The DMTF, CIM, WBEM and Related Standards

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What is WBEM?

- **Web Based Enterprise Management**
- **incorporates:**
  - representations of elements of systems: the Common Information Model (CIM);
    - methodology for relating those elements to create a system description;
    - enables interacting with interfaces proprietary to the implementation of those elements.
  - defines Internet-based protocols for accessing and manipulating those description: XML-based over HTTP.

The DMTF

- **Distributed Management Task Force**
- **Members are interested corporate members and others (*e.g.*, academia).**
- **Sponsors:**
  - development of standards for distributed management;
  - technical conferences;
  - working groups and committees;
  - publication of the standards and related information.
  - http://www.dmtf.org/

Examples of members

THE DMTF BOARD

- 3Com
- Avaya Communications
- BMC Software, Inc.
- Cisco
- Compaq Computer Corp.
- Dell Computer Corp.
- Hewlett-Packard Company
- IBM/Tivoli Systems, Inc.
- Intel Corporation
- Microsoft Corporation
- NEC Corporation
- Novell
- Sun Microsystems, Inc.
- Symantec Corporation

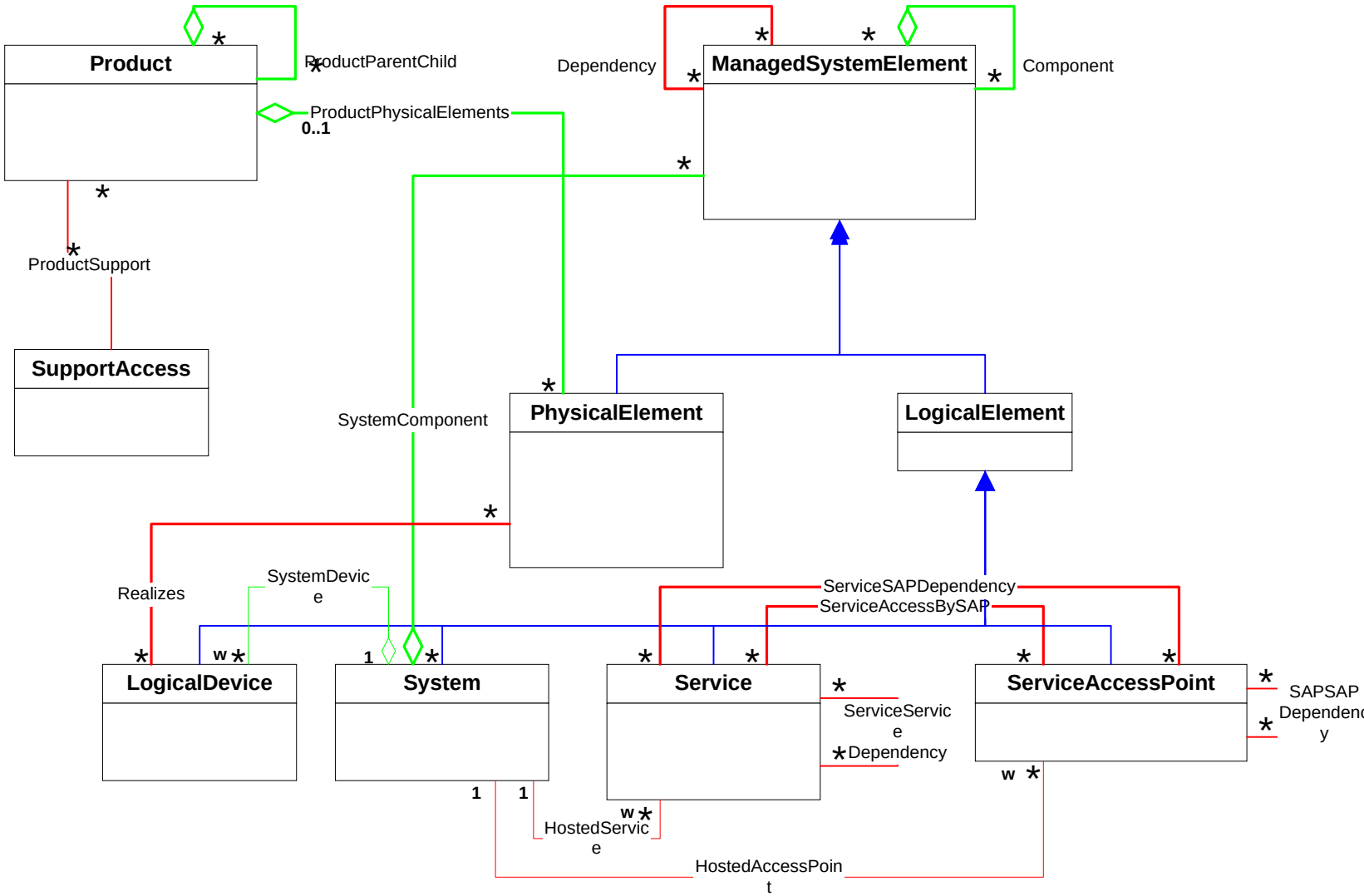
The Common Information Model

The "Common Information Model Specification, v2.2", which includes:

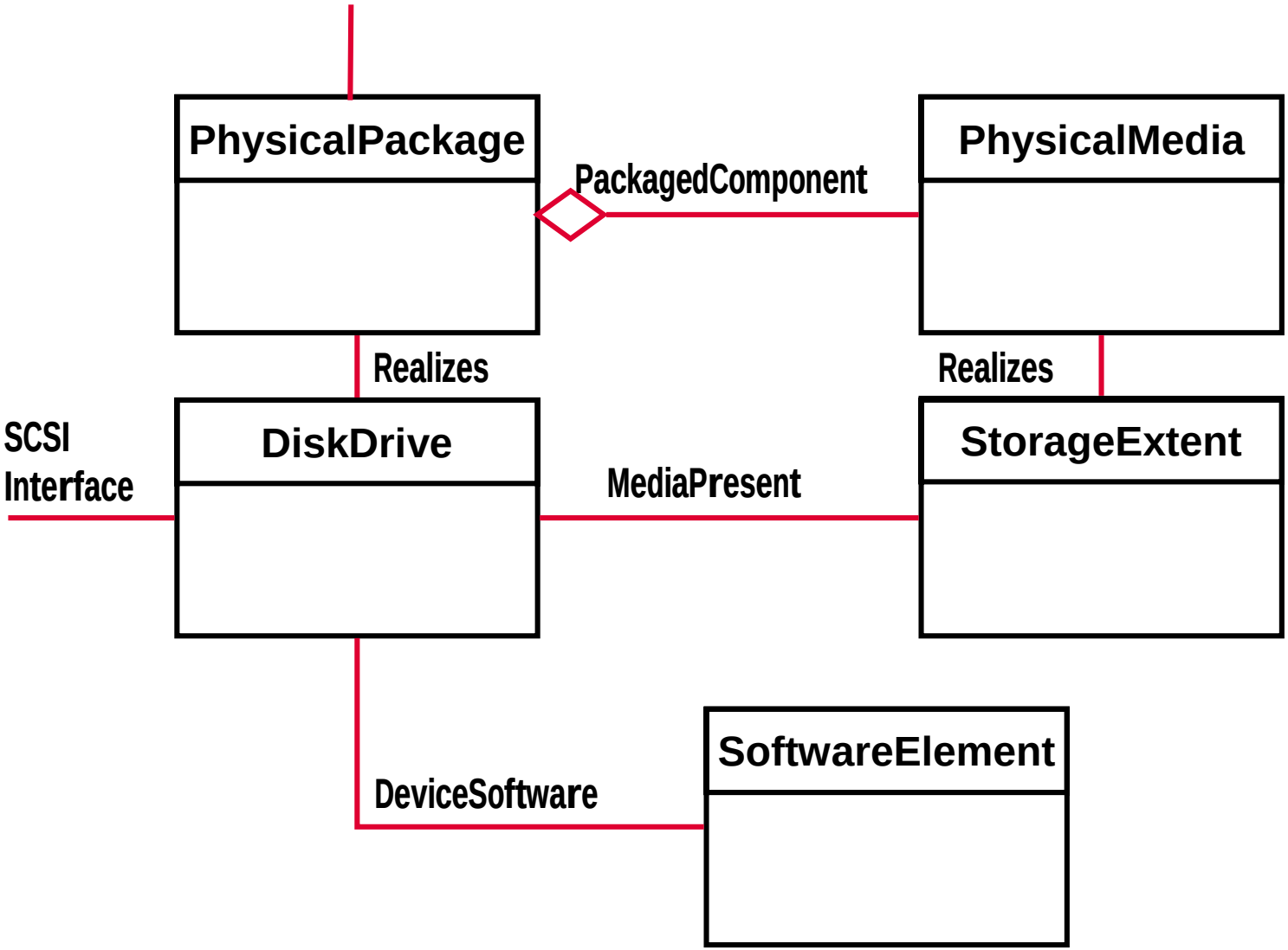
- a language for representing classes and instances (the Managed Object Format);
- various rules for the use of the above (including a UML representation);
- an object model (classes, instances, inheritance, polymorphism, etc.);
- event and IPsec models to help manage a network;
- and a schema of common classes.

http://www.dmtf.org/spec/

Example: Core Model Schema



Example: Part of a Model; HDD



How Is The CIM Schema Defined?

- **MOF - Managed Object Format (ASCII or Unicode)**
- **UML (Unified Modeling Language)**
- **XML - eXtensible Markup Language**
  - XML grammar describes CIM metaschema - Described as DTD (Document Type Definition).
  - CIM classes and instances are valid XML documents.
  - References are XML “hyperlinks” (inline links)

MOF Example

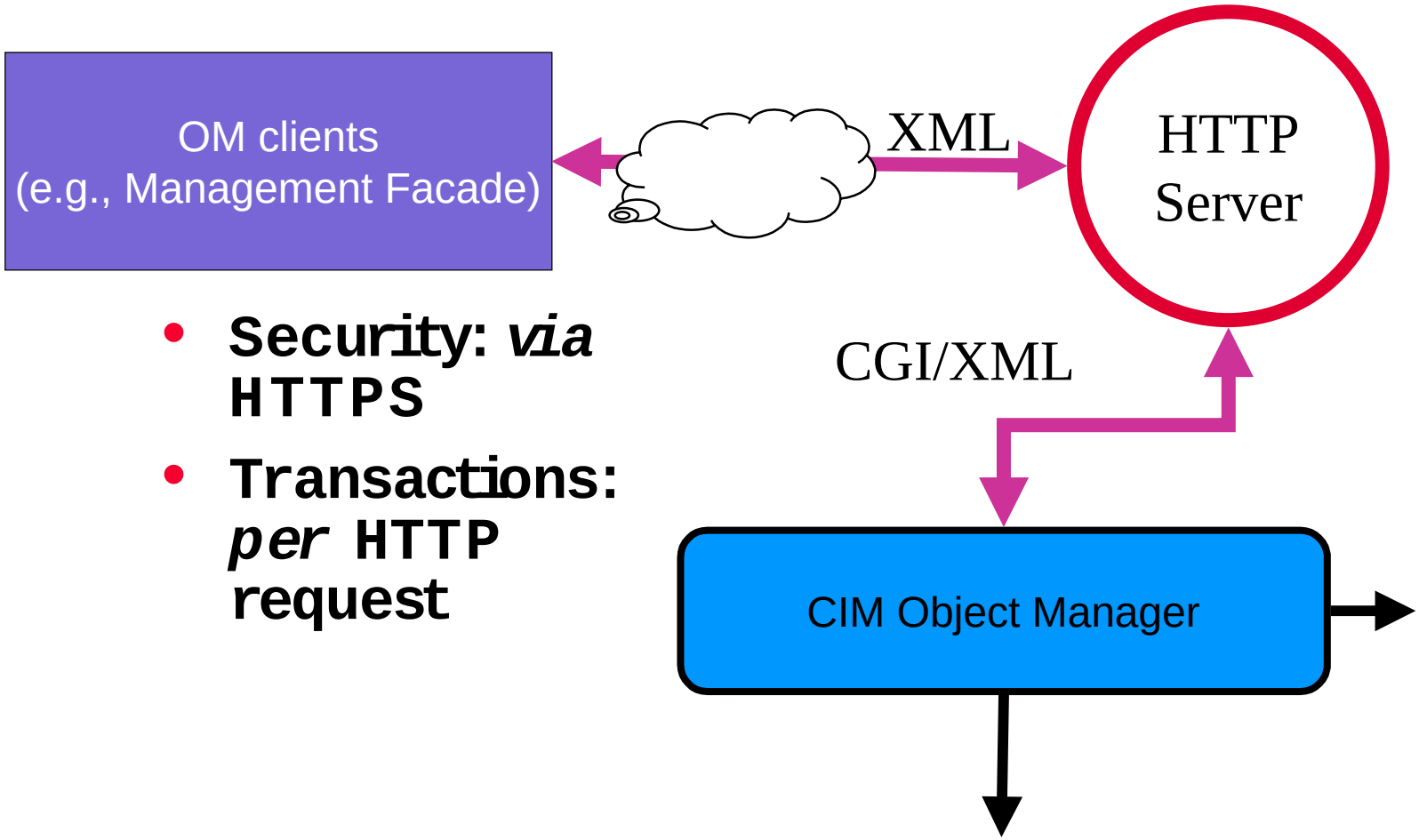
```
   [Association, Description (
   "The ActsAsSpare association indicates which elements "
   "can spare or replace the other aggregated elements. The "
   "fact that a spare can operate in \"hot standby\" mode is
   "
   "specified on an element by element basis.")
   ]
class CIM_ActsAsSpare
{  [Key, Description ("The SpareGroup")]
   CIM_SpareGroup REF Group;
      [Key, Description (
      "A ManagedSystemElement acting as a spare and "
      "participating in the SpareGroup.")
      ]
   CIM_ManagedSystemElement REF Spare;
      [Description (
      "HotStandby is a boolean indicating that the spare is "
      "operating as a hot standby.")
      ]
   boolean HotStandby;
};
```

XML Example

```
<?xml version= "1.0"?>
<!DOCTYPE CIM SYSTEM
    "http://www.dmtf.org/cim-
    v2.dtd/">
<CIM VERSION="2.0" >
    <CLASS
    NAME="ManagedSystemElement">
        <QUALIFIER
         NAME="abstract"
         TYPE="boolean">
         <VALUE>TRUE</VALUE>
        </QUALIFIER>
   <PROPERTY NAME="Caption"
         TYPE="string">
        <QUALIFIER NAME="MaxLen"
         TYPE="sint32">
         <VALUE>64</VALUE>
        </QUALIFIER>
    <\PROPERTY>
    <PROPERTY NAME="Description"
        TYPE="string">
    <\PROPERTY>
```

```
    <PROPERTY NAME="InstallDate"
         TYPE="datetimev>
        <QUALIFIER
         NAME="MappingStrings”
         TYPE=”string”>
         <VALUE>MIF.DMTF|
          ComponentID|
          001.5</VALUE>
       </QUALIFIER>
    </PROPERTY>
    <PROPERTY NAME=”Status”
         TYPE=”string”>
        <QUALIFIER NAME=”Values”
         TYPE=”string”
         ARRAY=”TRUE”>
         <VALUE>OK</VALUE>
         <VALUE>Error</VALUE>
         <VALUE>Degraded</VALUE>
         <VALUE>Unknown</VALUE>
        </QUALIFIER>
      </PROPERTY>
    </CLASS>
</CIM >
```

The XML Protocol over HTTP



- **Security: *via* HTTPS**
- **Transactions: *per* HTTP request**

XML Protocol Example

```
M-POST /cimom HTTP/1.1
HOST: www.erewhon.com
Content-Type: application/xml;
    charset="utf-8"
Content-Length: xxxx
Man: http://www.dmtf.org/cim/
       operation ; ns=73
    73-CIMOperation: MethodCall
    73-CIMMethod: GetProperty
    73-CIMObject: root/cimv2
    <?xml version="1.0"
    encoding="utf-8" ?>
    <CIM CIMVERSION="2.0"
    DTDVERSION="2.0">
 <MESSAGE ID="87872"
    PROTOCOLVERSION="1.0">
      <SIMPLEREQ>
       <IMETHODCALL
    NAME="GetProperty">
        <LOCALNAMESPACEPATH>
         <NAMESPACE NAME="root"/>
<NAMESPACE
    NAME="myNamespace"/>
        </LOCALNAMESPACEPATH>
        <IPARAMVALUE
    NAME="InstanceName">
         <INSTANCENAME
    CLASSNAME="MyDisk">
          <KEYBINDING
    NAME="DeviceID"><KEYVALUE>
    C:</KEYVALUE></KEYBINDING>
         </INSTANCENAME>
        </IPARAMVALUE>
        <IPARAMVALUE
    NAME="PropertyName"><VALUE>
    FreeSpace</VALUE>
    </IPARAMVALUE>
       </IMETHODCALL>
      </SIMPLEREQ>
     </MESSAGE>
</CIM>
```

Development Timeline

- **Distributed Management Task Force, founded 1992 by industry participants**
- **Started work on CIM in 1996,**
- **CIM Specification 2.2 is current**
- **CIM Schema released:**
  - V1 released 1997,
  - V2.0 and 2.1 1998.
  - V2.2 June, 1999.
  - V2.3 November, 1999.
  - V2.4 June, 2000.
  - V2.5 February, 2001

Storage Related Changes

Over last three years: much has been added to CIM for storage management:

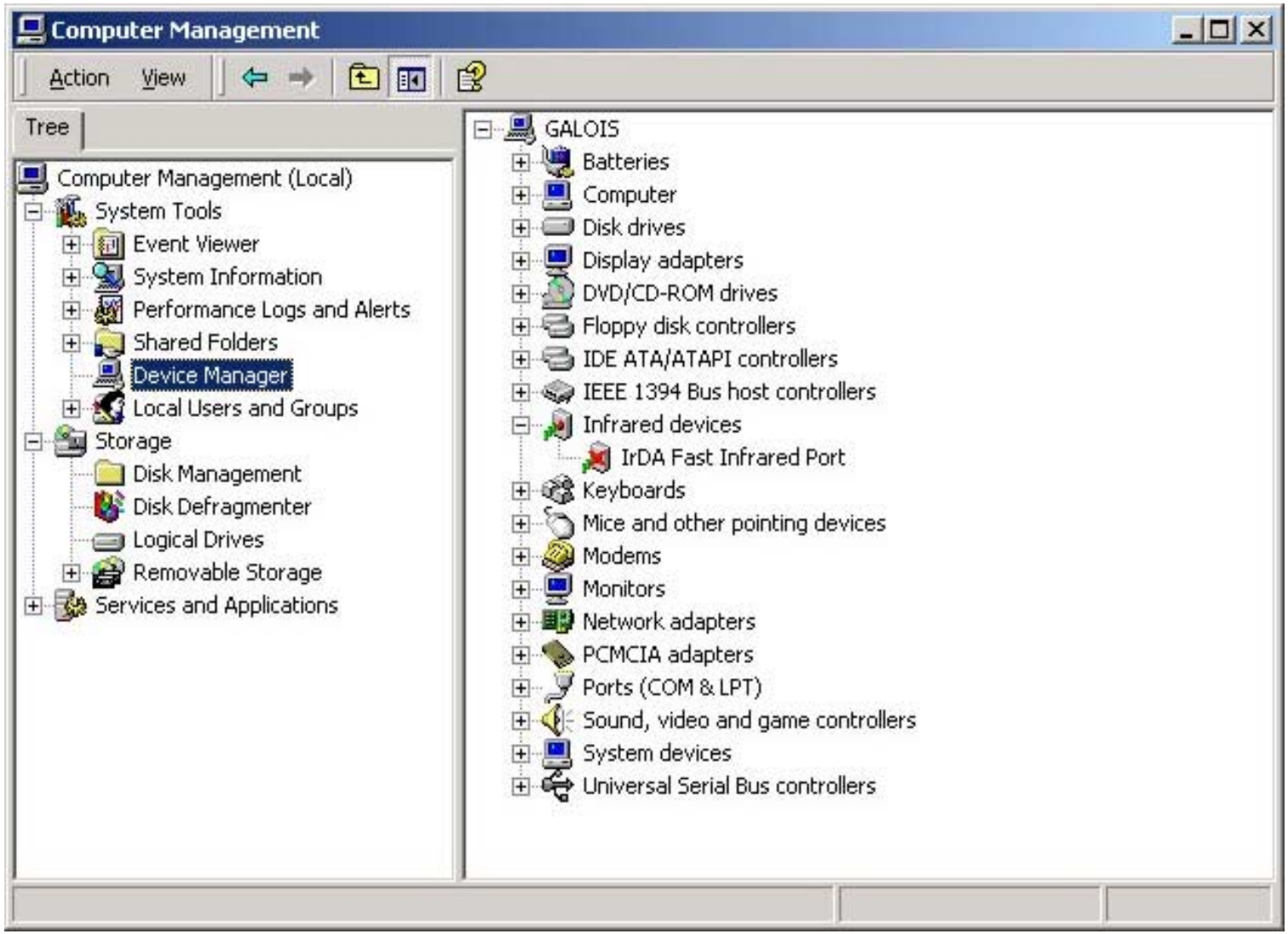
- Storage devices (tape, disk)
- Storage extents abstractions
- Redundancy mappings
- Automated library representations
- SCSI, FC, *etc.*, connectivity
- Associations for all above

Support

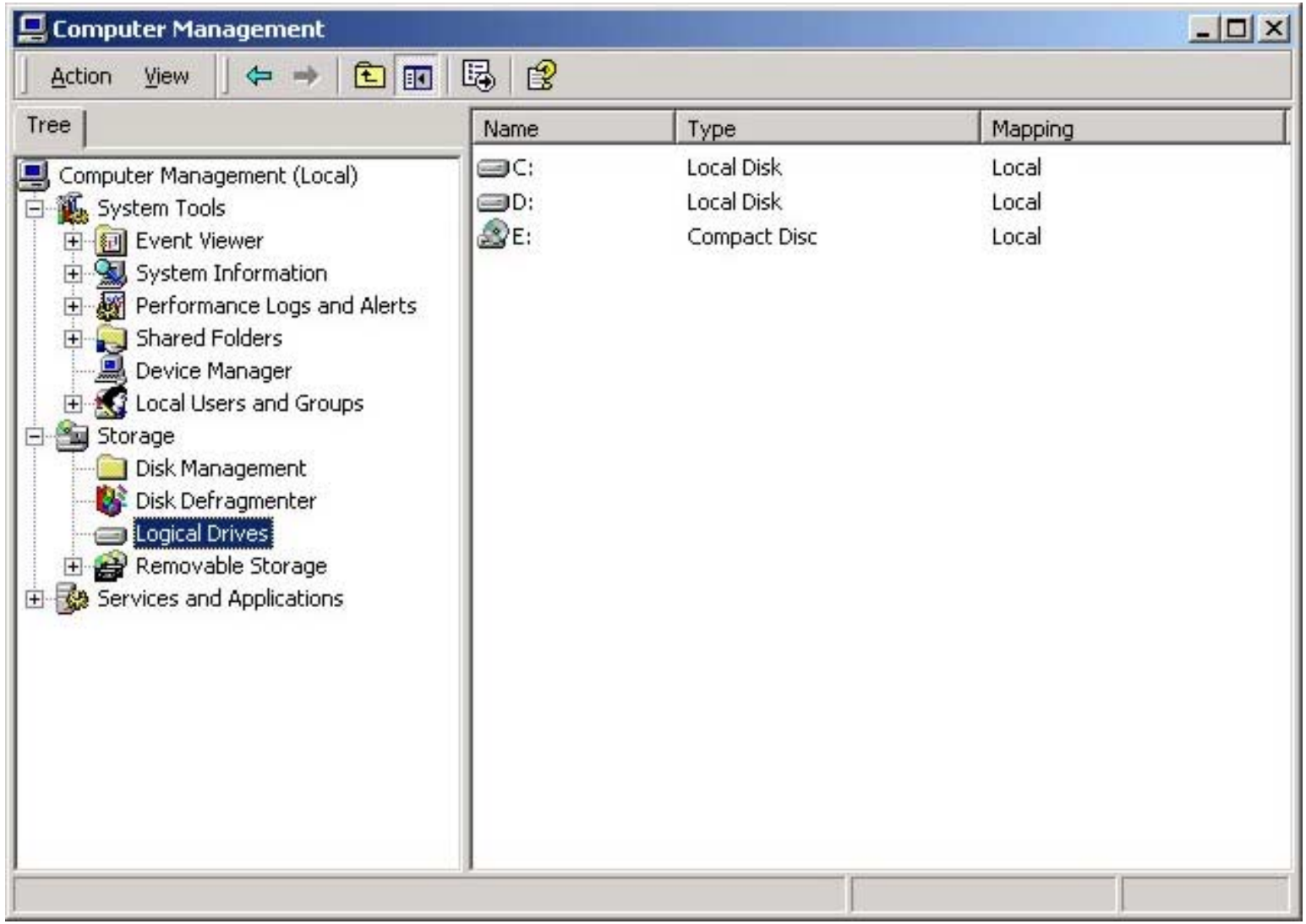
The CIM Schema is in use in

- **Sun Solaris 8.0**
  - Sun Management Console
- **Windows 2000**
  - Computer Management Application
- **Add-in for Windows NT 4.0**
  - similar functionality to W2K
- **SNIA Interoperability Demonstration**
  - Many firms involved, including Troika, Seagate, Hitachi, STK, Compaq, …

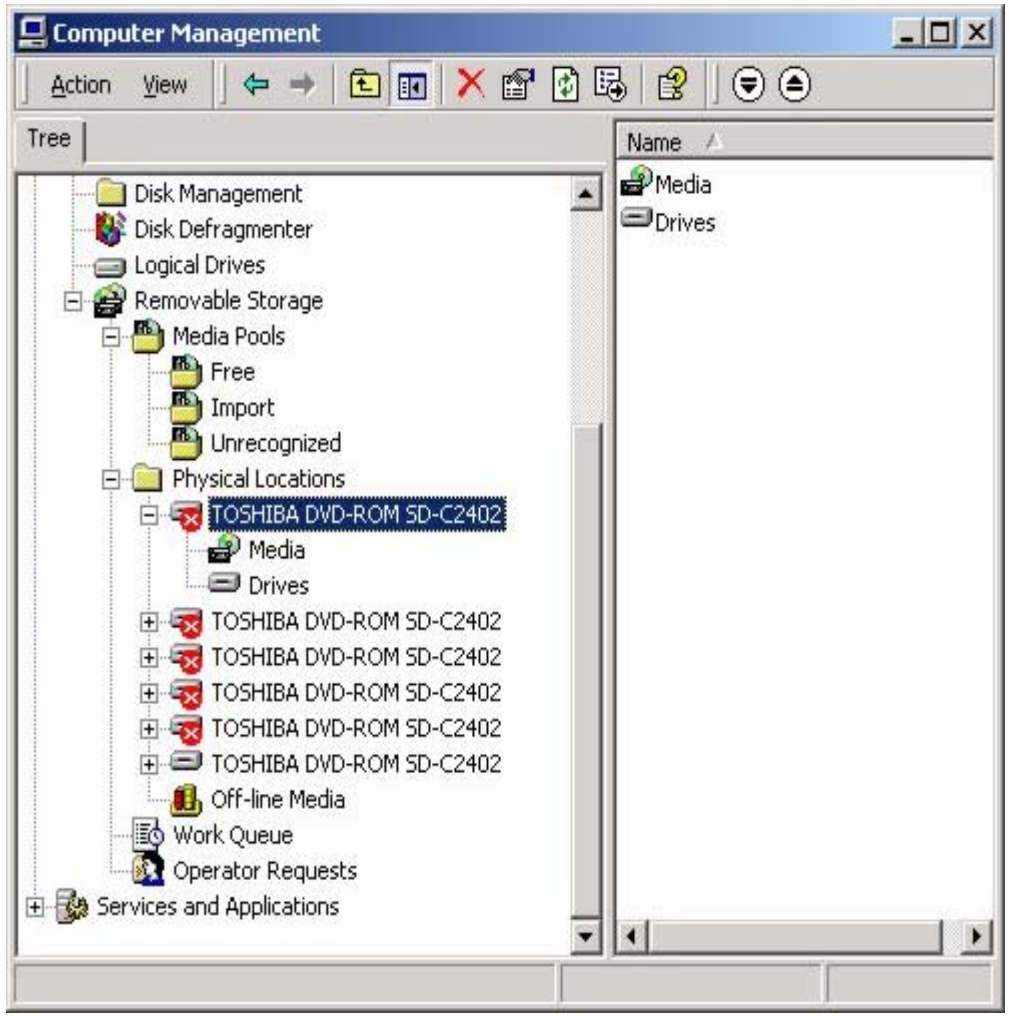
Example


Computer Management
Action
View
Tree
Computer Management (Local)
System Tools
Event Viewer
System Information
Performance Logs and Alerts
Shared Folders
Device Manager
Local Users and Groups
Storage
Disk Management
Disk Defragmenter
Logical Drives
Removable Storage
Services and Applications
GALOIS
Batteries
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Floppy disk controllers
IDE ATA/ATAPI controllers
IEEE 1394 Bus host controllers
Infrared devices
IrDA Fast Infrared Port
Keyboards
Mice and other pointing devices
Modems
Monitors
Network adapters
PCMCIA adapters
Ports (COM & LPT)
Sound, video and game controllers
System devices
Universal Serial Bus controllers

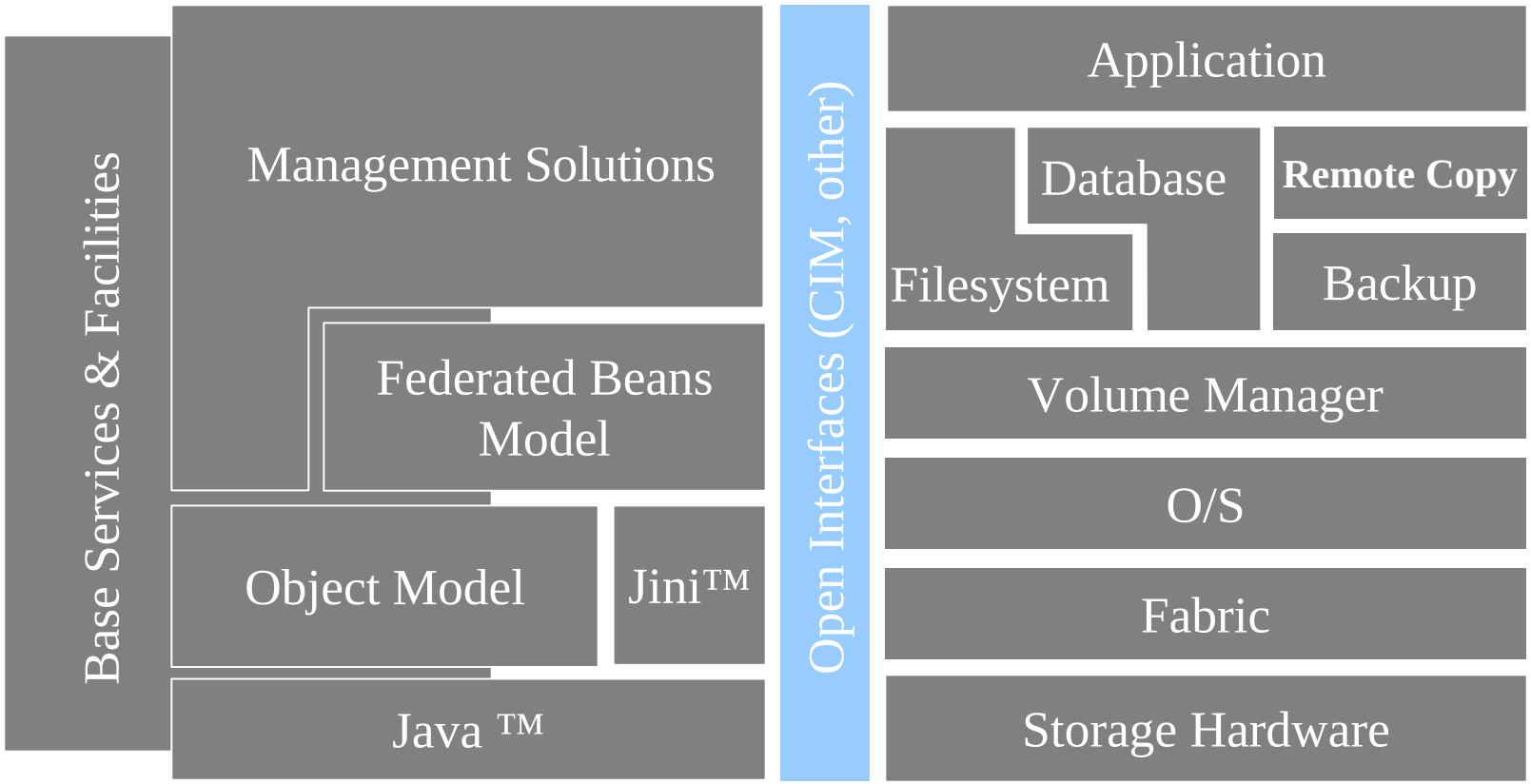
Example (continued)



Example (continued)



A Jiro™ Platform Architecture



- **A Java extension supporting management**

What does Jiro offer?

- a common way to interact with the many different things that are to be managed;
- a "middle" or "logic" tier, that controls and interacts with management state;
- defined architecture for management services, so that products dynamically interact;
- a pre-defined set of basic service, such as discovery, messaging, scheduling, …
- platform independence, since it is a Java extension.

What is Jiro?

- a platform for the construction of distributed (object-oriented) applications;
- a component model, the Federated Management Architecure, defining Federated Beans;
- an installable product of Java classes instantiating default services, and a library supporting standard Jiro components.

The Façade Pattern

- Jiro uses the "façade" pattern to create interfaces to CIM object managers;
- the façade pattern also allows other interfaces to be incorporated, albeit in a less integrated fashion;
- CIM façades can be automatically generated;
- ensures integration between CIMOM management and automated management.

Timeline

Versions of Jiro released:

- Reference Implementation of the Federated Management Architecture, end 1999;
- Jiro Version 1.0, January, 2000;
- Jiro Version 1.5, March, 2001;
- Next release planned for end of 2001.

http://www.sun.com/download/

References

- CIM standard - DMTF web site
  http://www.dmtf.org/
- Jiro
  http://www.sun.com/jiro/
- MS WMI framework
  http://www.microsoft.com/ntserver/management
- XML - W3C
  http://www.w3.org/
- XML RPC - IETF
  http://www.ietf.org/