CIM/WBEM Tutorial

DMTF Slides prepared by:

Andrea Westerinen(Cisco)

Julie Schott (Cisco)

Presented by: Jim Willits (HP)

November 18, 2003

Agenda

- Information Modeling
- CIM Metaschema
- CIM Schema
- WBEM Interoperability
- DMTF Activity

Information Model

> An abstraction and representation of the entities in a managed environment, their properties, attributes and operations, and the way that they relate to each other. It is independent of any specific repository, software usage, protocol, or platform.

Excerpt from IETF RFC 3198

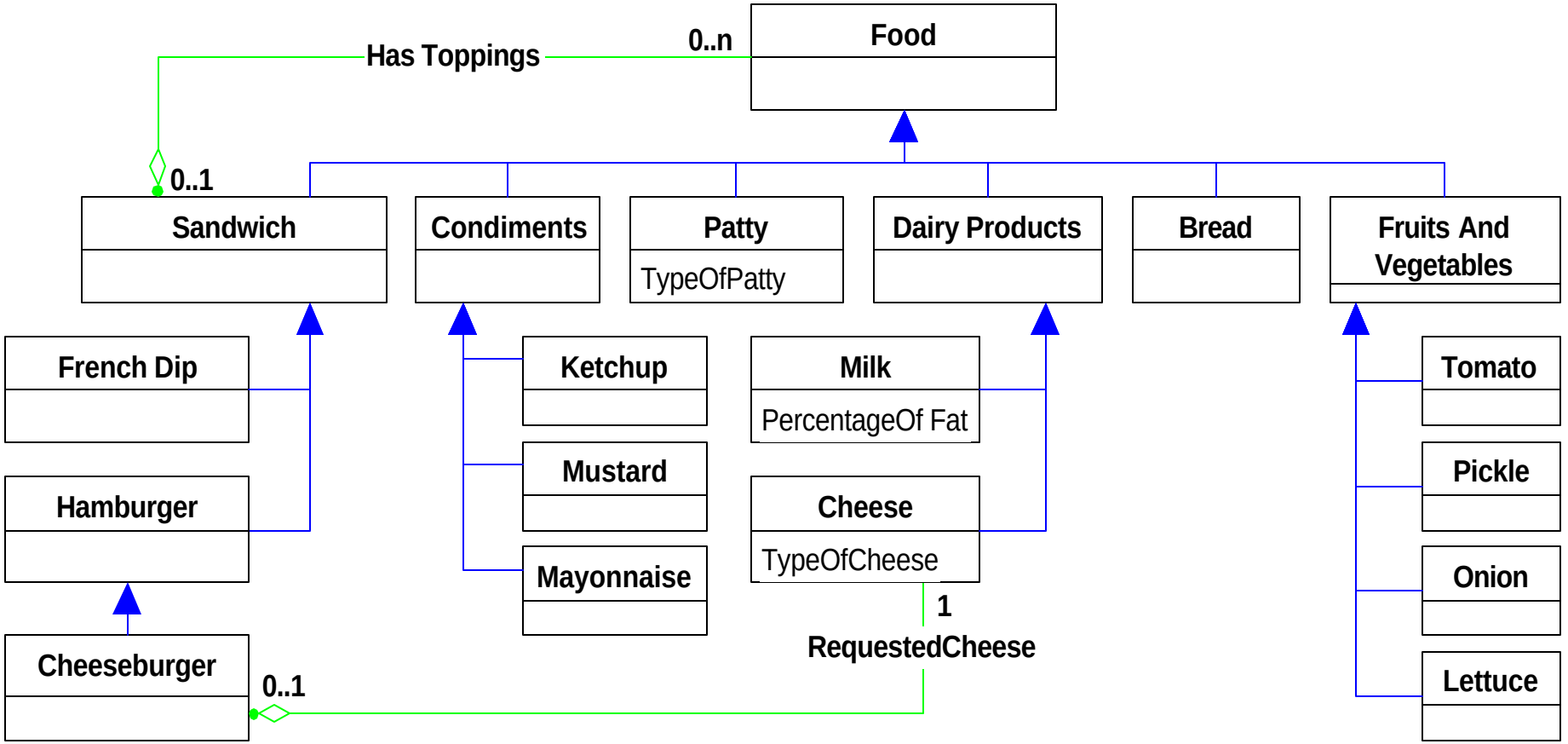
Elements of an Information Model

- **Key Concepts**
  - **Abstraction**
  - **Modularity**
  - **Encapsulation**
  - **Hierarchy**
- **Key Elements**
  - **Classes**
  - **Objects**
  - **Relationships**

Key Elements

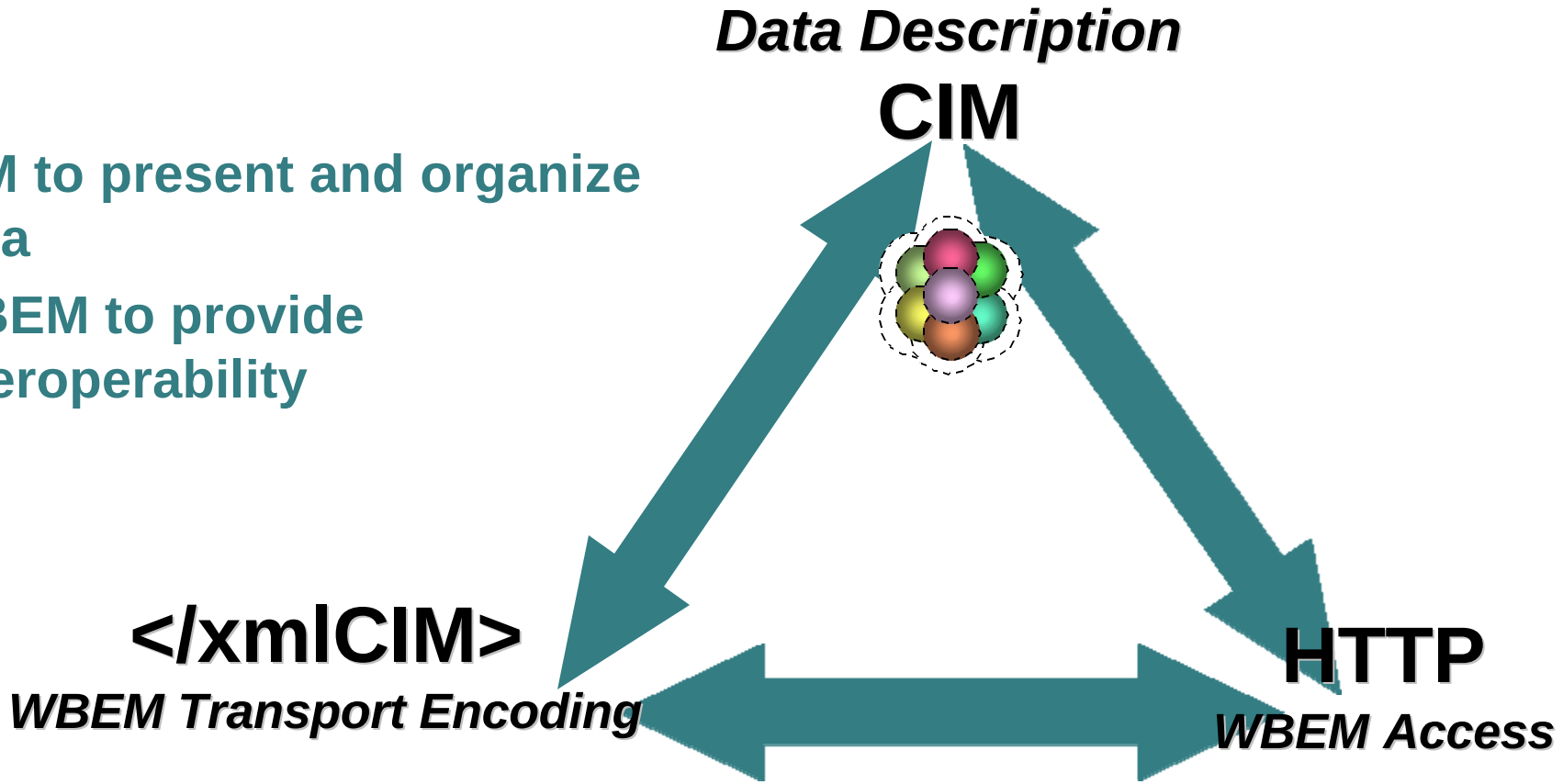
- **Classes – A collection of definitions of state, behavior, and/or identity**
  - **Properties**
  - **Methods**
- **Objects – Instances of a class**
- **Associations - Relationships**
  - **Dependency**
  - **Identity**
  - **Aggregation**
  - **Composition**
  - **And others**

Information Model - Example



WBEM and CIM

- CIM to present and organize data
- WBEM to provide interoperability



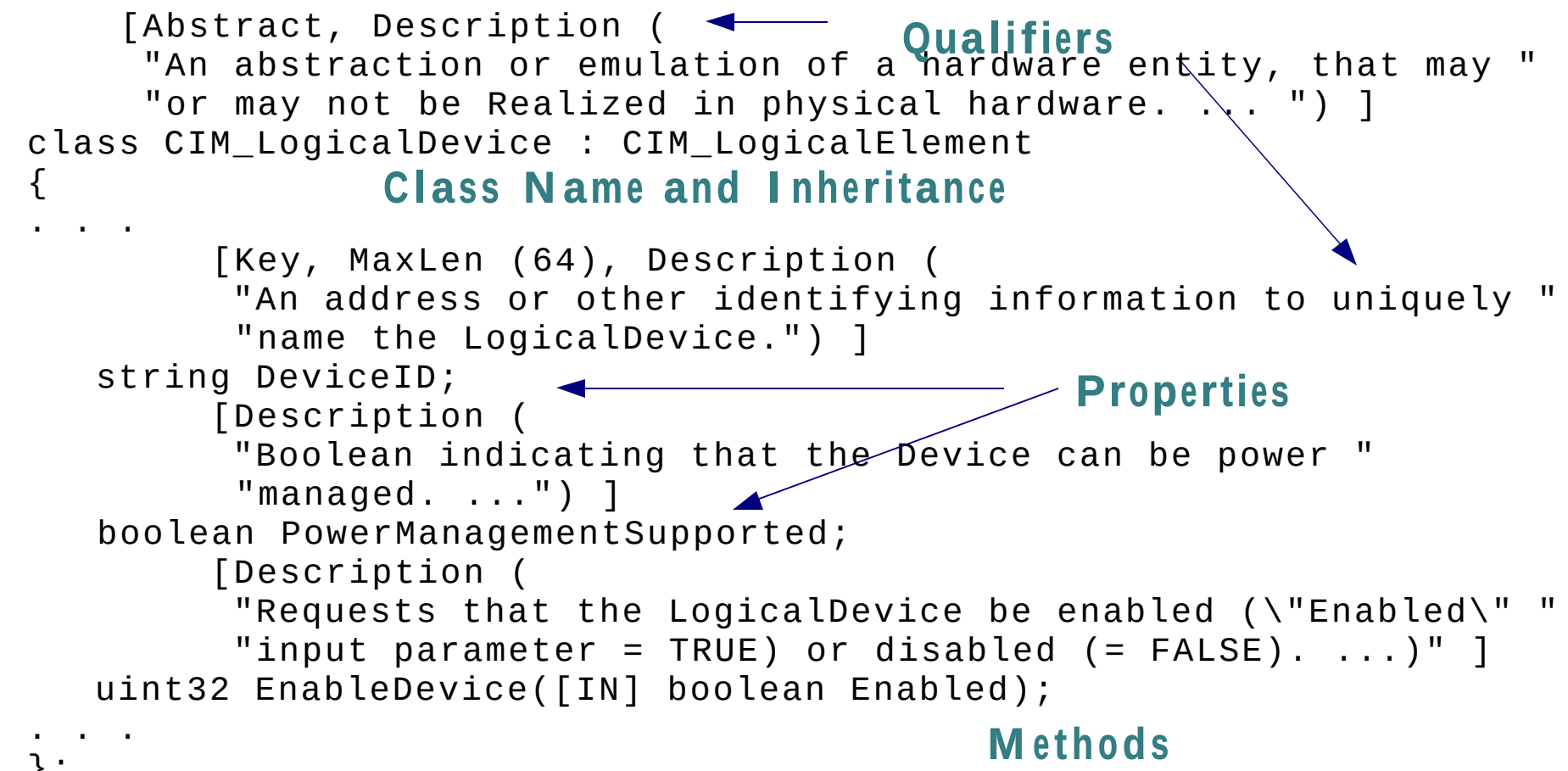
CIM

- Common Information Model
  - http://www.dmtf.org/standards/standard_cim.php
- Core Specification
  - "Meta"-model, high level concepts and language definitions
- "Core" and "Common" Models
  - Object oriented design
  - Core Model contains info applicable to all management domains
  - Common Models address specific domains - Systems, Devices, Applications, Networks, Users, ...
    - Subclass from the Core Model
    - Models overlap and cross-reference
  - Vendor extensions encouraged

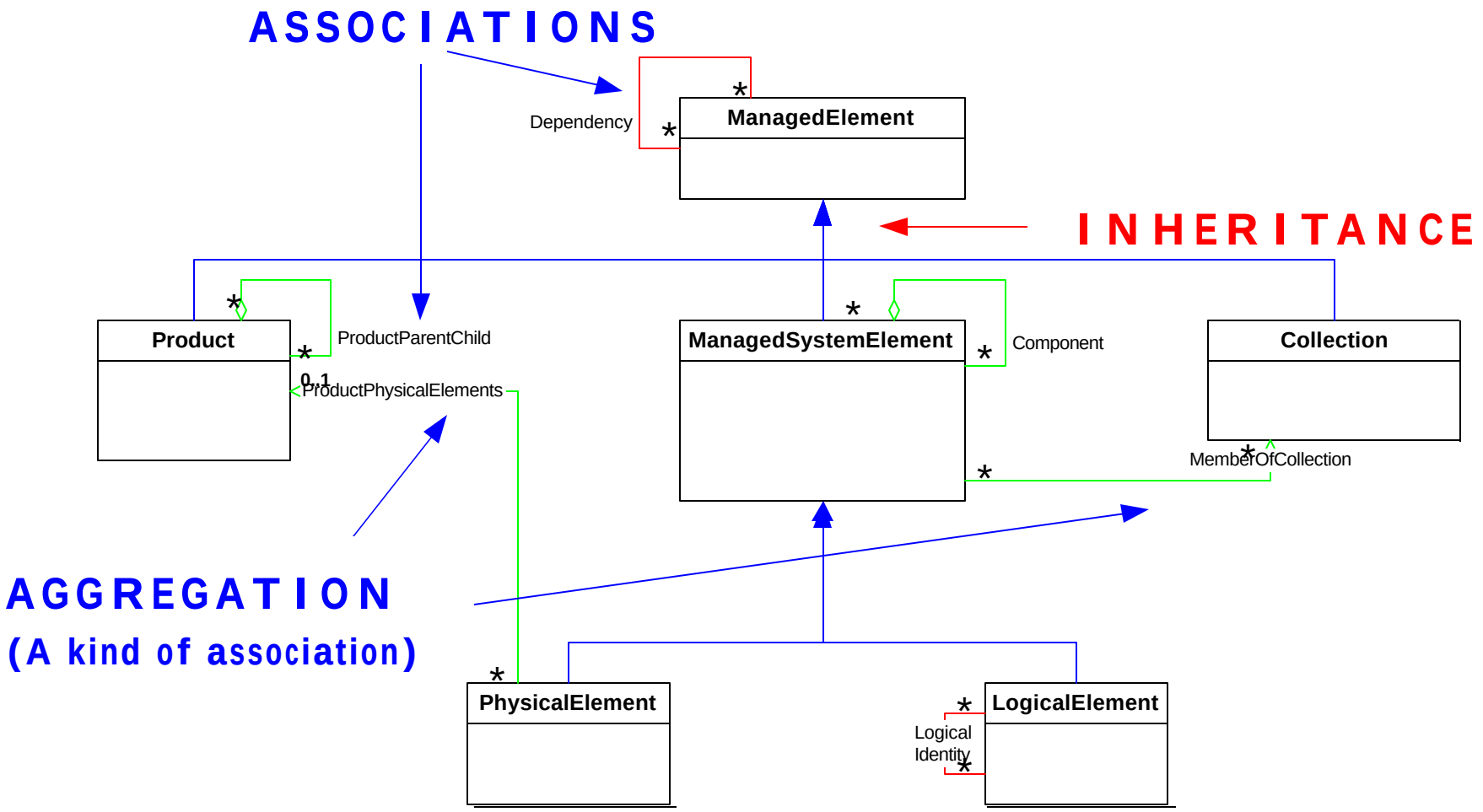
Meta Schema Concepts

- Class
- Property
- Method
- Trigger
- Indication
- Association
- References
- Qualifiers

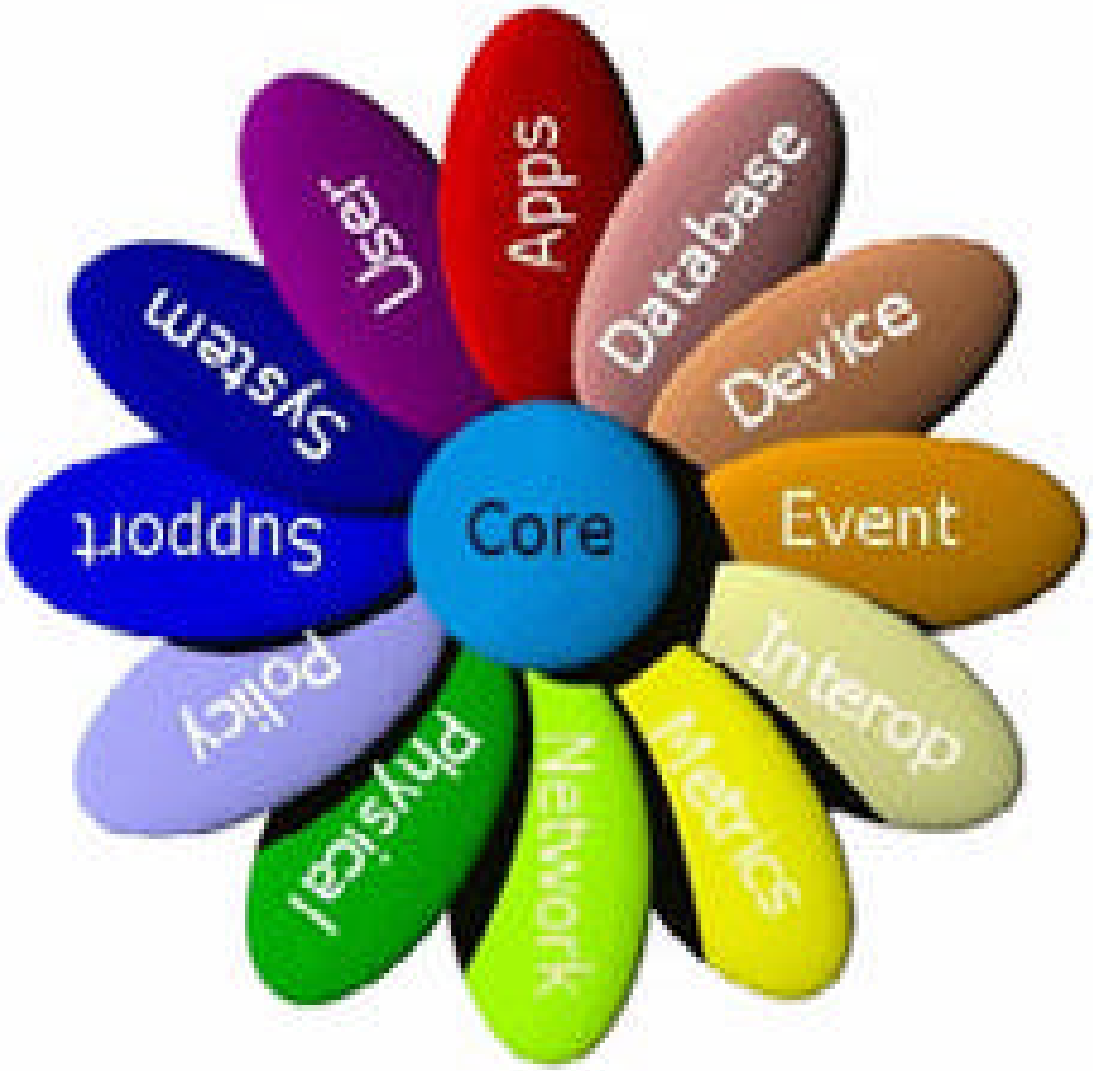
MOF Example



VISIO Example



CIM Schema – Core/Common Model



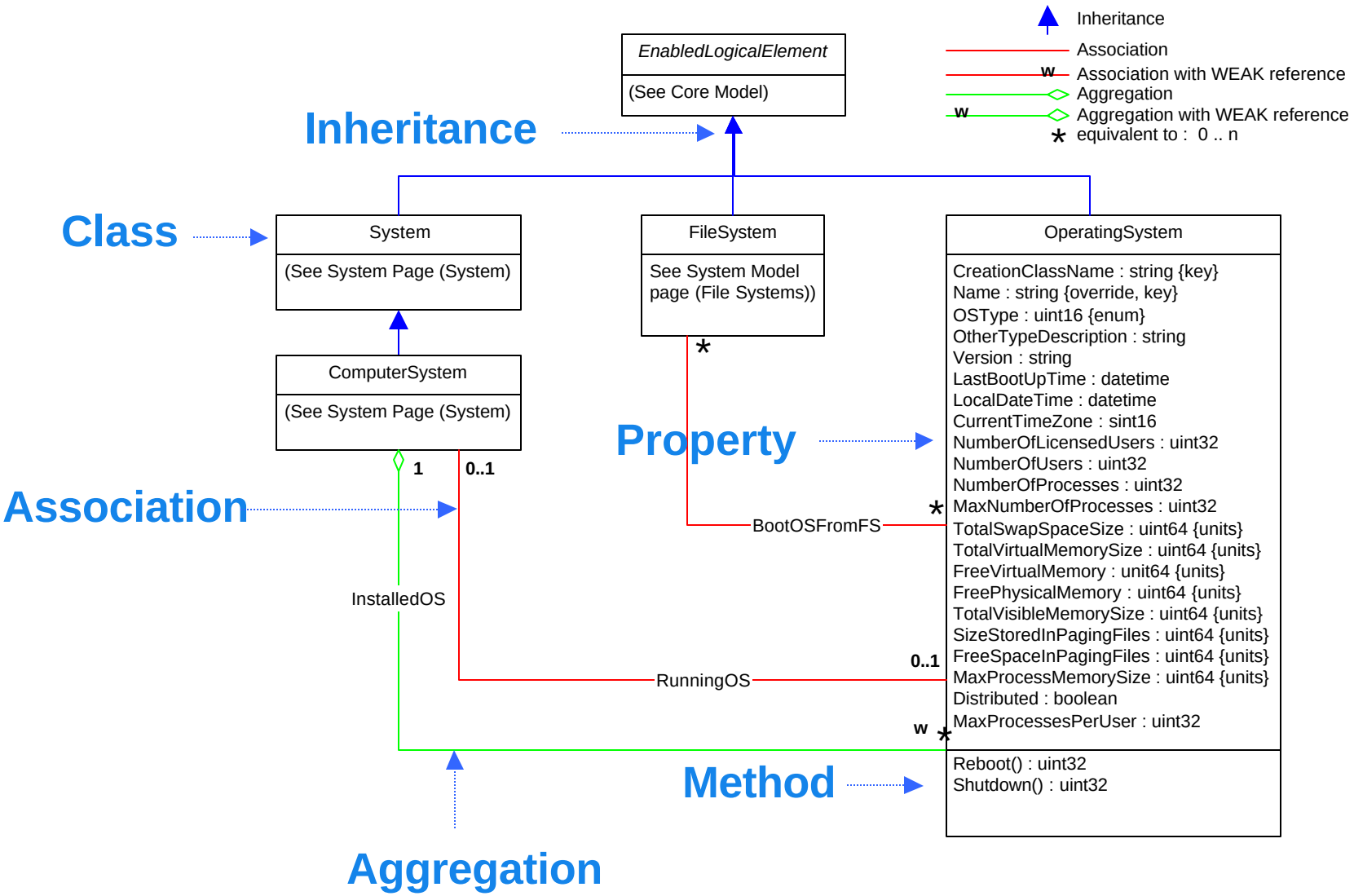
CIM Schema

- **Core** – High-level abstractions (Logical and Physical Elements, Collections, …)
- **Physical** – Things that you see and touch (for ex, (PhysicalPackage, Rack and Location)
- **System** – Computer systems, operating systems, file systems, processes, jobs, diagnostic services, …
- **Device** – Logical function of hardware (for ex, Battery, Printer, Fan, NetworkPort and StorageExtent)
- **Network** – Services, endpoints/interfaces, topology, …
- **Policy** – If/then rules and their groupings/applicability
- **User and Security** – Identity mgmt, white/yellow page data, RBAC, …

CIM Schema

- **Applications and Metrics** – Deployment and runtime management of software and software services
- **Database** – Properties and services performed by a database (both inventory and behavioral)
- **Event** – Notifications and subscriptions
- **Interoperability** – Management of the WBEM infrastructure
- **Support** – Help desk knowledge exchange and incident handling

CIM Schema Example



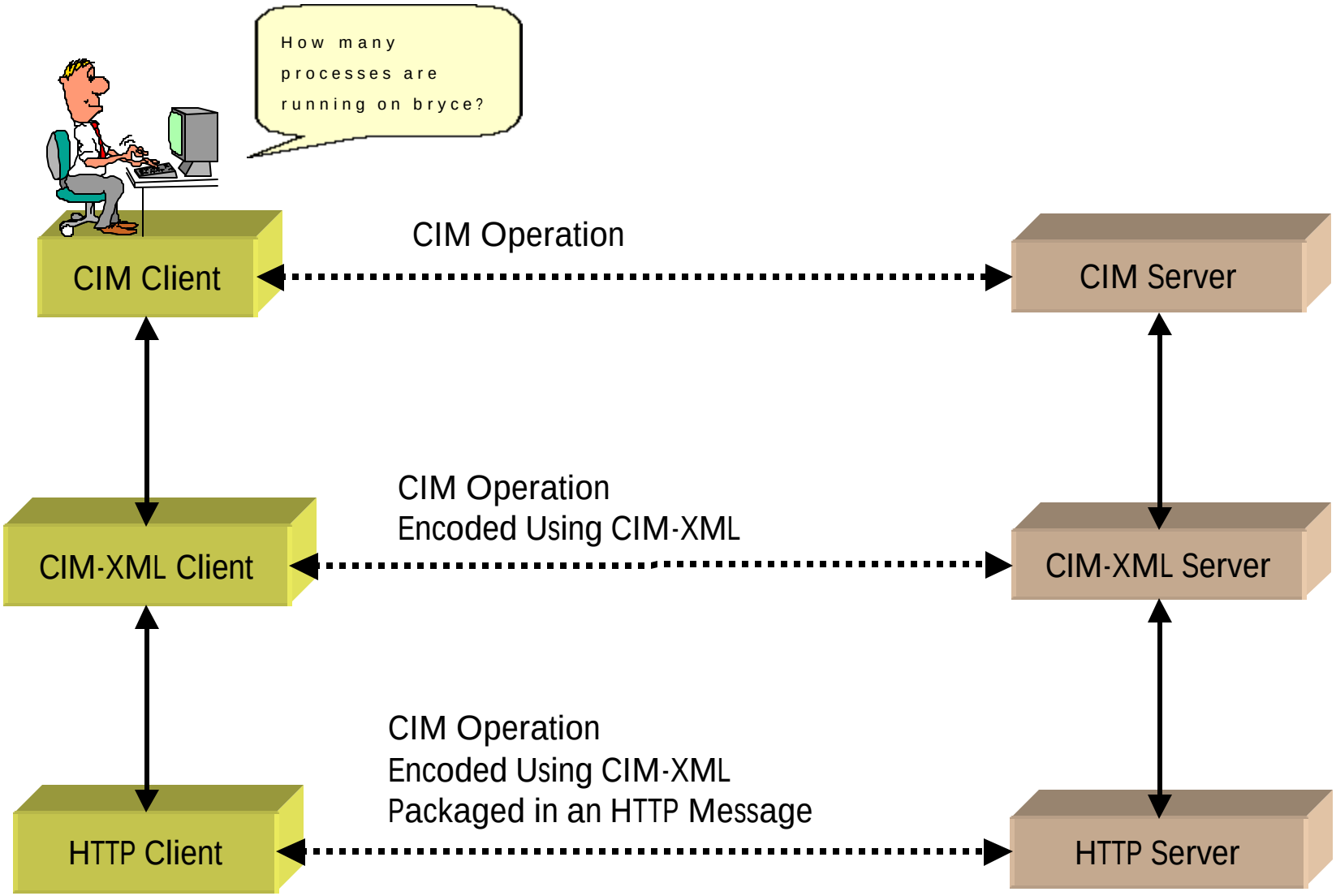
WBEM

- **Web-Based Enterprise Management**
  - **http://www.dmtf.org/standards/standard_wbem.php**
- **A set of technologies**
  - **CIM Schema**
  - **XML DTD to encode the Schema**
  - **CIM Operations over HTTP**
    - **Synchronous and asynchronous message request and response; Simple and multiple methods supported**
    - **Publish/subscribe mechanism for Indications (event notifications)**
    - **Extrinsic (methods on a class) and intrinsic (model operations) methods are defined – Get, Create, Delete, Modify, Enumerate, …**

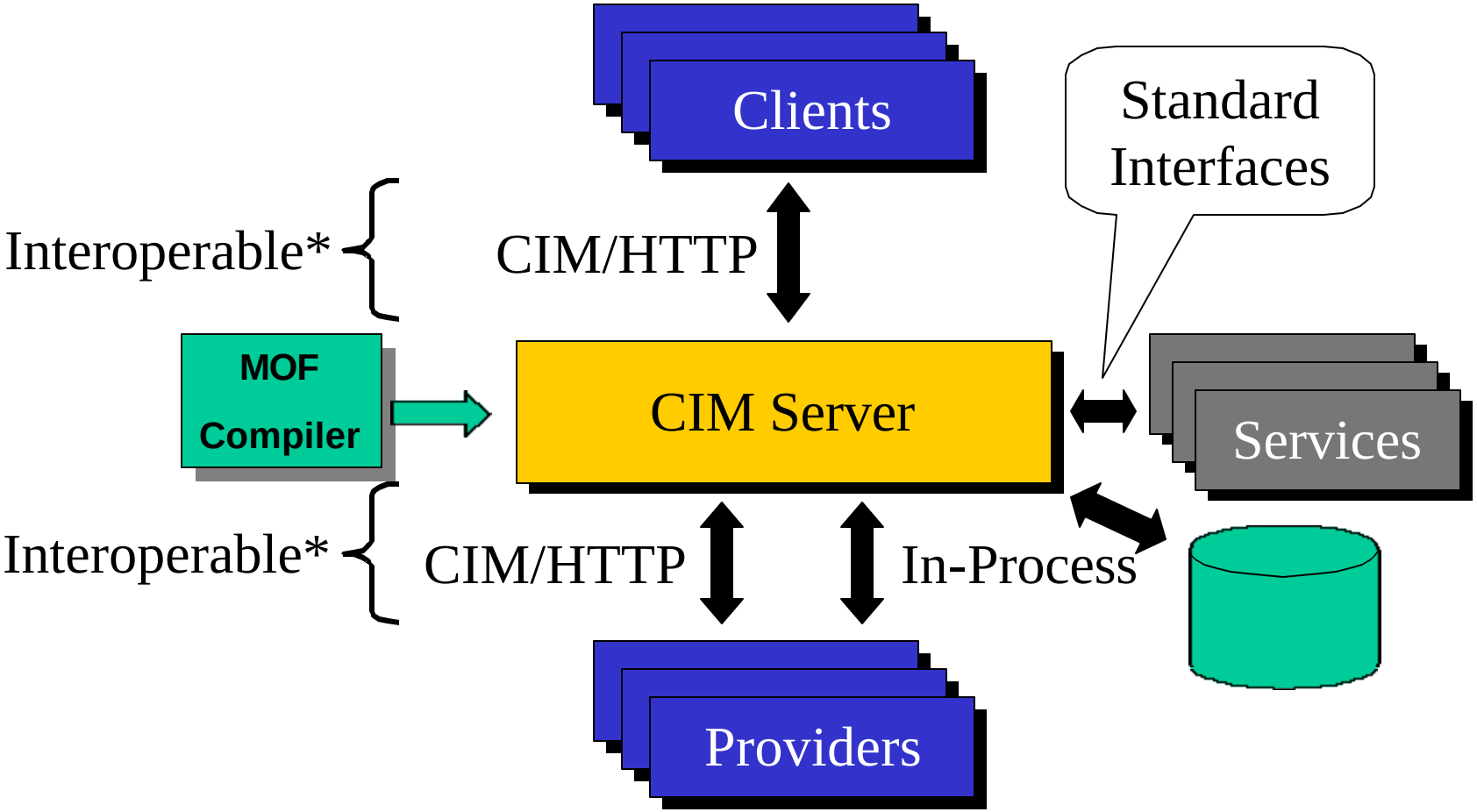
XML Example

```
<CLASS NAME="CIM_LogicalPort" SUPERCLASS="CIM_LogicalDevice">
  <QUALIFIER TRANSLATABLE="true" NAME="Description" TYPE="string">
    <VALUE>The abstraction of a port or connection point of a Device. This object
      should be instantiated when the Port has independent management
      characteristics from the Device that includes it. Examples are a Fibre Channel
      Port and a USB Port. This class would not be instantiated for an Ethernet Port
      which is not managed independently of the EthernetAdapter.</VALUE>
  </QUALIFIER>
  <PROPERTY NAME="Speed" TYPE="uint64">
    <QUALIFIER TRANSLATABLE="true" NAME="Description" TYPE="string">
      <VALUE>The speed of the Port in Bits per Second.</VALUE>
    </QUALIFIER>
    <QUALIFIER TRANSLATABLE="true" NAME="Units" TYPE="string">
      <VALUE>Bits per Second</VALUE>
    </QUALIFIER>
  </PROPERTY>
  <PROPERTY NAME="MaxSpeed" TYPE="uint64">
    <QUALIFIER TRANSLATABLE="true" NAME="Description" TYPE="string">
      <VALUE>The max speed of the Port in Bits per Second.</VALUE>
    </QUALIFIER>
    <QUALIFIER TRANSLATABLE="true" NAME="Units" TYPE="string">
      <VALUE>Bits per Second</VALUE>
    </QUALIFIER>
  </PROPERTY>
</CLASS>
```

CIM-XML Communication Protocol



Example Implementation: Pegasus



DMTF CIM/WBEM Working Groups

http://www.dmtf.org/about/committees.php

CIM TC (Technical Committee)

Chair: Andrea Westerinen, Cisco

Board Members:
Intel, Microsoft, Cisco, Sun, Tivoli/IBM, Dell, HP, 3Com, BMC, NEC, Oracle, Novell, Symantec, Veritas

Contributing Members, Alliance Partners, WG Chairs

Interoperability/ Events
Chair: WBEM Solns

Applications/Metrics
Chair: TOG

Networks
Chair: Cisco

Support
Chair: CSI

System/Devices
Chair: HP

Database
Chair: Oracle

Policy/SLA
Chair: IBM

User/Security
Chair: IBM

Security
Chair:
Symantec

Architecture

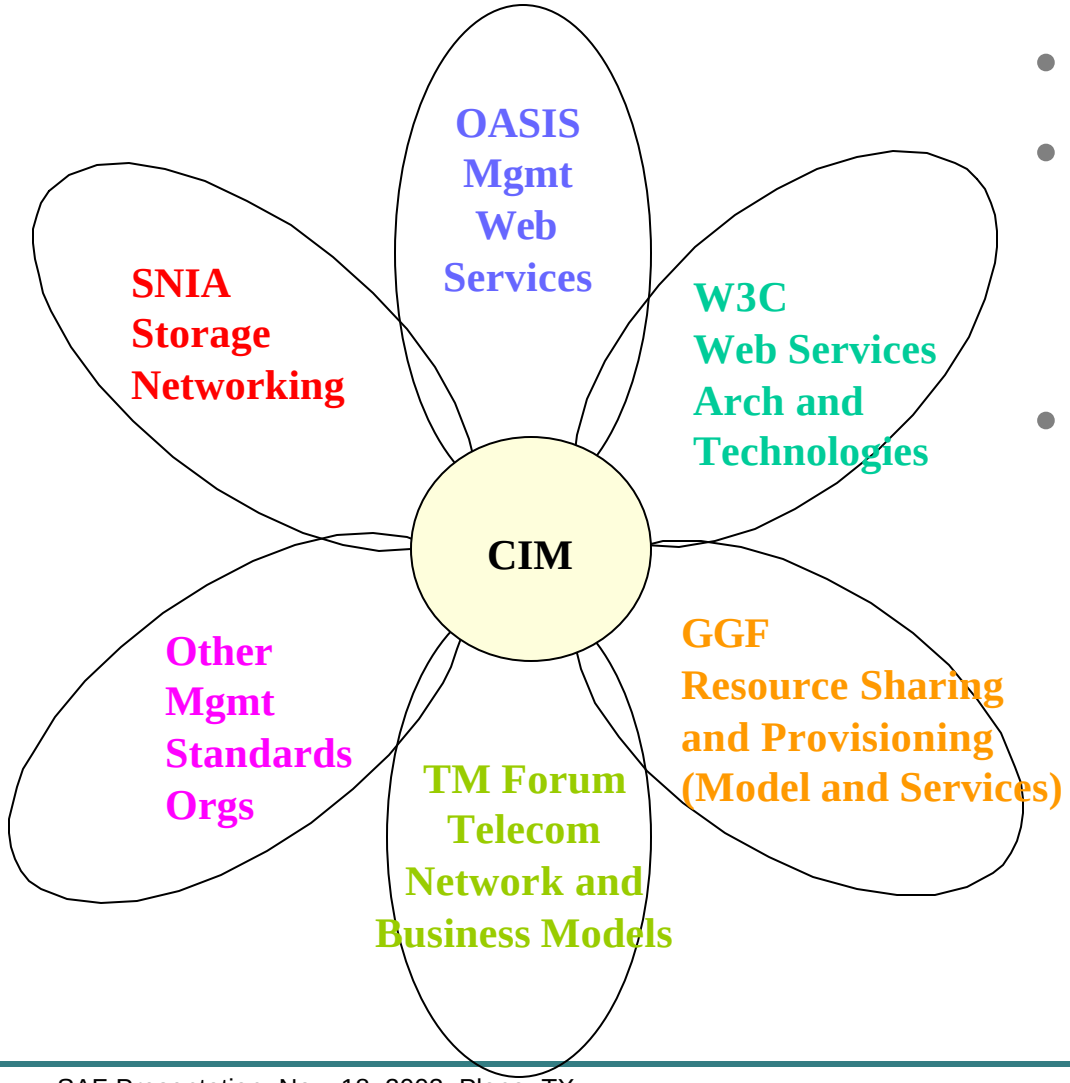
Under Discussion:
Utility Computing,
Behavior/State WG

CIM Related Tools

- Pretty Printer for MOF
- Oracle Nortel Networks mof2html converter
- Microsoft SNIA's SMI-S CIM Miner
- MOF Editor
- Intel CIM Compatibility Checker
- WBEMSource
  - TOG's Pegasus and SNIA CIM Object Manager
    - Sun's WBEM Services
    - Caldera's OpenWBEM
    - Major vendors contributing to Pegasus

DMTF Background

Alliance Partners



- One unified model
- Coordinated development processes
- Shared technologies, expertise and competencies

DMTF Futures

Technology

- UML 2.0
- CIM/SOAP and CIM/WSDL
- Protocol Interoperability Certification

Models

- Behavior and State
- Utility Computing

Solutions

- Provisioning
- Asset Management