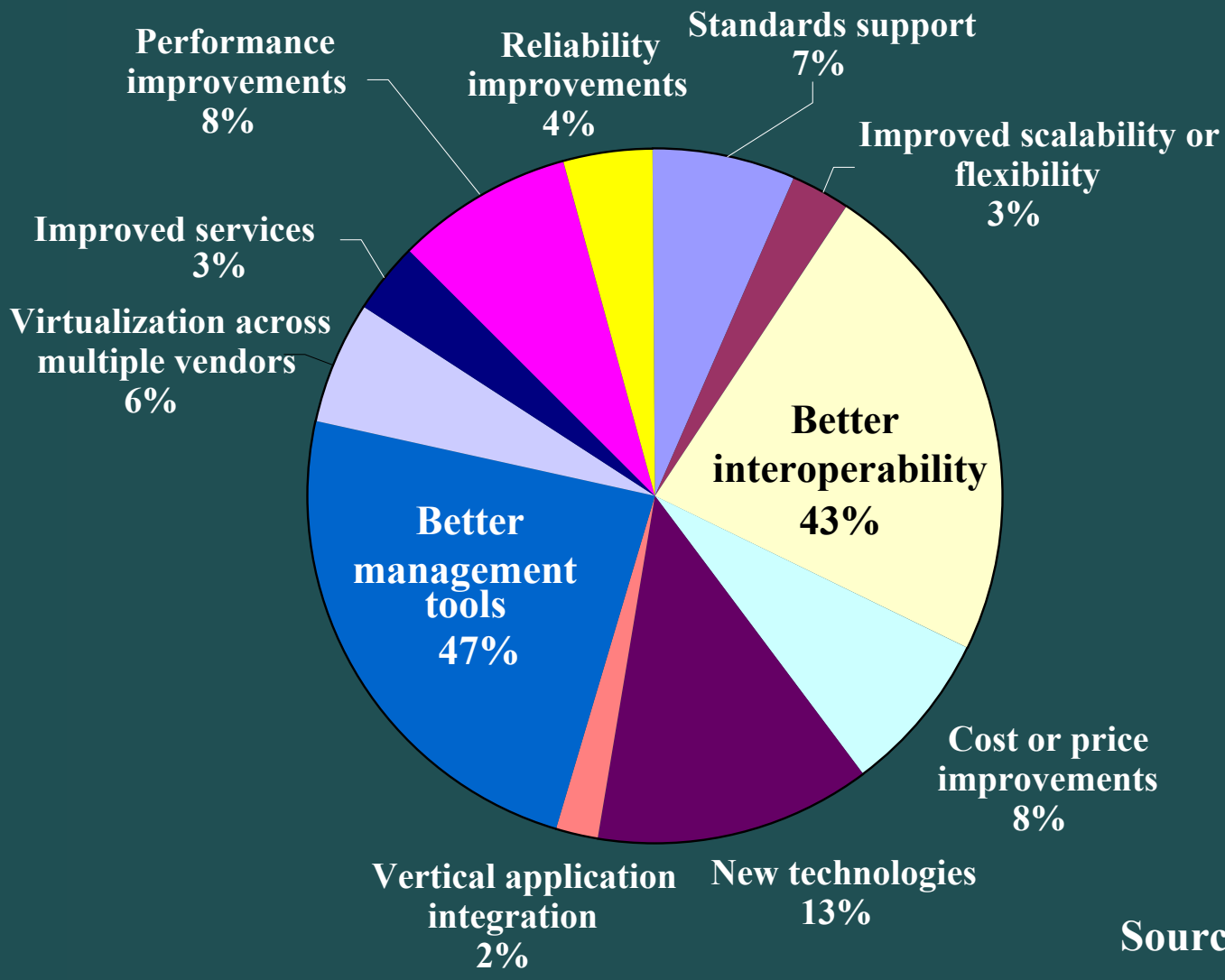
Large and Complex Networks



Cascaded/Diverse Relationships

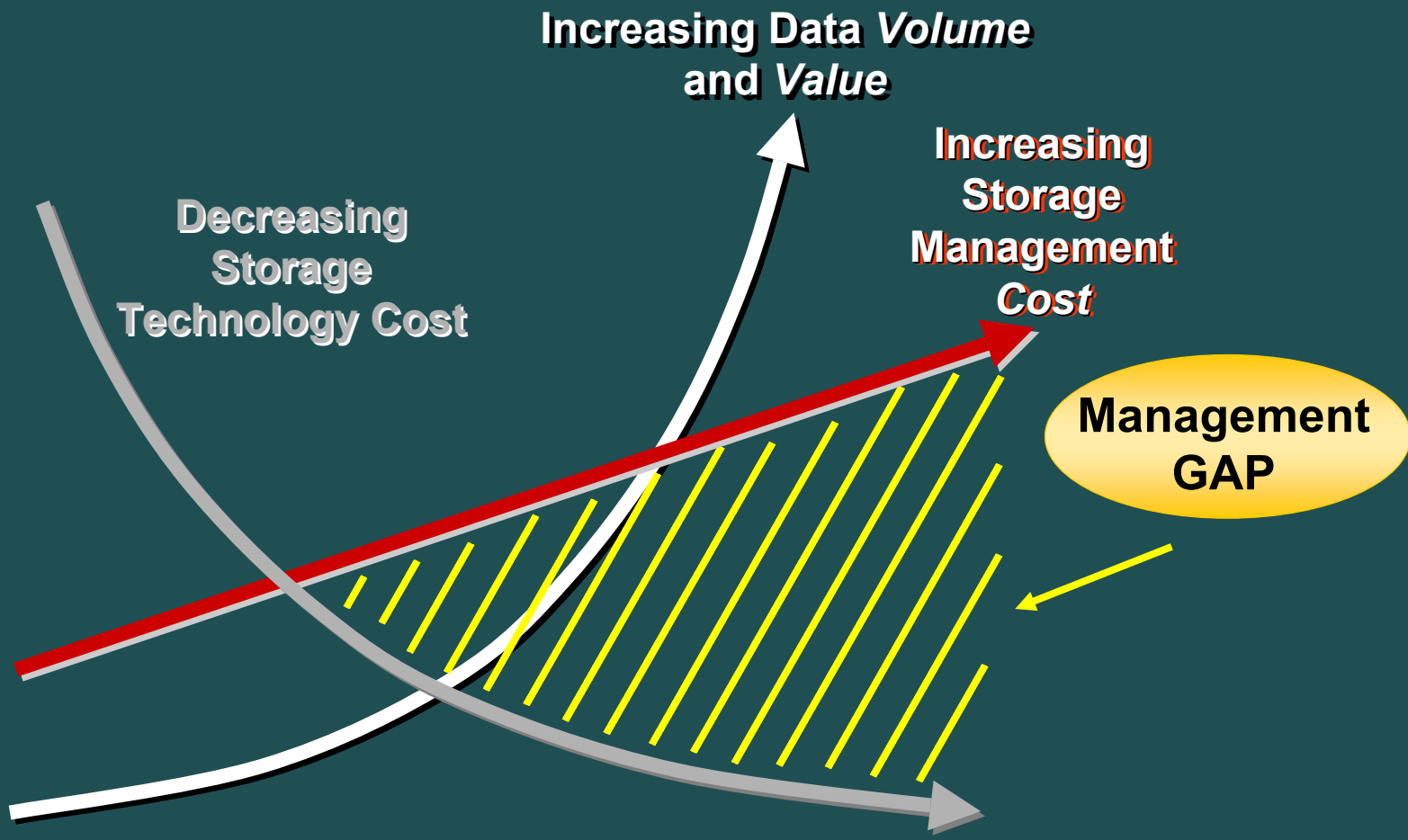


Fortune 1000 Requests



Source: InfoPro

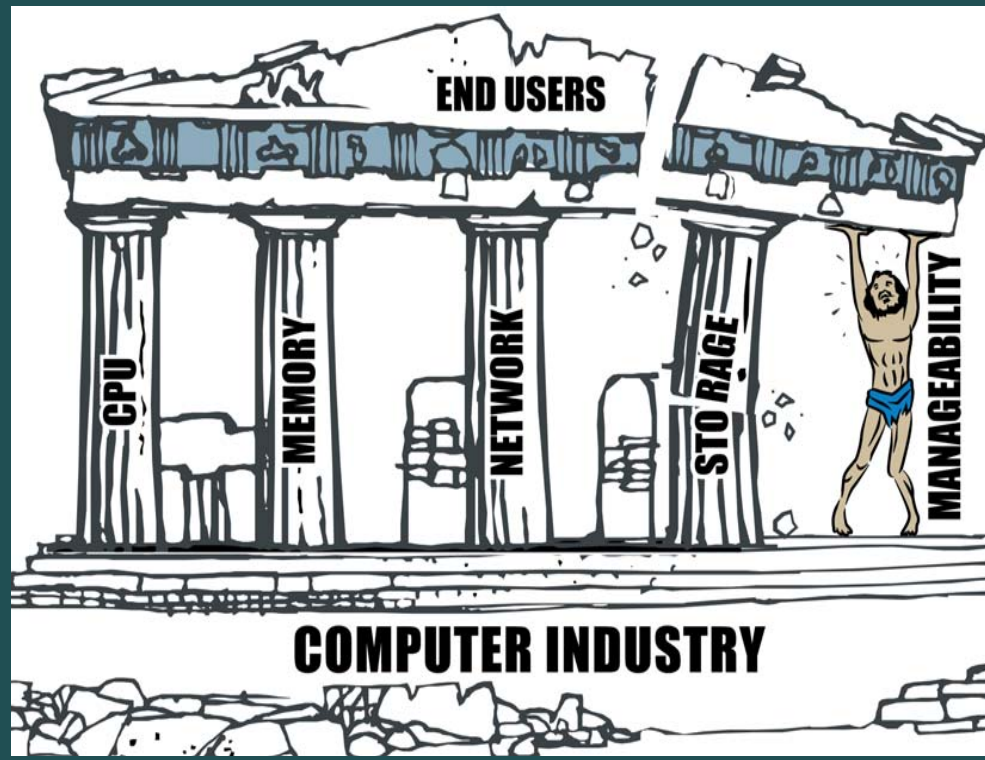
Emerging Storage Management Problems



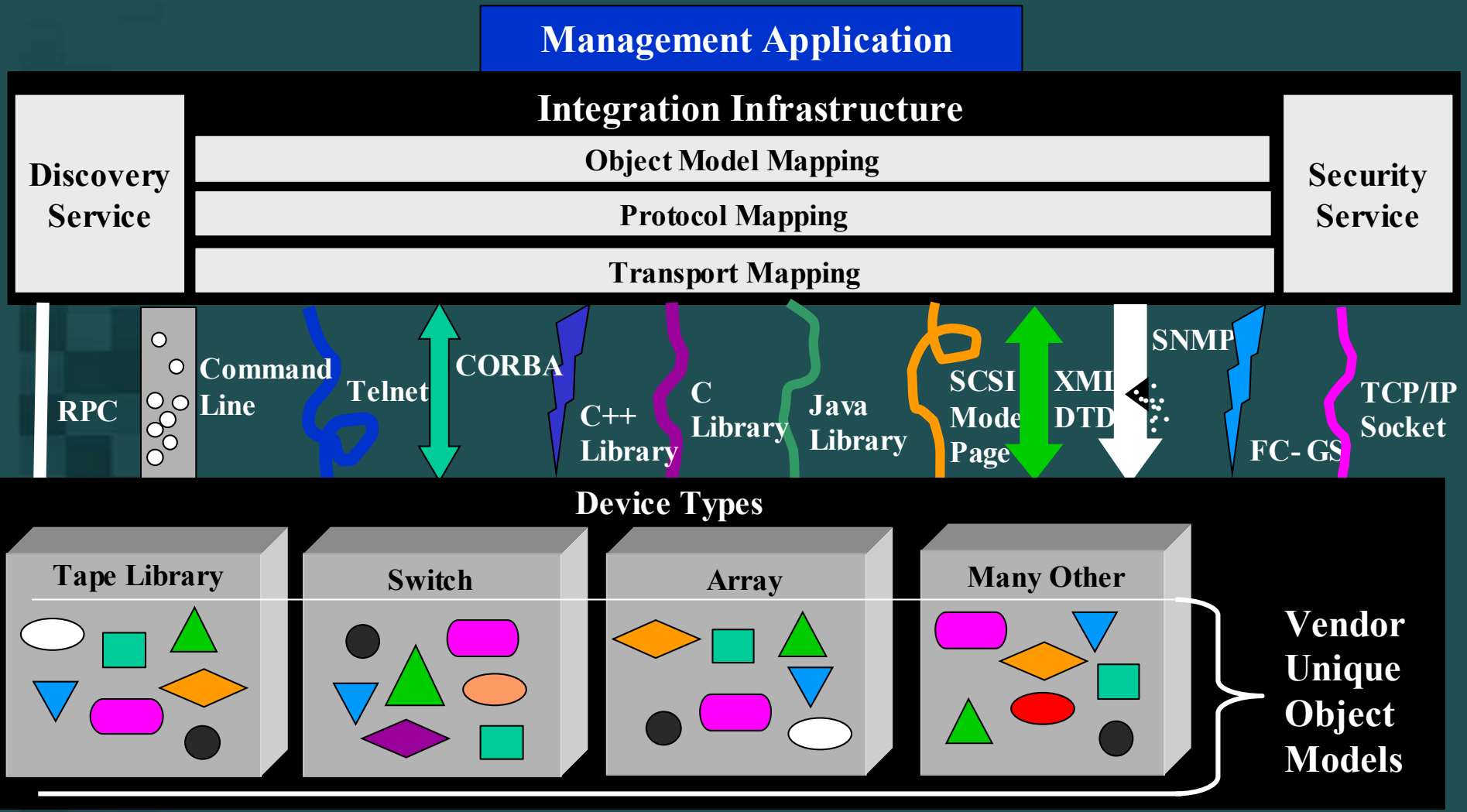
Source: Michael Peterson, In-Fusion

Additional Problem Dimensions

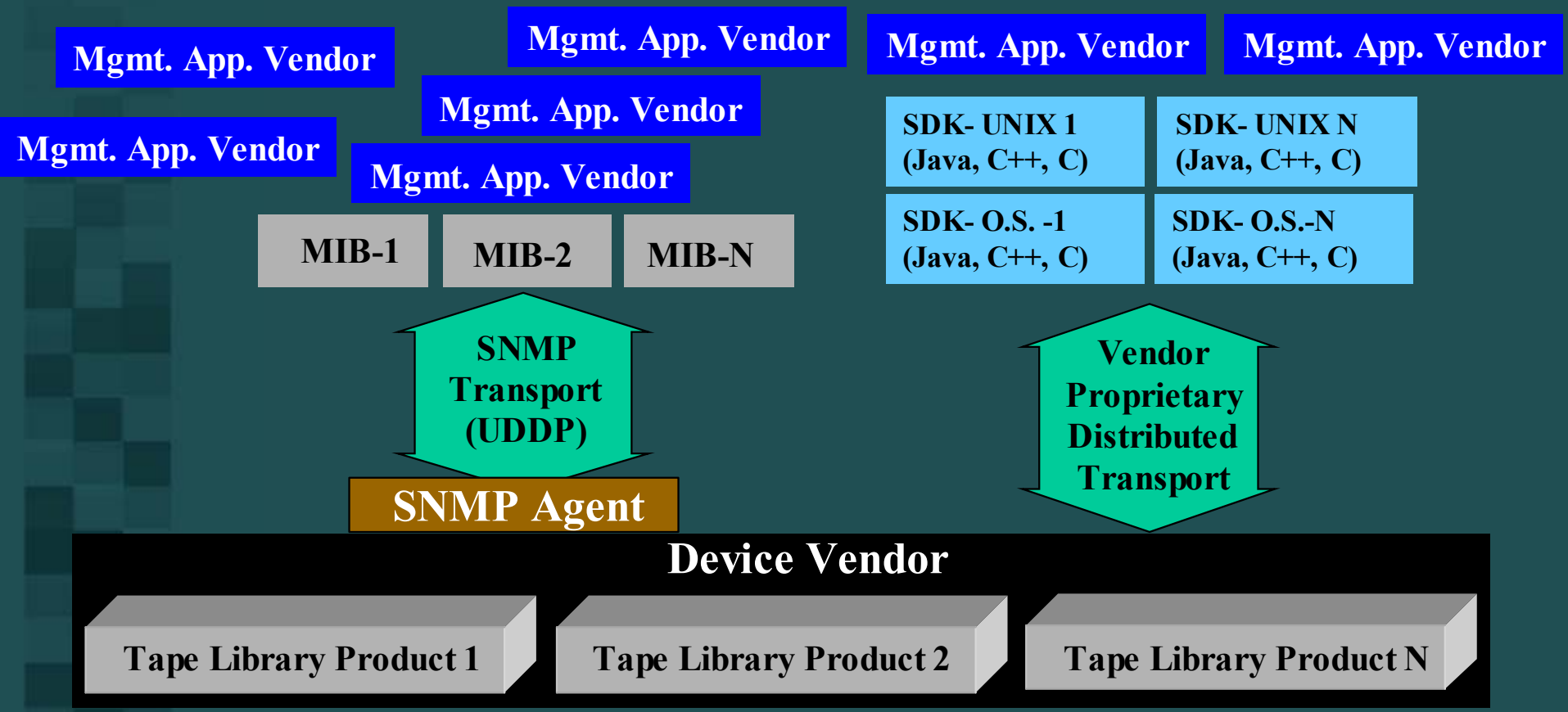
- Security
  - Privacy
  - Authentication
  - Authorization
  - Certificate distribution
- Automated discovery
  - Devices/subsystems
    - Device features
    - Security practices
    - Vendor unique extensions
- Non-cooperating active management clients
- Physical transport independence (in/out-band)
- In-field seamless multi-vendor interoperability
- Vendor Extensibility



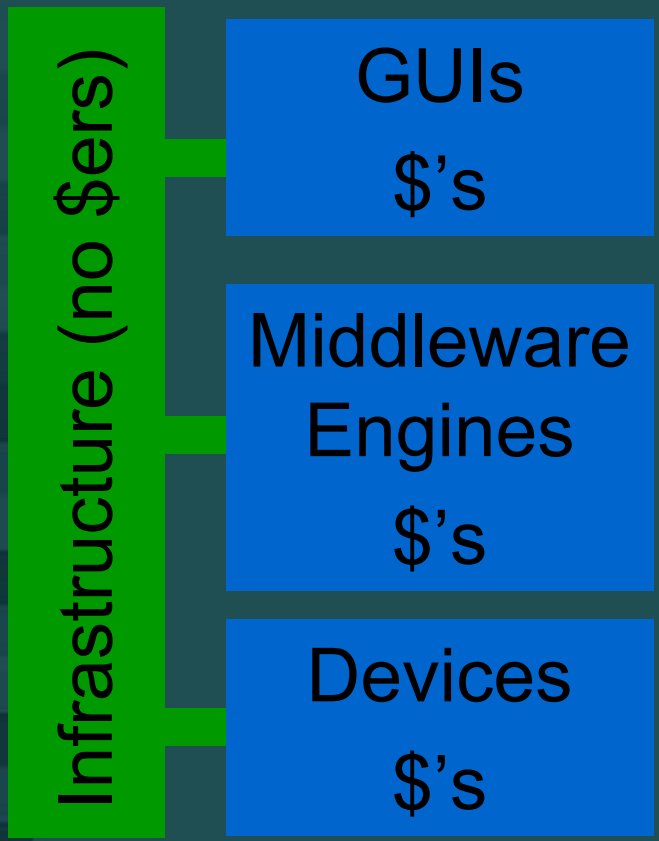
Management App Dilemma



Device Vendor Dilemma



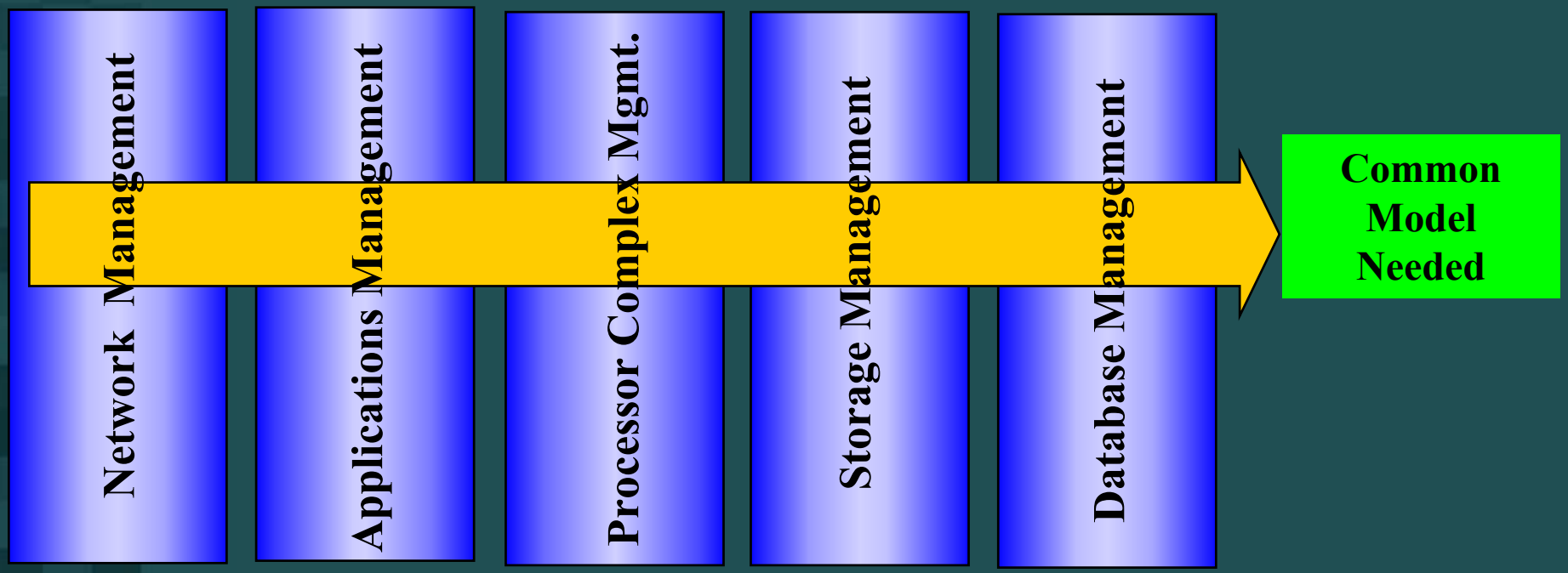
Changing Business Model



- Proprietary integration infrastructures impractical:
  - OpenSource Avail.
  - Common Transport (SMI/CIM/WBEM)
  - Development Velocity
  - Affordability Model

The Larger Problem

Systems Management "Stovepipes"

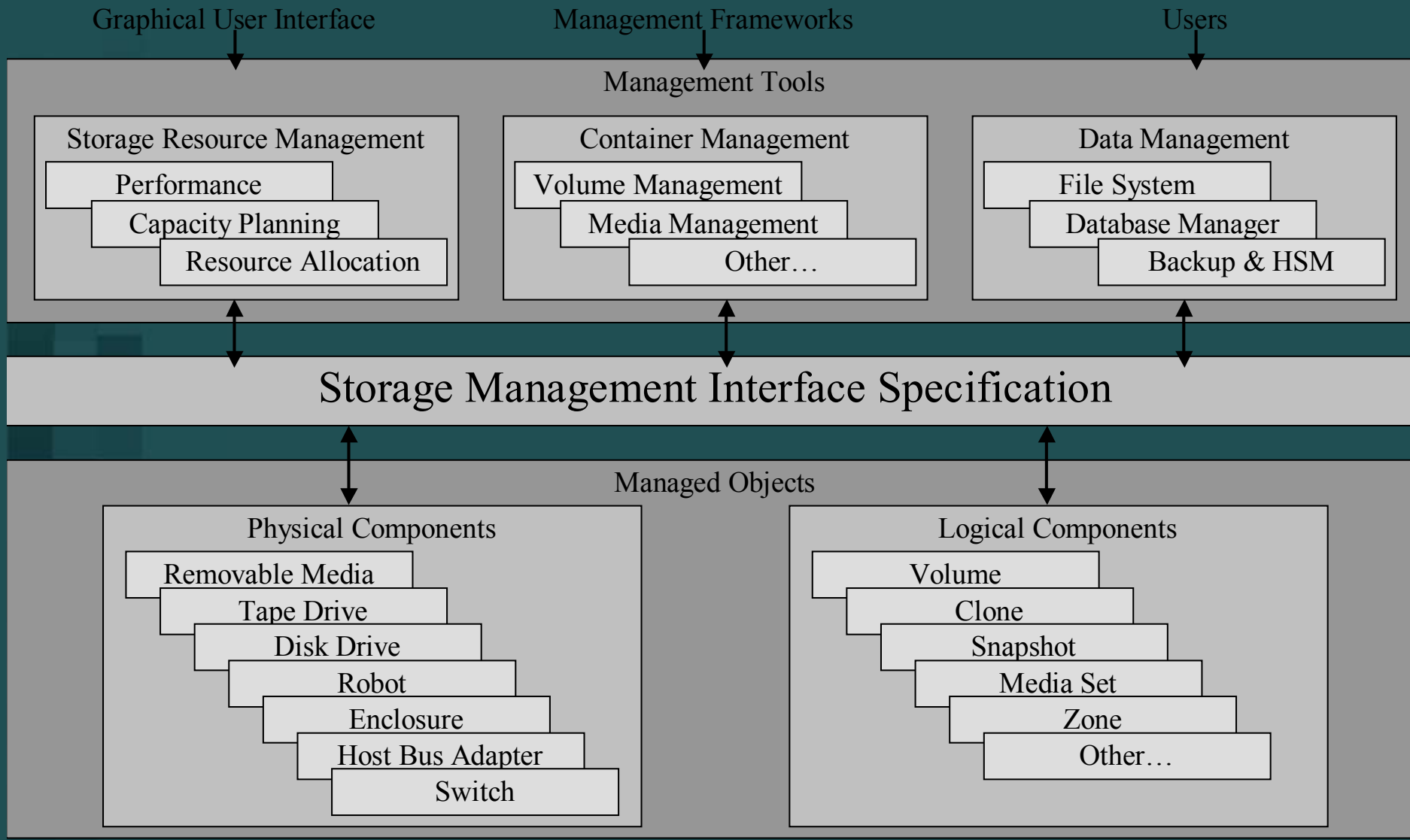


Why Not SNMP?
(Simple Network Management Protocol)

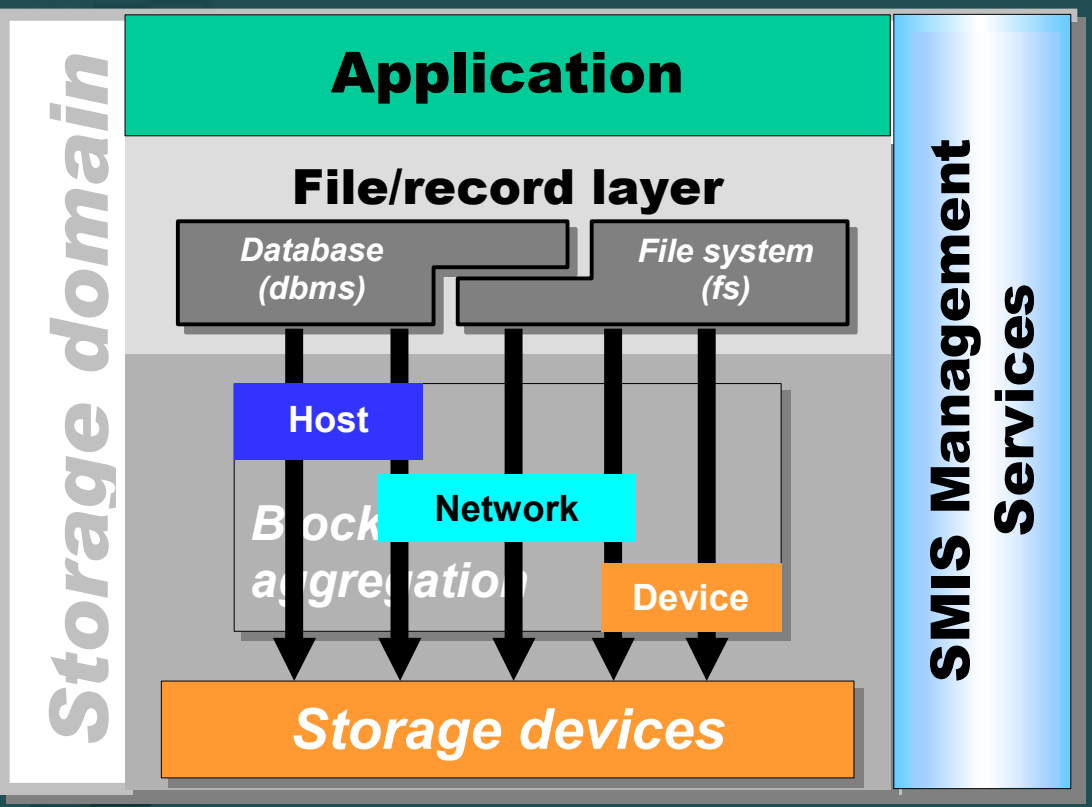
- Common Object Model
- Security
- Positive Response Mechanism
- Inflexible no auto discovery
- ACID properties
- Richness of canonical intrinsic methods
- Modeling Constructs
  - Associations

No Dominant Vendor

Architectural Vision



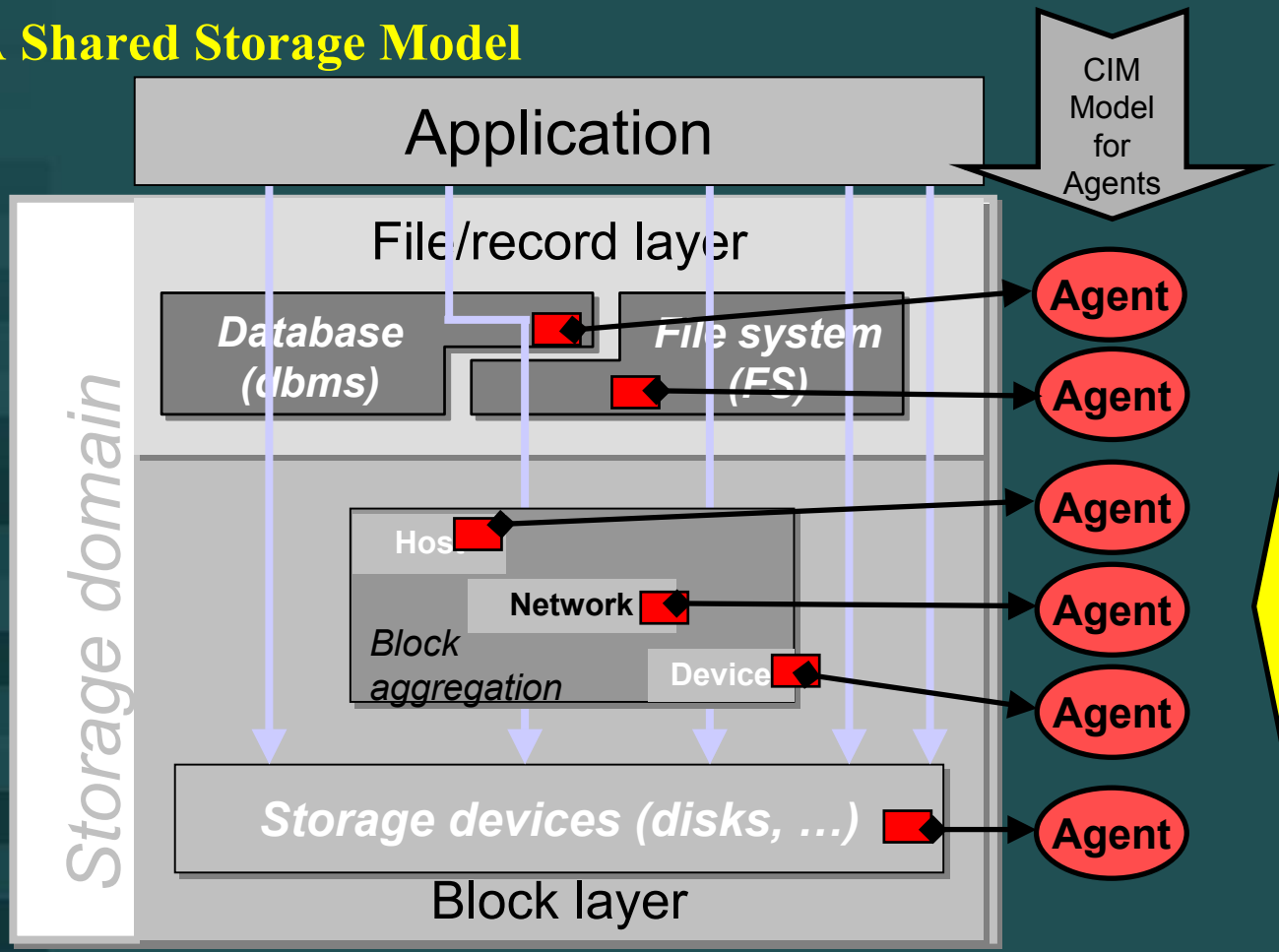
SMI-S



- Single interoperable transport
- Rigorous object model
- Durable names
- Automated discovery
- Resource locking
- Client considerations (use recipes)
- Security
- Future - transactions

SMIS

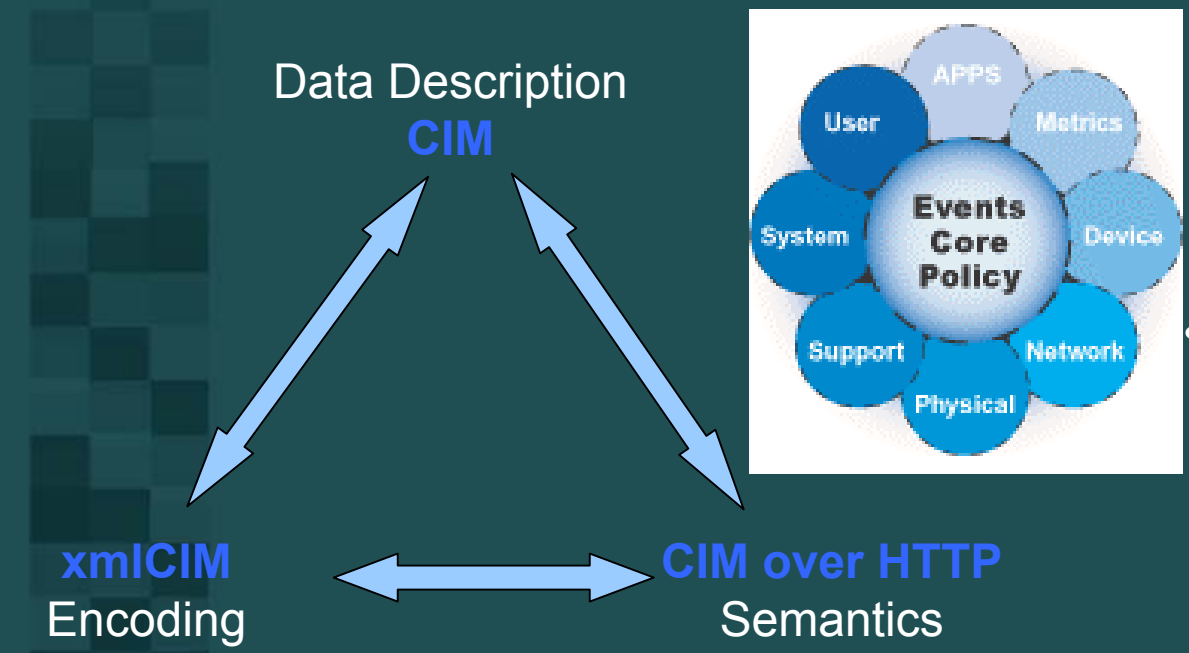
SNIA Shared Storage Model



CIM-XML Protocol for Communication with Managers

CIM/WBEM Transport Unification

DMTF distributed management task force, inc.



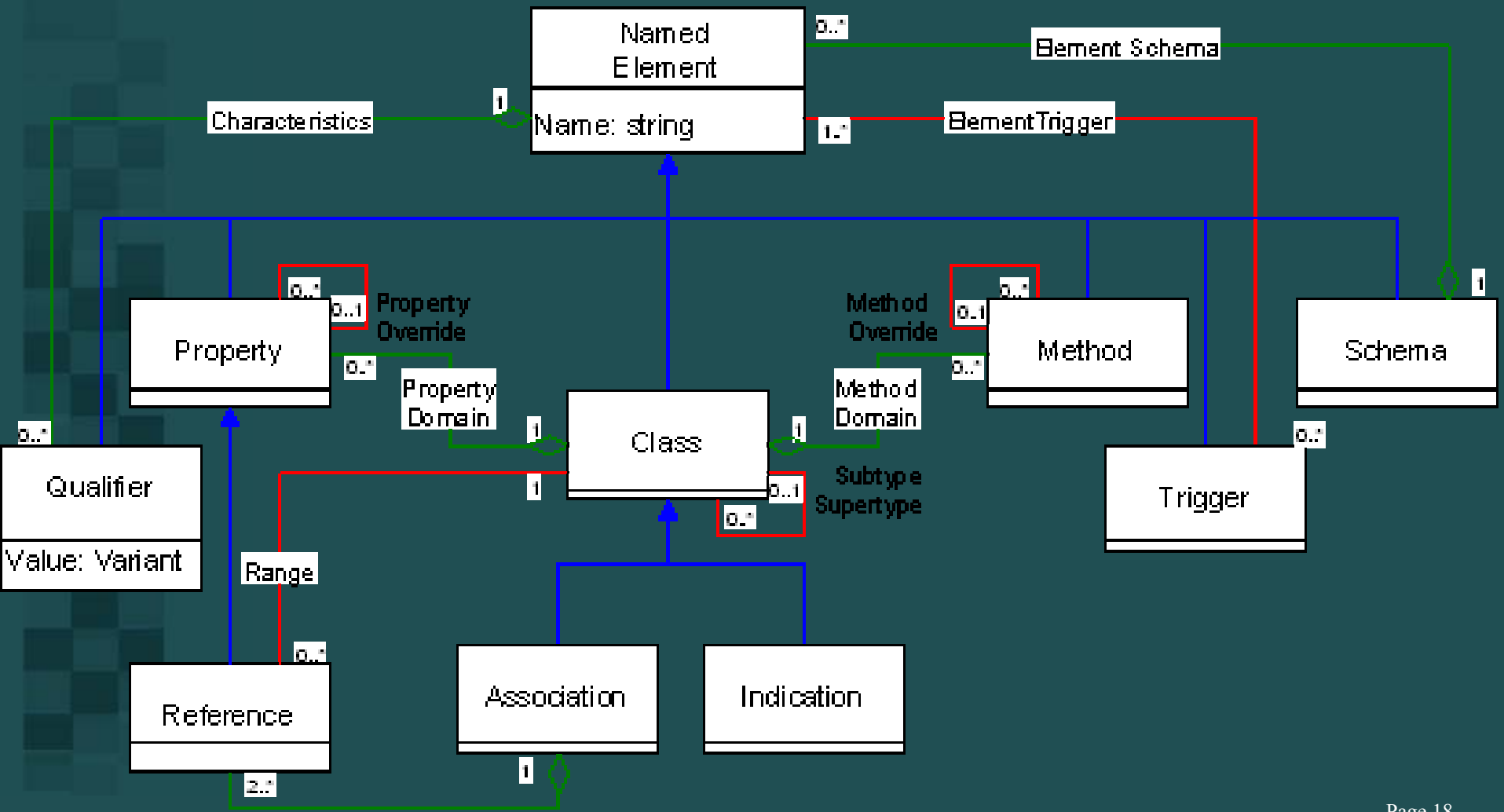
WBEM is a set of technologies:

- CIM Model: Common Information Model. UML modeling constructs + Object Definition Language (MOF Meta-Language) + Schema (Model Descriptions)
- WBEM Interface
  - CIM over HTTP: Defines semantics for the transport of CIM data descriptions over Http.
  - xmlCIM: Specification for the encoding of CIM Ops into XML.

The CIM Schema

- ~1000 Classes (maturing)
- Most aspects of computer systems and their applications
- Described by:
  - MOF - Managed Object Format (ASCII or Unicode)
  - VISIO for UML (Unified Modeling Language)
  - Whitepapers
  - XML - eXtensible Markup Language
    - **XML grammar can be used to describe CIM metaschema, Detailed in DTD (Document Type Defn)**
      - **DTD defines tags such as CLASS, INSTANCE and QUALIFIER**
    - **Associations are described via an ASSOCIATION.CLASS tag (Distinguished because they include references as properties)**

CIM Model Constructs



MOF Example

```
    [Abstract, Description (
     "An abstraction or emulation of a Hardware entity, that may "
     "or may not be Realized in physical hardware. ... ") ]
class CIM_LogicalDevice : CIM_LogicalElement
{
. . .
        [Key, MaxLen (64), Description (
         "An address or other identifying information to uniquely "
         "name the LogicalDevice.") ]
   string DeviceID;
        [Description (
         "Boolean indicating that the Device can be power "
         "managed. ...") ]
   boolean PowerManagementSupported;
        [Description (
         "Requests that the LogicalDevice be enabled (\"Enabled\" "
         "input parameter = TRUE) or disabled (= FALSE). ...)" ]
   uint32 EnableDevice([IN] boolean Enabled);
. . .
};
```

Qualifiers

Class Name and Inheritance

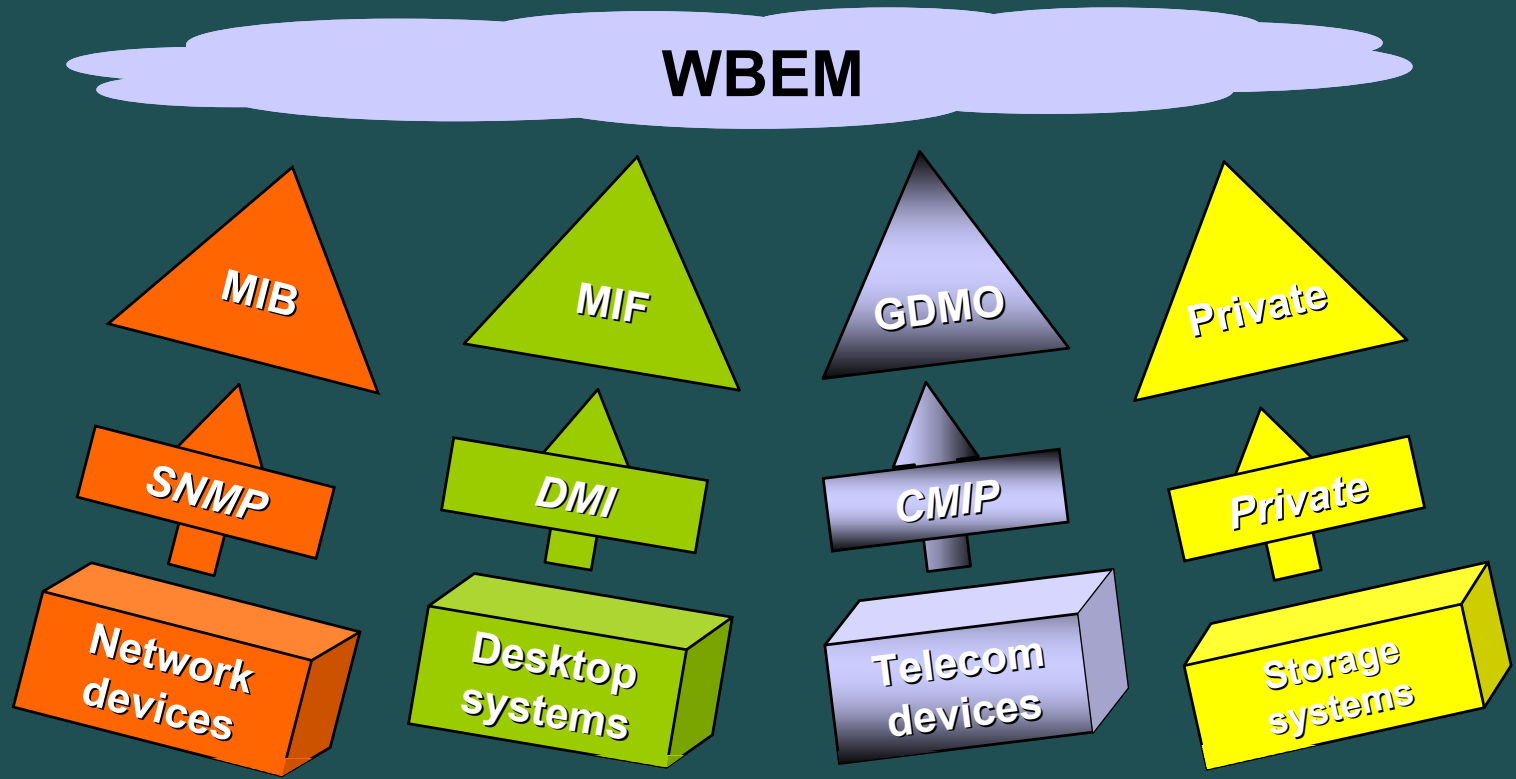
Properties

Methods

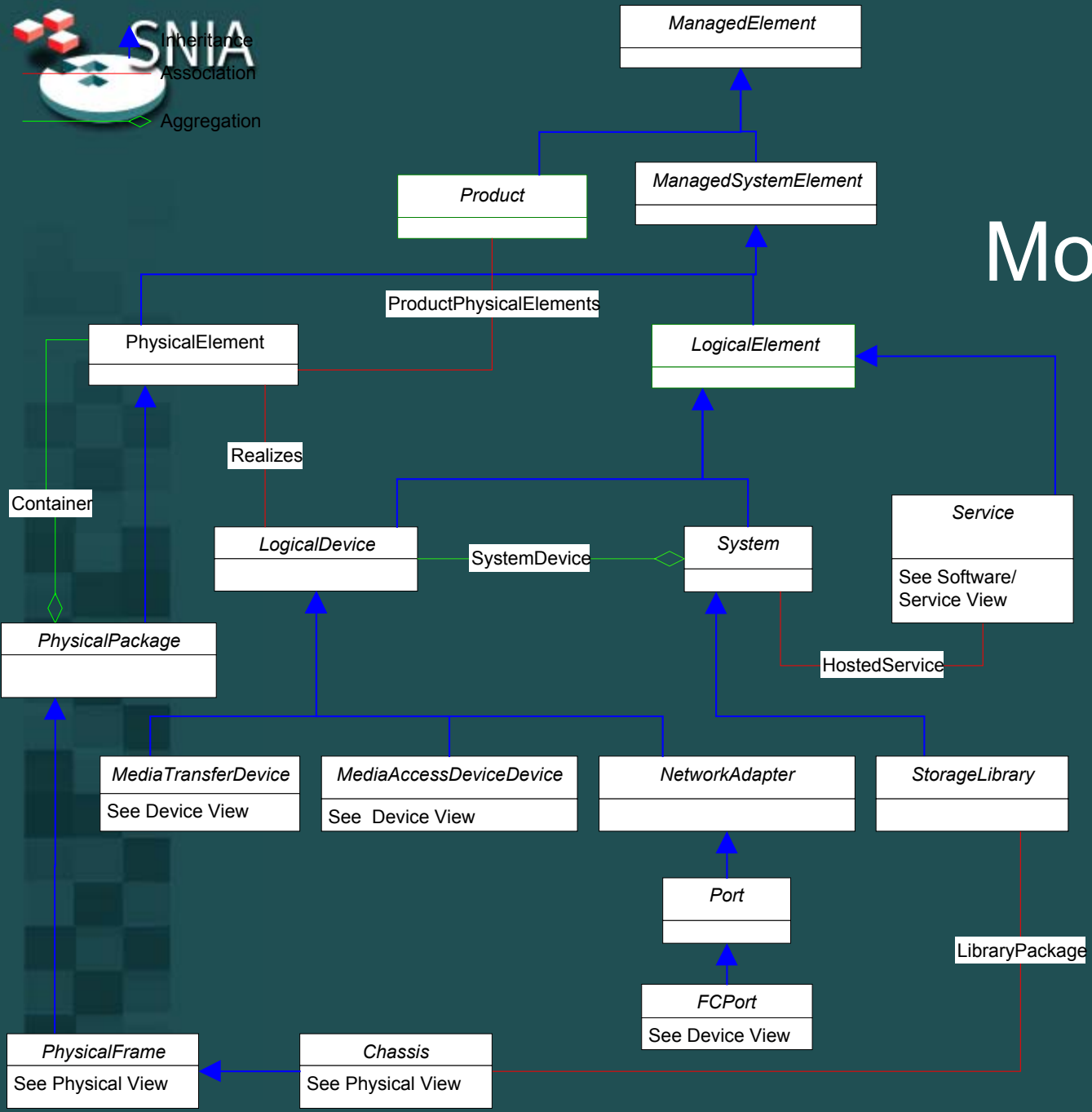
Human and Machine Readable!

WBEM Integration

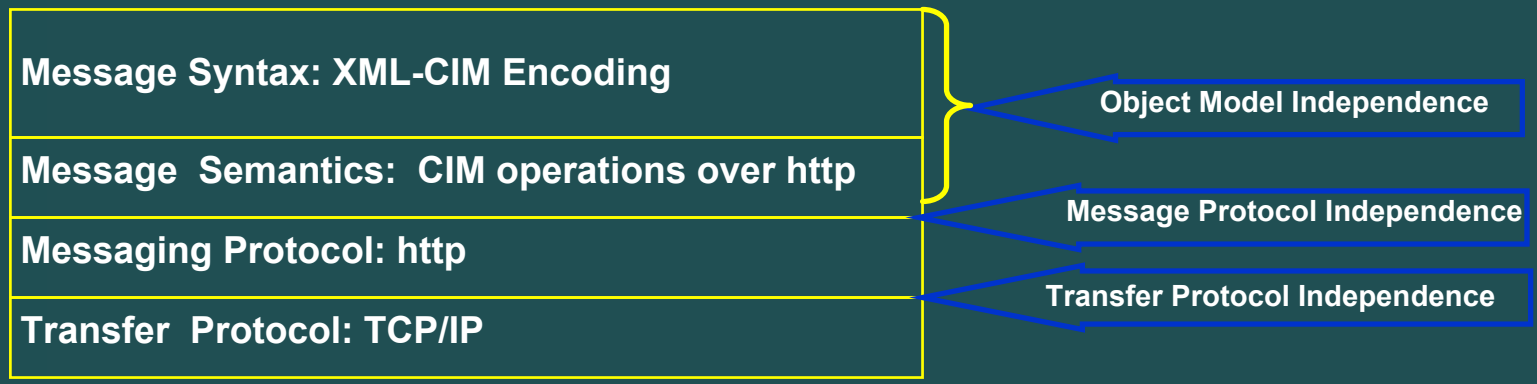
Integration Success = Semantic Richness



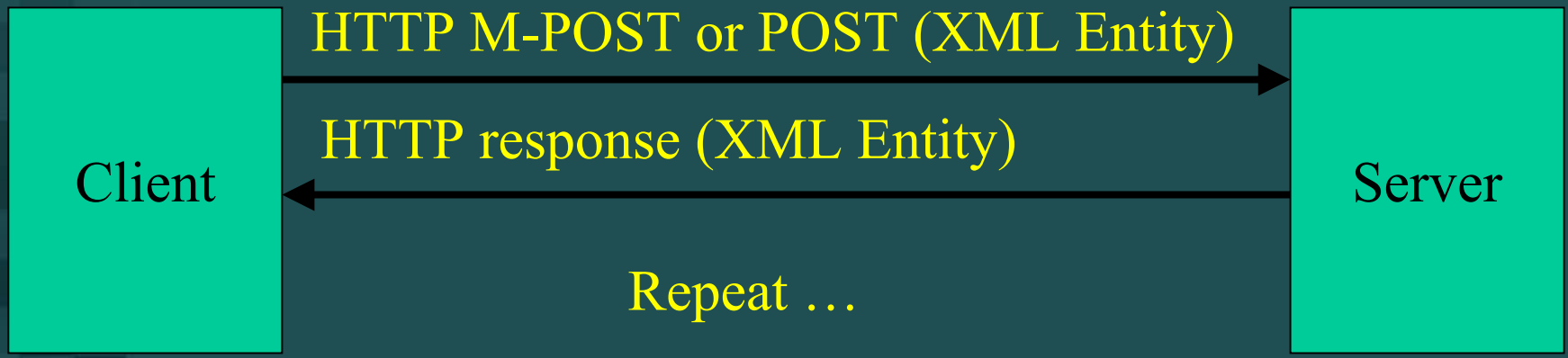
Tape Model/Profile



Protocol Stack Flexibility



Sequence Diagram



XML Method Request

```
<?xml version="1.0" ?
<CIM CIMVERSION="2.0" DTDVERSION="2.0">
    <MESSAGE ID="3" PROTOCOLVERSION="1.0">
        <SIMPLEREQ>
            <METHODCALL NAME="createLun">
                <LOCALINSTANCEPATH>
                    <LOCALNAMESPACEPATH>
                        <NAMESPACE NAME="root"> </NAMESPACE>
                    </LOCALNAMESPACEPATH>
                    <INSTANCENAME CLASSNAME="SNIA_StorageService">
                        <KEYBINDING NAME="id">
                            <KEYVALUE VALUETYPE="string"> 42 </KEYVALUE>
                        </KEYBINDING>
                    </INSTANCENAME>
                </LOCALINSTANCEPATH>
                <PARAMVALUE NAME="Size"><VALUE>40</VALUE></PARAMVALUE>
                <PARAMVALUE NAME="Lun"><VALUE>20</VALUE></PARAMVALUE>
                <PARAMVALUE NAME="test"><VALUE>1</VALUE></PARAMVALUE>
            </METHODCALL>
        </SIMPLEREQ>
    </MESSAGE>
</CIM>
```

Instance path

Parameters

XML ‘Response’ for Method

```
<?xml version="1.0" ?>
<CIM CIMVERSION="2.0" DTDVERSION="2.0">
   <MESSAGE ID="3" PROTOCOLVERSION="1.0">
      <SIMPLERSP>
         <METHODRESPONSE NAME="createLun">
            <RETURNVALUE>
               <VALUE>24</VALUE>
               <PARAMVALUE NAME="test">
                  <VALUE>21</VALUE>
               </PARAMVALUE>
            </RETURNVALUE>
         </METHODRESPONSE>
      </SIMPLERSP>
   </MESSAGE>
</CIM>
```

Human readable protocol!

CIM Operations – Canonical Intrinsic

Functional Group	Dependency	Methods
Basic Read	none	GetClass EnumerateClasses EnumerateClassNames GetInstance EnumerateInstances EnumerateInstanceNames GetProperty
Basic Write	Basic Read	SetProperty
Schema Manipulation	Instance Manipulation	CreateClass ModifyClass DeleteClass
Instance Manipulation	Basic Write	CreateInstance ModifyInstance DeleteInstance
Association Traversal	Basic Read	Associators AssociatorNames References ReferenceNames
Query Execution	Basic Read	ExecQuery
Qualifier Declaration	Schema Manipulation	GetQualifier SetQualifier DeleteQualifier EnumerateQualifiers

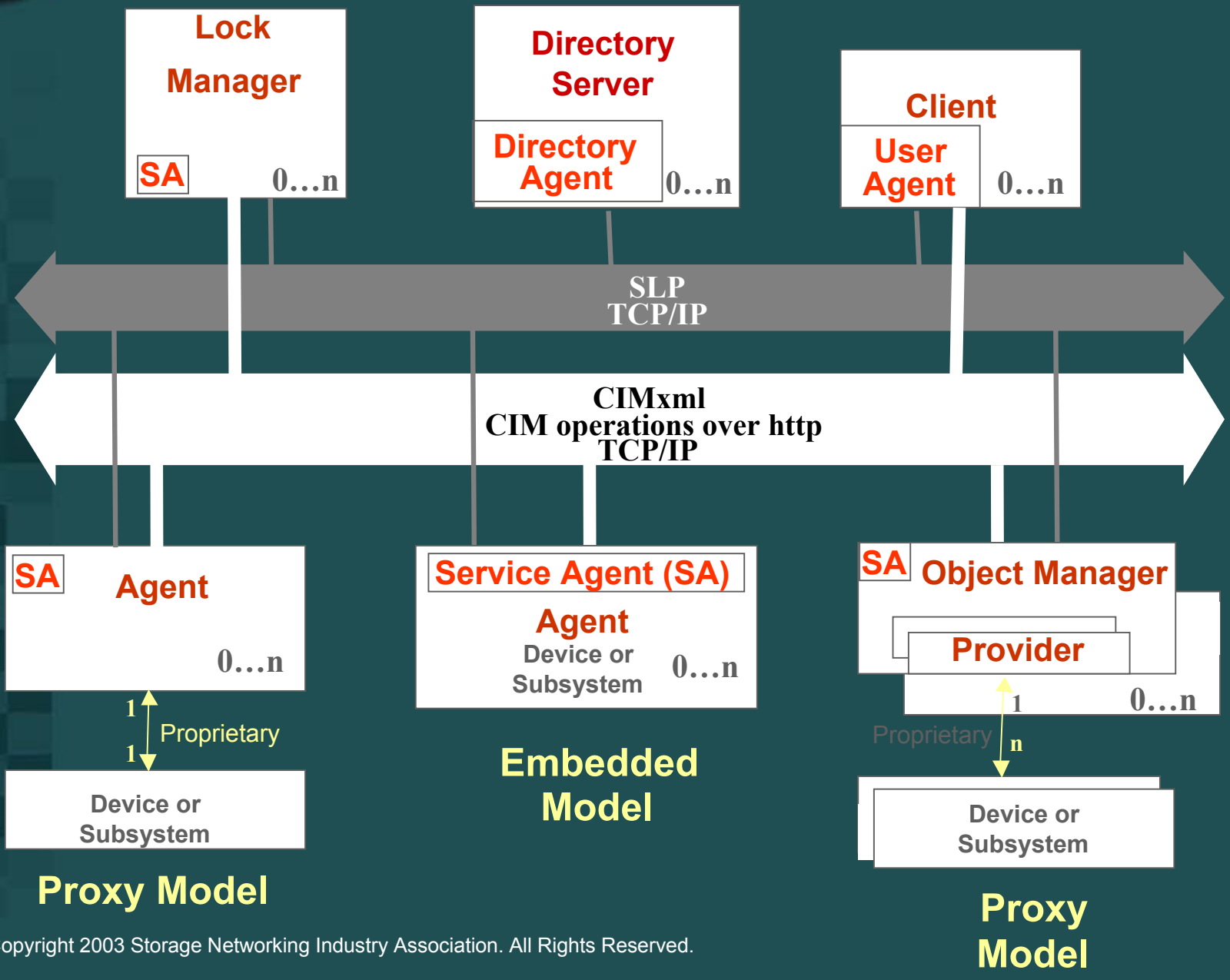
Management Discovery

- Clients need to discover agents/object managers
  - Enables “Plug and Play” Management
  - Discover the management interface (not necessarily the actual device) – the management interface is responsible for finding the device (may be proprietary)
- Uses SLP V2
  - Roles - Agent, Lock Manager, Object Manager
  - Agents include supported Profiles
  - Directory Server Optional

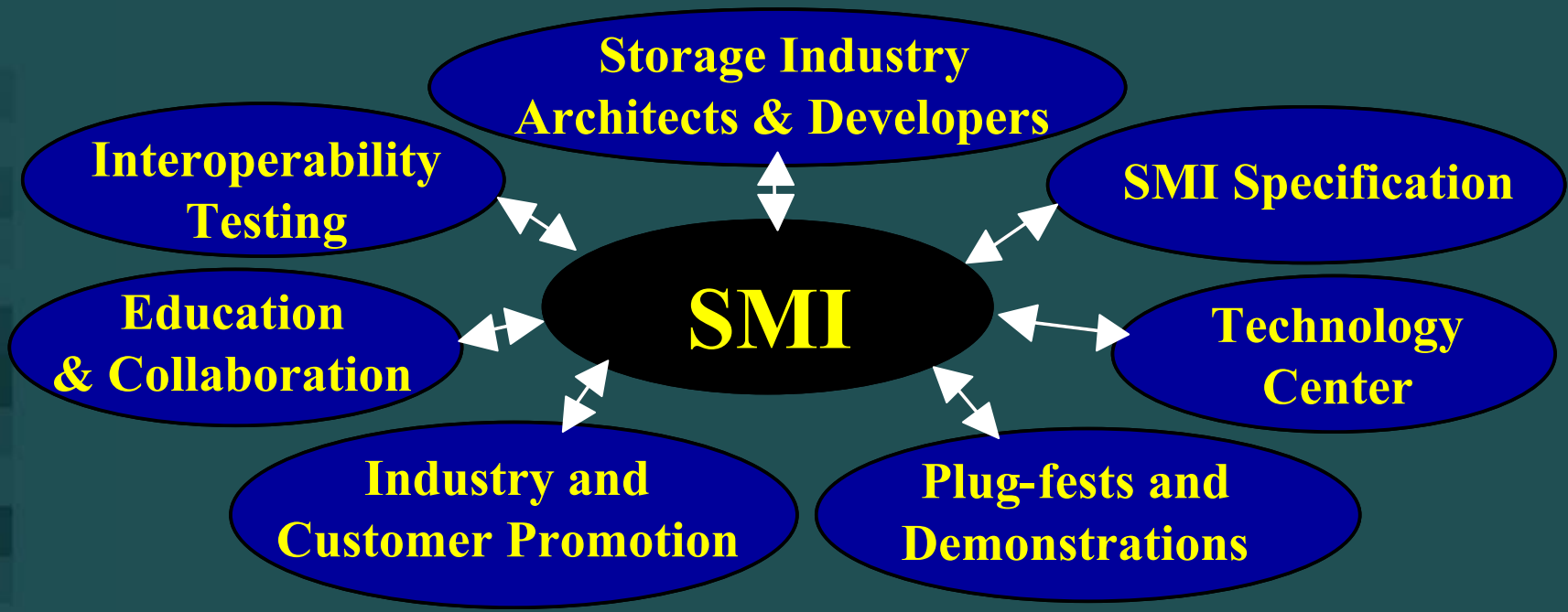
Service Template

- Language of service template: en
- Security Considerations:
- Template Text:
- ----------template begins here----------
- template-type=bluefin:http
- template-version=0.1
- template-description=
- *# This is a concrete service type based on the bluefin abstract service*
- *# type. This service type describes the Bluefin interface that uses*
- *# HTTP as the transport protocol.*
- template-url-syntax=
- url-path = ; *Not used in this service template*
- security = string O M L
- none
- *# The security protocol supported by the SLP agent.*
- none, ssl, password

SMIS Reference Model



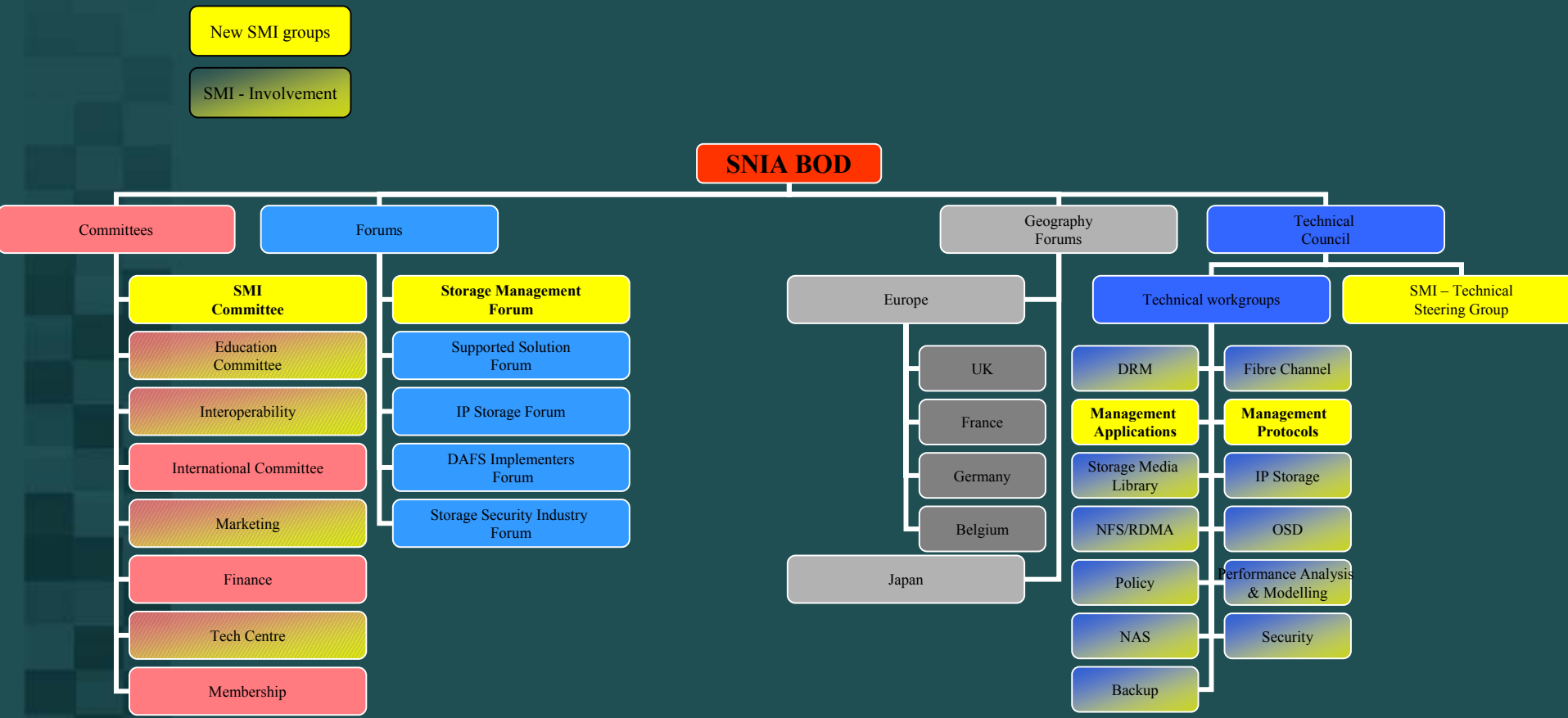
SMI Key Components



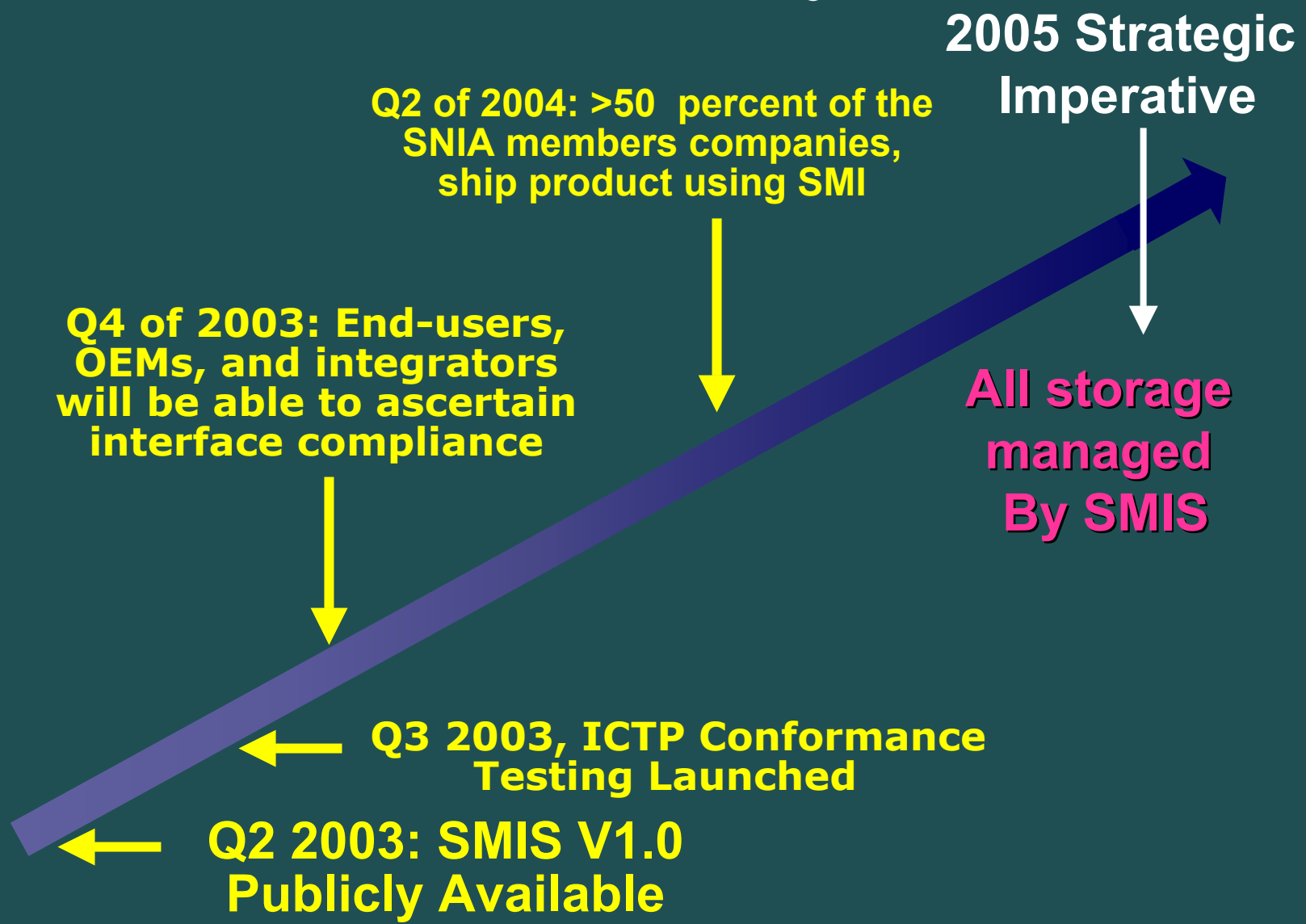
Only the SNIA can deliver !

#1 Priority for SNIA in 2003

SMI Organization



The Evolutionary Path



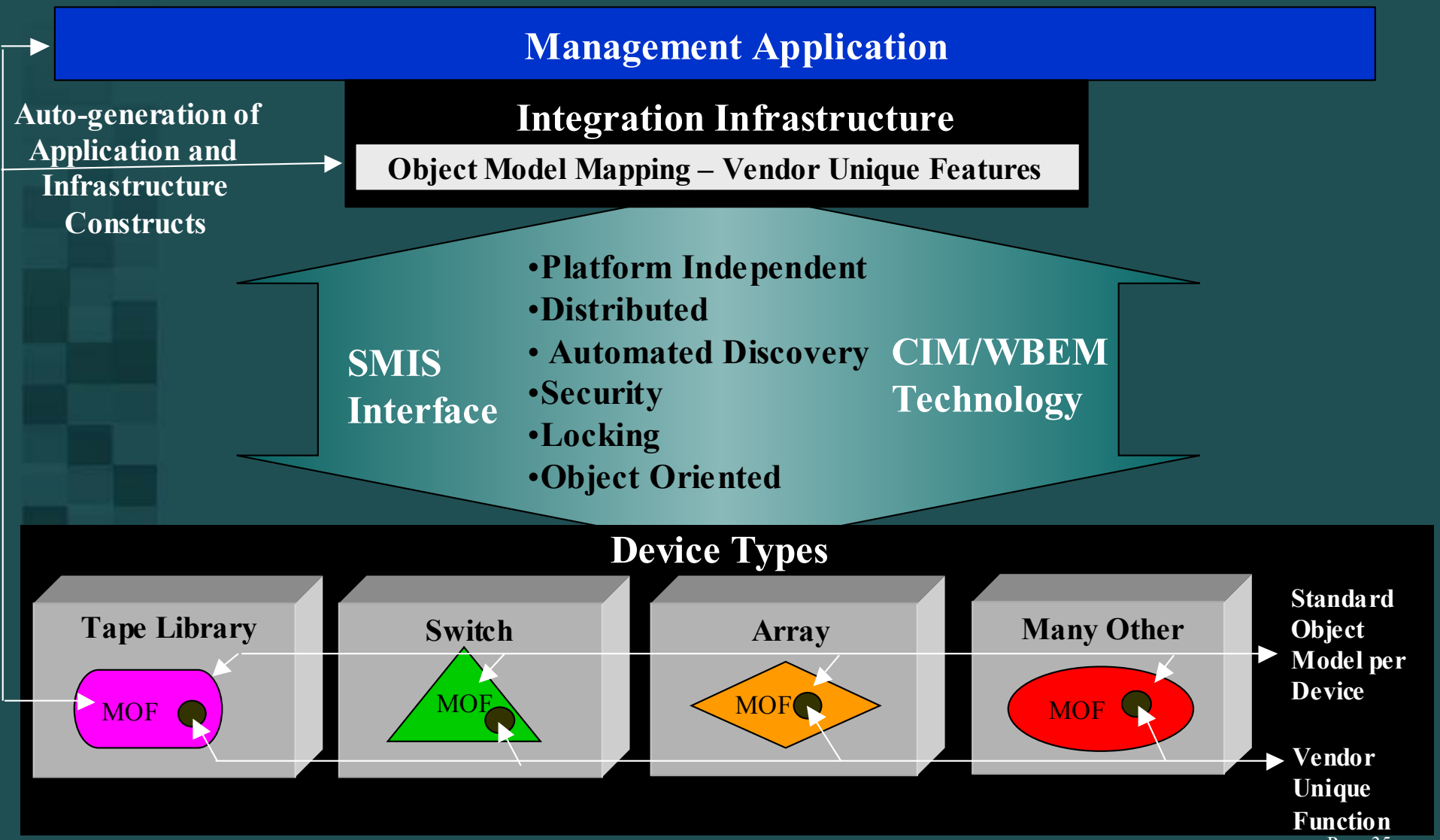
SMI 2003 – Focus

- Ship V1.0 Spec
- Start V1.1 Spec
- Start ICTP conformance Testing
- Launch marketing effort (SM-Forum)
  - Branding
  - Promotion (Industry + Consumers)
- CIM-SAN-2 & 3, expand participation and functionality
- SMIS technology and spec roadmap
- Foster the availability of tools/education/services to accelerate vendor implementation

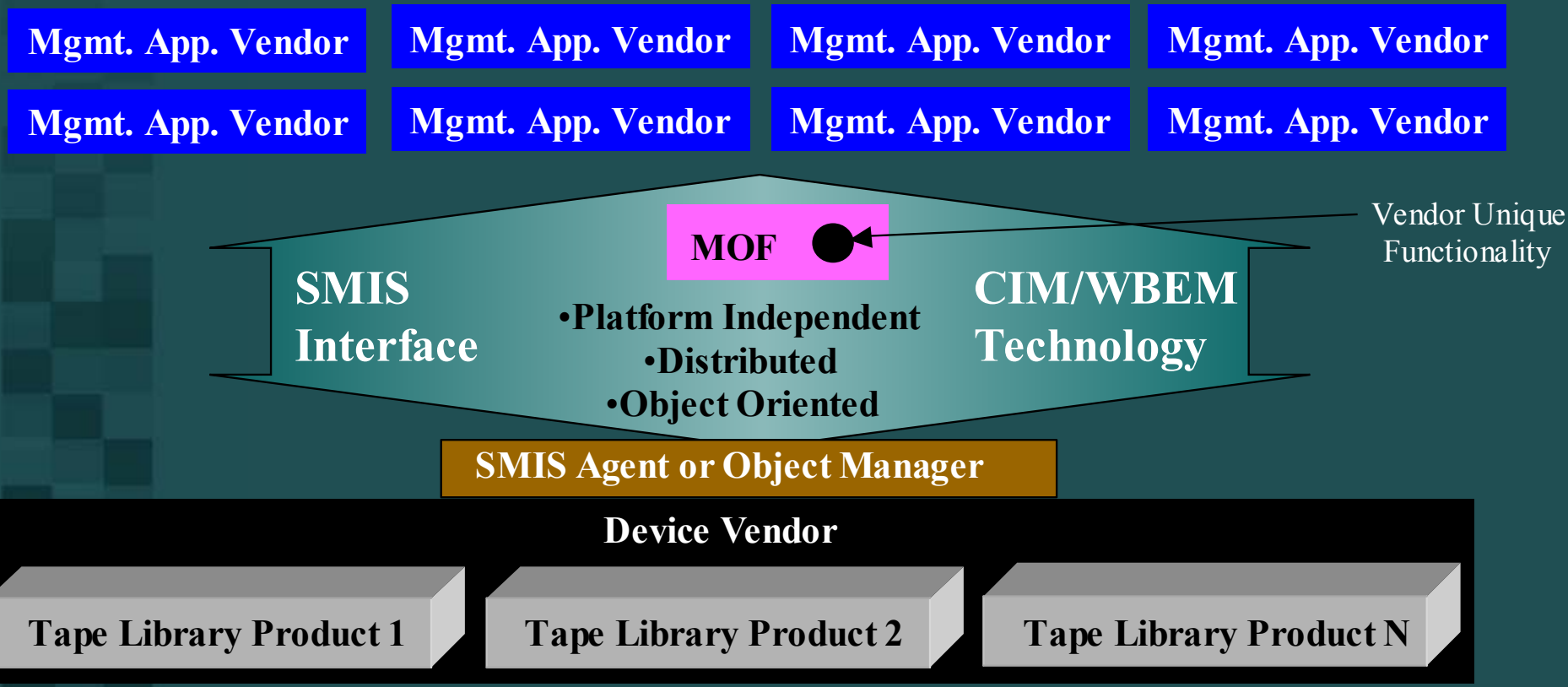
CIM-SAN-1

	Brocade	Crossroads	EMC	HDS		HP			IBM			InRange	LSI	NetA	Qlogic		Quantum	SUN	Veri
Clients and (Types)	2800, 3200, 3800	10000	Symmetrix	HDS 9970	HDS 9200	Enterprise Virtual Array (EVA)	Virtual Array (VA)	Tape Library	Tape Library	2105 F20	ESS Model 800	9000	E4600	F825	2300	San Box2	Super loader	T3	VxVM
AppIQ Manager (WBEM Services-based)	O		O	O	O	O	O			O	O	O	O	O		*		O	
BMC Patrol Storage Management (SNIA-based)	O	X	O	O	O	O	O	O	O	O	O	O	O	O	O	*	X	X	O
CA Brightstor SAN Mgr (SNIA-based)	O	*	O	O	O	O	O	X	O	O	O	O	O	O	O	O	*	O	*
CA Brightstor Portal (SNIA-based)	O	*	O	O	O	O	O	X	O	O	O	O	*	*	O	O	*	*	*
EMC:VisualSAN (SNIA-based)	*	*	O	O	O	O	O	*	*	O	O	*	O						*
EMC:Control Center (SNIA-based)	X	O	O	O	O	O	O	*	O	O	O	O	O						*
SNIA Generic GUI (SNIA-based)	O	O	O	O	O	O	O	O	O	O	O	O	O						O
HP:OpenView SAM (SNIA-based)	*	*	O	O	O	O	O	*	*	O	O	*	O						*
IBM Tivoli:TSRM,TSANM,etc.(SNIA-based)			O	O	O	O	O	*	O	O	O		O						O
InterSAN PATHLINE (WBEM CLI-based)	O		O	O	O	O	O		*	O	O	O	*						
McData/SANavigator (?-based)	O			*	*					*	*	*	*						
Sun:StorEdge Configuration Service (WBEM Services-based)			X	0	0	X	X			X	X		O						*
Veritas: NetBackup								O	O										
Veritas:SAN Point Control (Pegasus-based)			O	O	O	O	O			O	O		O					O	O

Management App Accelerator



Device Vendor Opportunity



The Value Chain

Single Extensible Management Transport

+

"Base" Object Model Compatibility

↓

New More Powerful Management Systems

↓

Reduce Storage Management Costs

↓

Customers Embrace Storage Networking Technology Faster

Distributed Management Task Force Standard

CIM TC (Technical Committee)

Chair: Andrea Westerinen, Cisco

Board Members:
Intel, Microsoft, Cisco, Sun, Tivoli/IBM, Compaq, Dell, HP, 3Com, BMC, NEC, Novell, Symantec, VERITAS
Alliance Partners, WG Chairs

Architecture Subcommittee

Interoperability
Chair: Sun

System/Devices
Chair: Cisco

Database
Chair: Oracle

Events
Chair: Sun

Networks
Chair: Cisco

LDAP Mapping
Chair: Avaya

Policy/SLA
Chair: IBM

User/Security
Chair: IBM

DEN
Chair: <Open>

Applications/Metrics
Chair: TOG

Support/Help Desk
Chair: STEI

Open Source Code

- Decide whether Java or C++ development language
- Java:
- SNIA (Open Group) CIMOM
- WBEM Services (Sun) CIMOM
- C++:
- OpenWBEM (Caldera's) CIMOM
- Pegasus (Open Group) CIMOM

References

- DMTF – http://www.dmtf.org
- W3C – http://www.w3c.org
- SNIA – http://www.snia.org
- OpenGroup – http://www.opengroup.org