Printing and CIM

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Agenda

- Overview of DMTF, CIM and WMI
  - Who, What, When
- Schema Work Today
  - Why Are Vendors Interested?
  - Vendor Participation
  - Data Models and Goals
- What's Needed
- More Information
- Questions

Overview of DMTF

- **Desktop Management Taskforce, Founded 1992 by PC Industry**
- **Original efforts to define DMI (Distributed Management Interface)**
  - DMI support prevalent today on “the node”
  - Tried to expand DMI coverage into Modems, Printers, Software - but unsuccessful
- **Started work on CIM (Common Information Model) in 1996**
  - Efforts originally lead by Tivoli and Microsoft
  - CIM V1 released 1997, V2.0 and 2.1 released 1998, V2.2 scheduled for 2Q99

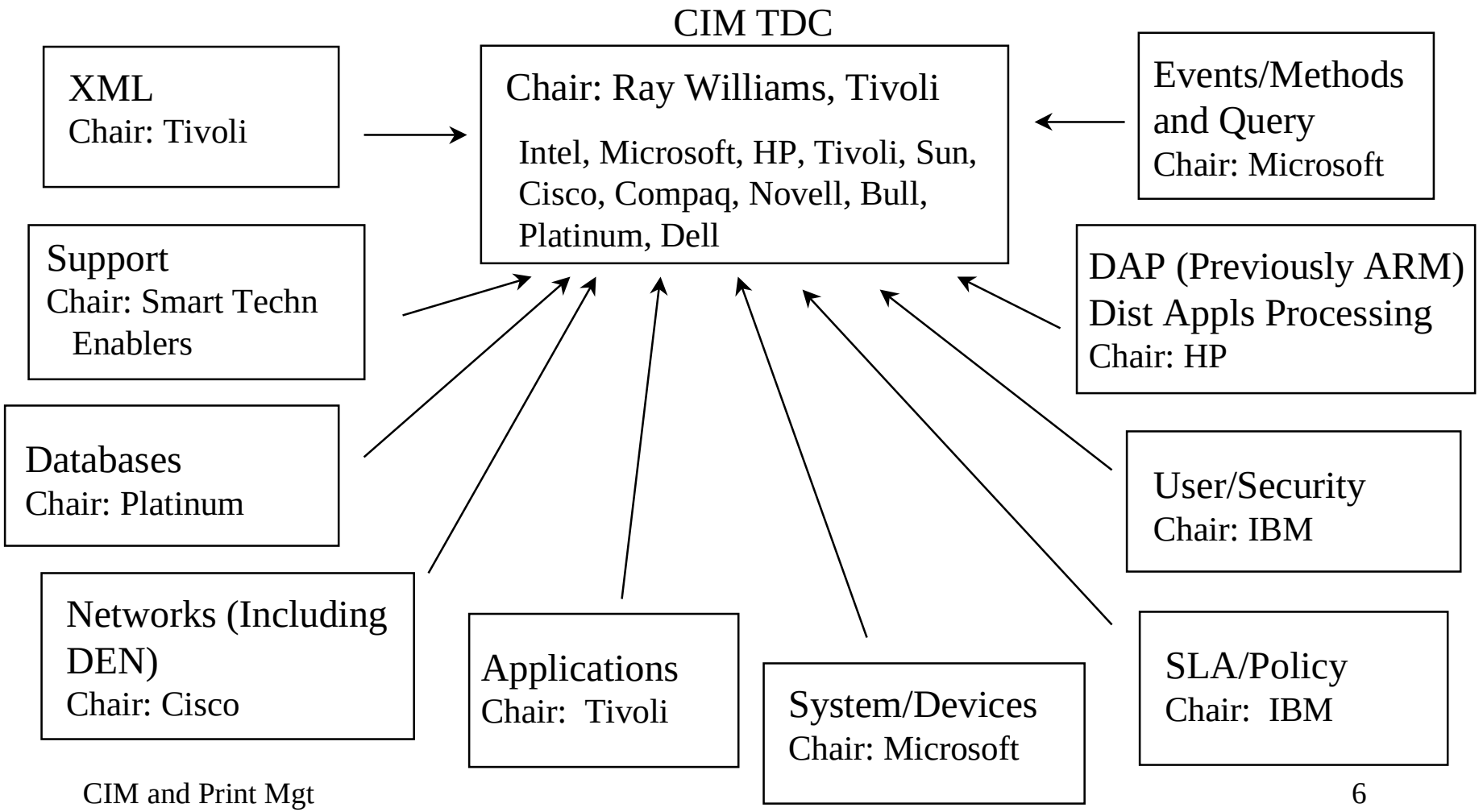
Overview of CIM

- **Implementation neutral schema for describing enterprise-wide management information**
  - Facilitates the common understanding of management data across different management systems
  - Facilitates the integration of management information from different sources
  - Data model, not an implementation
    - Managed Object Format (MOF) syntax and XML definition supports sharing information across management systems
  - Designed as model for both instrumentation data and management databases

What is CIM?

- **CIM Specification**
  - Describes the language, naming, meta-schema and mapping techniques to SNMP, DMI, etc.
  - The meta-schema is a formal definition of the model's terms and their usage/semantics (for example, Class, Property, Method, ...)
- **CIM Schema provides the actual model descriptions**
  - Defines object and association classes (with properties) that provide a well-understood conceptual framework for organizing data about a managed environment

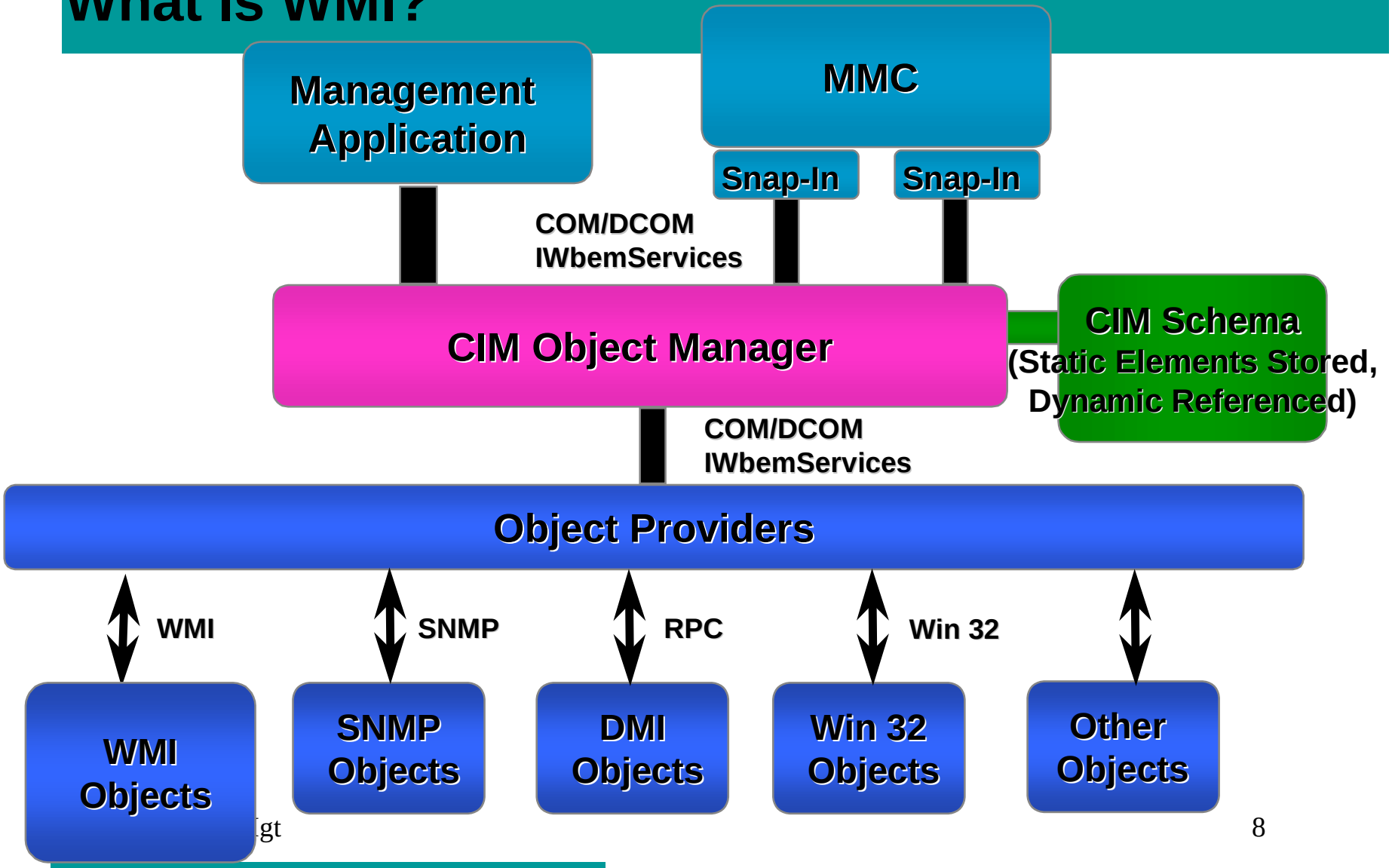
CIM Committees and Working Groups



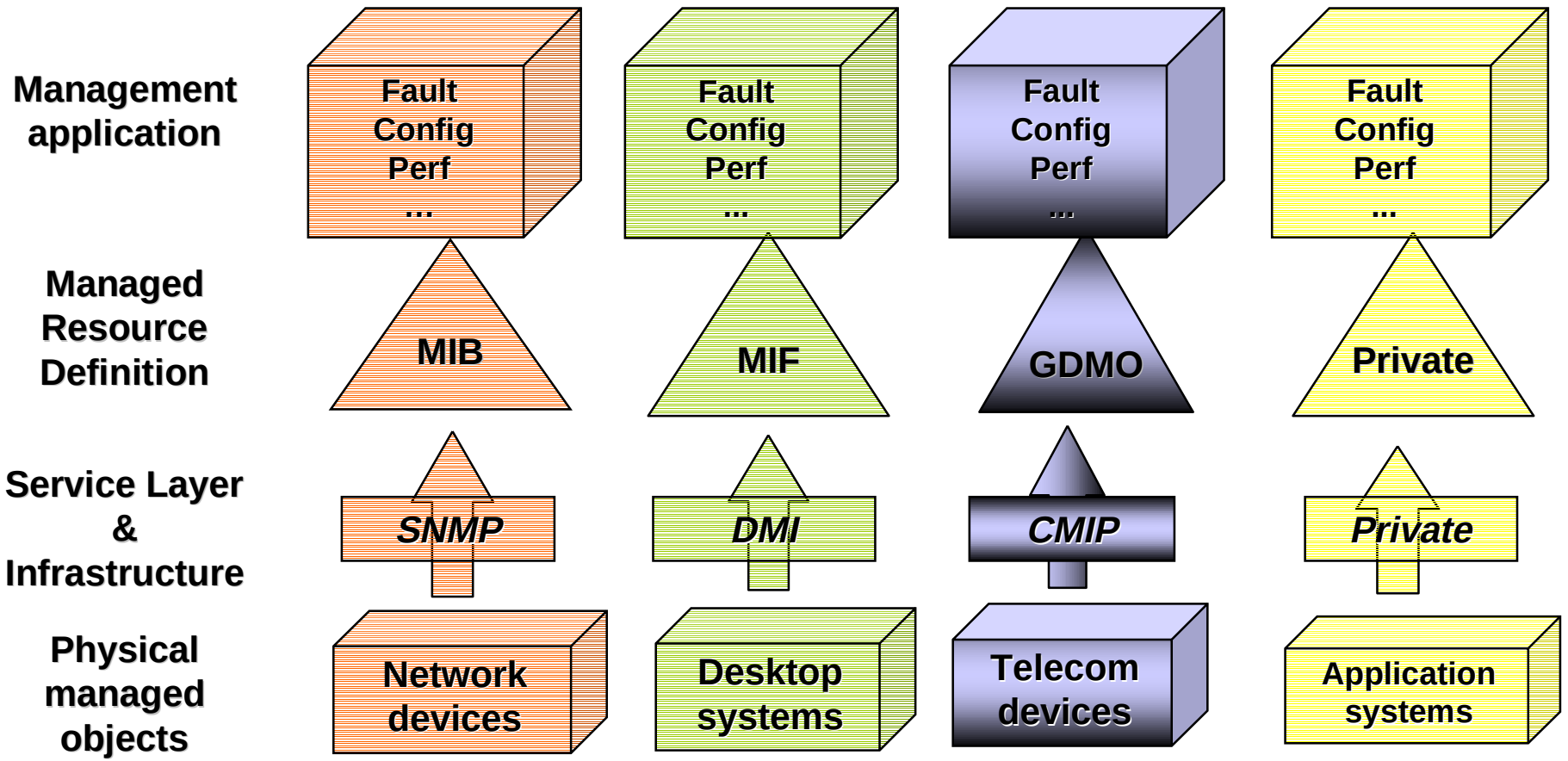
Overview of WMI

- **Windows Management Instrumentation**
- **Microsoft's implementation and extension of CIM and mechanisms for providing/using CIM data**
  - A software stack defined by Microsoft for managing Win95, Win98, NT4.0 and NT5.0 systems
  - At the instrumentation level, uses WDM extensions and "Providers" to supply information to the CIM Object Manager (CIM OM)
  - CIM Object Manager understands a CIM object model and its associations, and stores/references the model's instance data
- **COM/DCOM-based API**

What Is WMI?


Management Application
MMC
Snap-In
Snap-In
COM/DCOM
IWbemServices
CIM Object Manager
CIM Schema
(Static Elements Stored, Dynamic Referenced)
COM/DCOM
IWbemServices
Object Providers
WMI
SNMP
RPC
Win 32
WMI Objects
SNMP Objects
DMI Objects
Win 32 Objects
Other Objects

The Environment Today



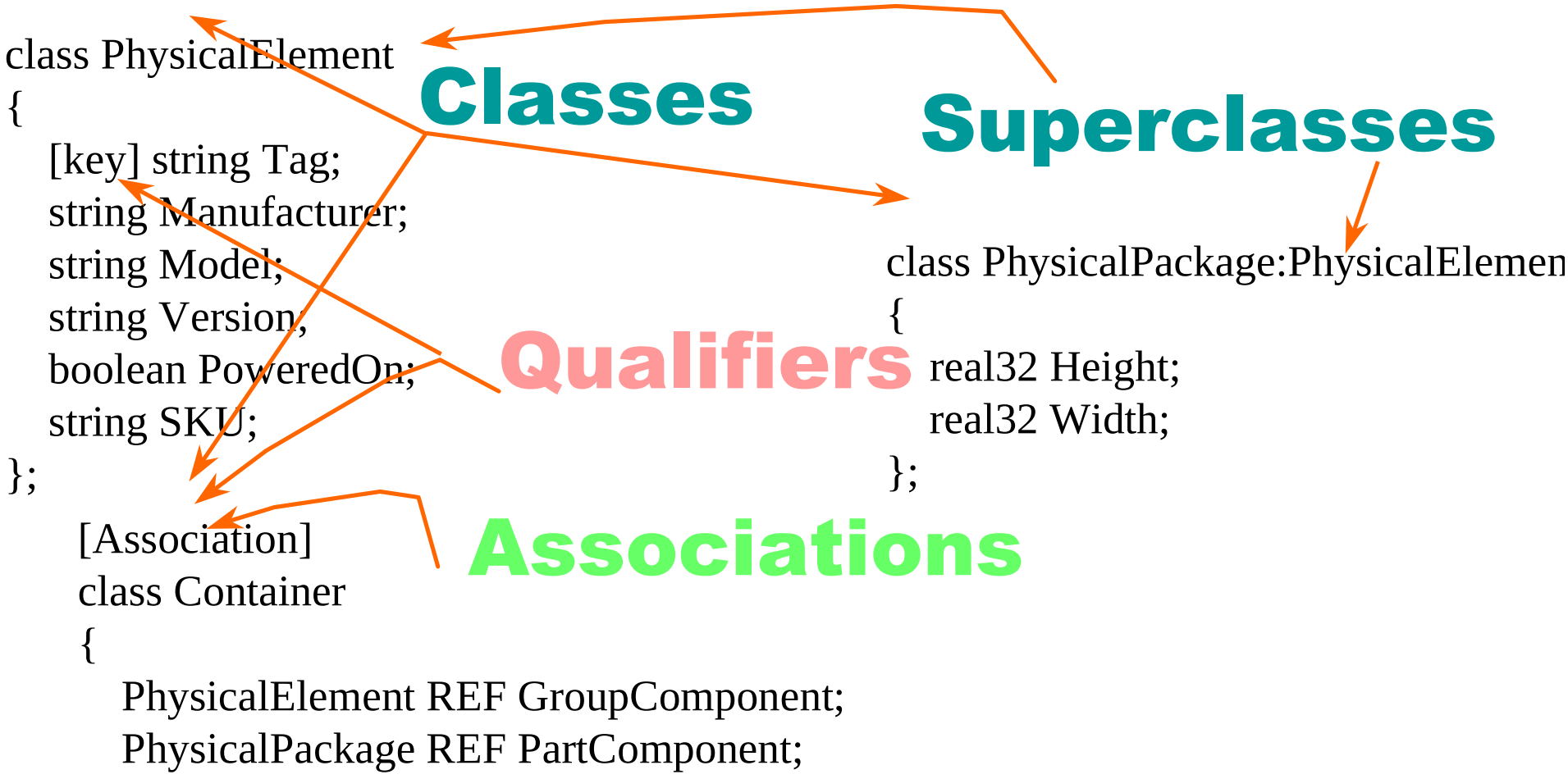
Why CIM? Today's World

- **Hardware supports some management standard (DMI, SNMP, …)**
  - Management data, GUIs and interfaces are different
  - Even terminology different
- **Dependencies and topologies clumsy to represent (as arrays or embedded data)**
- **Software is typically not instrumented**
- **Millions of dollars are spent bringing the data together at an enterprise console**
- **Simple node problems are still not identified and alerted**

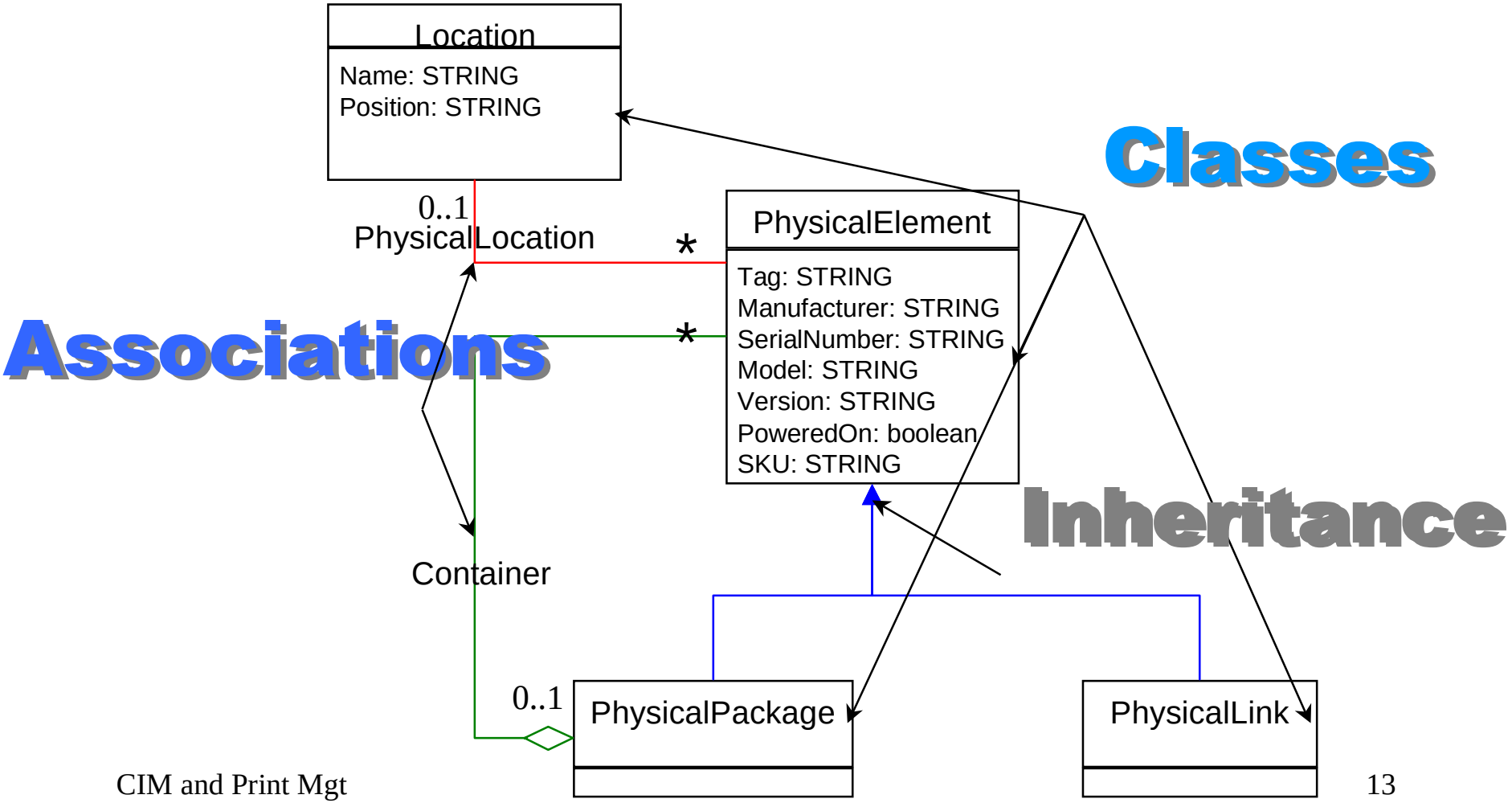
Why CIM?

- **Enterprise-wide management**
  - Attempt to address entire “environment” from nodes to network, users to policies
- **Object oriented**
- **Ability to depict associations (dependencies, topologies, …)**
  - Possible to model complex relationships with data defined by the relationship (not the objects in the relationship)
- **Mapping from a variety of data sources**
  - SNMP, DMI, Proprietary or industry specific mappings
- **Definition of “standard”, inheritable methods**

Expressing CIM in MOF



Expressing CIM in UML



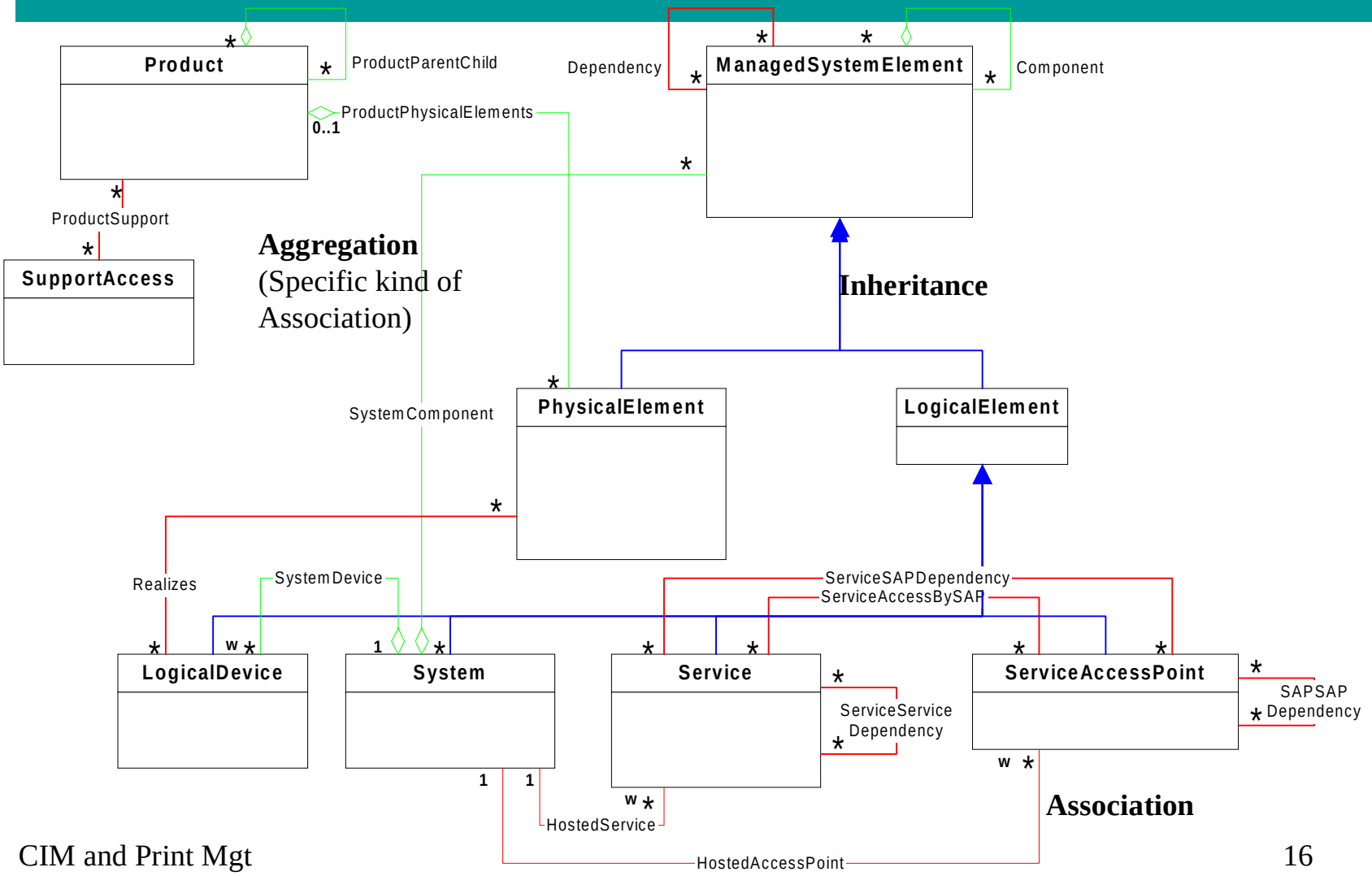
Data Modeled in CIM

- **Systems - Nodes, Clusters and Application Systems (for example, SAP)**
  - V2.2 to include Network Systems (the “cloud”) and functional groupings like a Tape Storage Library
- **OSs, Processes, Threads, Jobs, Files/File Systems, etc.**
- **Devices - Everything from Temperature Sensors and Printers to Logical Disks and RAID Physical Extents**
  - Including the relationships between devices
- **Physical entities - Racks, Chassis, Cards, Memory, Cabling, … and Locations**
- **Applications - Deployment and installation of Software Features and Elements**
  - V2.2 to include concepts and relationships behind “running software”

Data Modeled in CIM

- **Services and their AccessPoints - Functionality like boot and cluster services**
  - V2.2 to include backup and restore, print services, protocol stack and network services, and mapping of applications as Services
- **Users - Persons, Organizations, Roles, certificate and authentication info (V2.2)**
- **Networks - ProtocolEndpoints, Routing and Protocol Services, Network Systems, … (V2.2)**
  - Heavy DEN (Directory Enabled Networks) influence
- **Policies - Rules based on, influencing and associated with the Model (V2.2)**
  - Can be linked to Service Level Agreements and SLA objectives
  - Joint definition with IETF Policy Framework WG

Model Overview - Core UML



Industry Efforts on CIM

- **Joint development with IETF on DHCP and Policy schemas**
- **The Open Group - Unix model**
  - HP (Lead), Sun, IBM, NCR, SCO, Compaq/DEC, SNI
- **SNIA (Storage Network Industry Association)**
  - Fibre Channel Management WG
  - FC-Clustering Steering Committee
  - High End Storage Resource Management
  - Tape Library / Storage Library modeling
- **Collection of vendors defining SES (enclosure services) and backup/restore schemas as part of CIM SysDev WG**
- **SIGs & WGs - I2O, USB, ...**

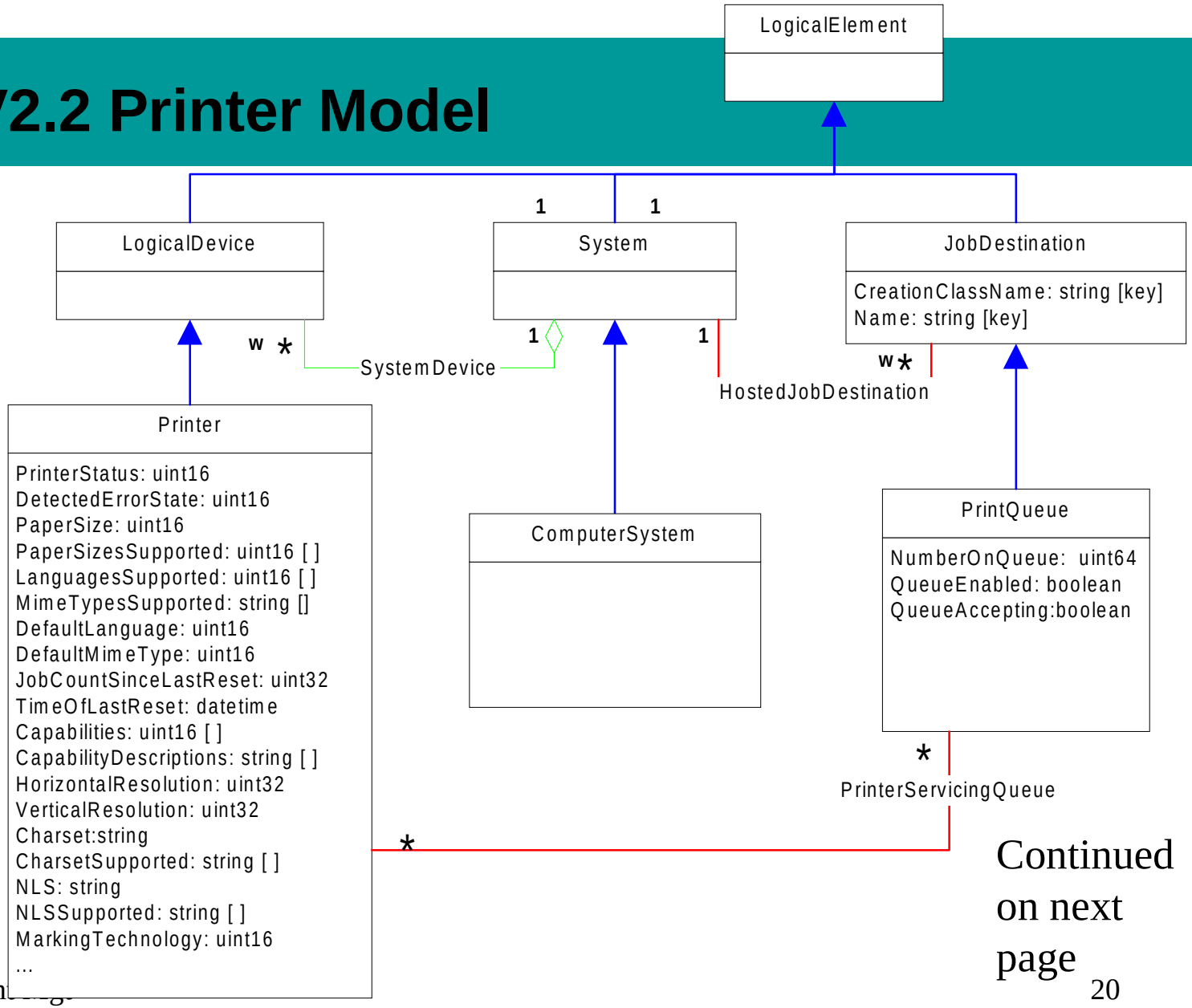
Current CIM Printer Model

- **Based mainly on SNMP Printer MIB with extensions**
- **Partial property list:**
  - PrinterStatus: uint16, DetectedErrorState: uint16
  - PaperSizesSupported: uint16 [ ], LanguagesSupported: uint16 [ ]
  - JobCountSinceLastReset: uint32, TimeOfLastReset: datetime
  - Capabilities: uint16 [ ]
- **Can define associated DeviceSoftware and ControlledBy relationships, and/or network services for Printer connection**
- **Deferred definition of Print Jobs, Queues, etc. until CIM V2.2**

Mapping of Concepts from IPP

- CIM_Printer represents the output device
- CIM_PrintService is very similar to IPP's print service
- Protocol (client and server) is described as kinds of CIM_ProtocolService with CIM_Protocol Endpoints
- Applications, spoolers and drivers are kinds of CIM_Services and CIM_SoftwareElements
- Files are instances of CIM_DataFile
- Various sets of "default" configurations can be defined for Printers and Jobs as CIM_Settings

CIM V2.2 Printer Model



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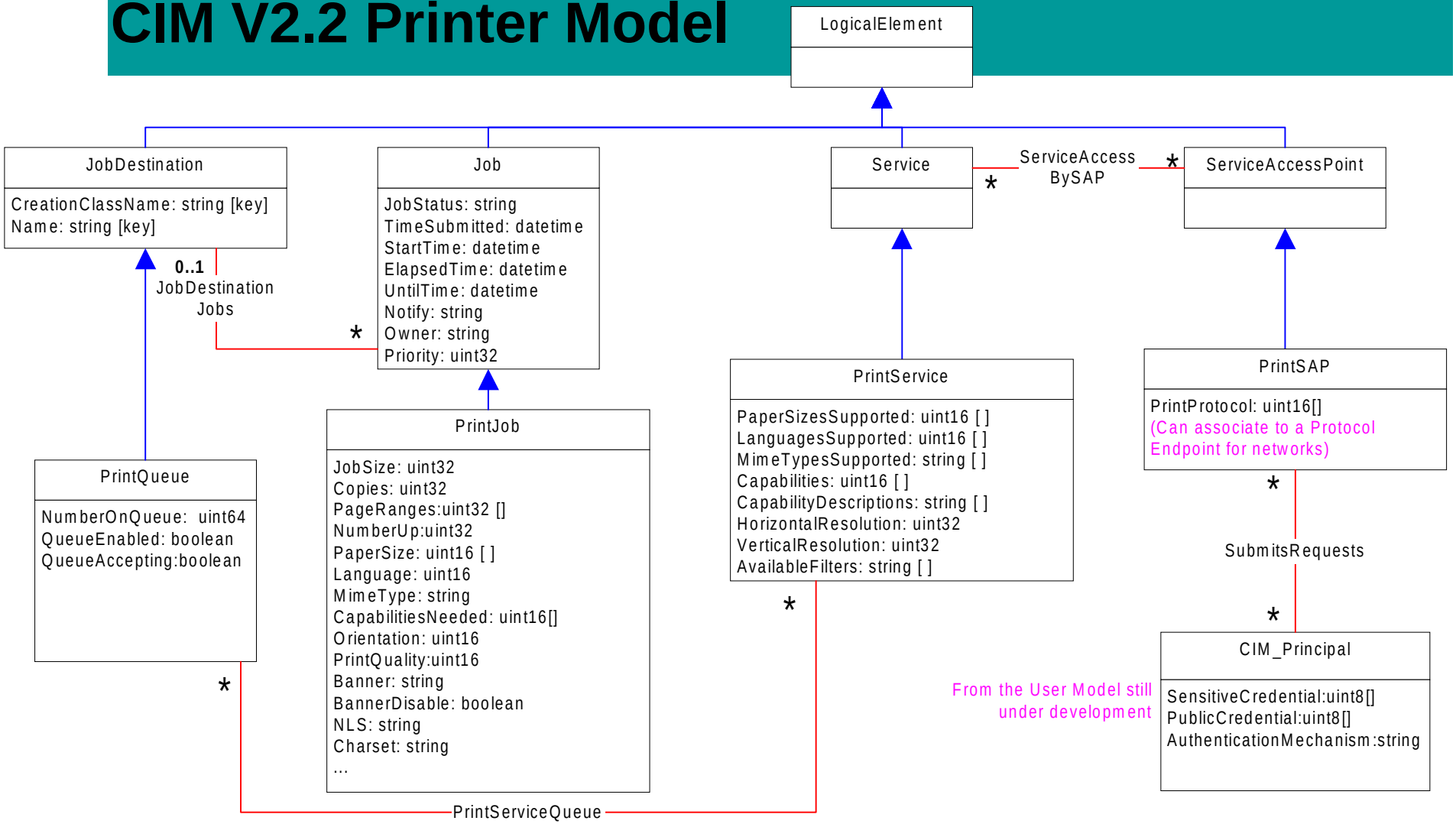
CIM V2.2 Printer Model



What's Needed

- **Input on Printer related objects, properties and associations**
  - Example: CIM_Printer.LanguagesSupported does not correspond to IPP document mime types -> Need to add properties to reflect mime data
  - Alignment with the new Printer, Job, ... MIBs (Where are they found?)
- **Answers for …**
  - How should IPP and other PWG data be defined and mapped to CIM?
  - How does the PWG data correspond to what is already defined in the CIM Printer objects?
  - What is missed?

What's Needed

- **Alignment of the concepts and schemas between CIM System/Devices WG and PWG**
  - Single "view" of a printer, its relationships to other entities, and its jobs and services
  - Allows the printer and its jobs to fit into the "managed enterprise" - Can define and apply configurations, locate problems using dependency analysis, etc.
  - Existing object definitions in CIM useful in extending print models
- **Should not move printing "function" to CIM**
  - Leave this in the appropriate standards and specific to individual environments
  - Move management data only

More Information

- **General CIM info at http://www.dmtf.org/spec/cims.html**
  - Pages have been recently updated
  - More detail is in “Members Only” sections, which need userid/password
- **WBEM and Win32 info at http://www.microsoft.com/ management/**
- **Contact Andrea Westerinen (andreawe@microsoft.com) or David Simons (davidsi@sco.com)**