WBEM – Web-based Enterprise Management
Outline

- What is Enterprise Management?
- What are the drivers in Enterprise Mgt.?
- Distributed Management Technology Forum (DMTF)
  - Web Based Enterprise Management (WBEM)
  - Common Information Model (CIM)
Enterprise Management

- Traditionally concentrated on managing IT infrastructure of an organisation:
  - Host management
  - Server management (key corporate applications)
  - Management of backbone network of organisation

- Has expanded into the management of the organisations:
  - Organisation’s network
  - Host management
  - Server management
  - Desktop Management
  - Service Management
  - Business-to-Business Management
## Traditional Enterprise Management

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Traditional Enterprise Management

- In the late 80s – 90s as organisations increasingly become computer/network dependant
  - Heterogeneous environments with multiple vendors
    - Hardware (Networks, CPUs, Hard disks)
    - Operating Systems (Linux, Windows)
    - Middleware (Db2, J2EE)
    - Applications
  - Increased number and diversity of machines and compounds
    - Problem determination
    - Problem resolution
    - Accessibility

=> Greater importance on good IT infrastructure management
Traditional Enterprise Management

- How to manage heterogeneous environments?
  - Telnet
    - Command-line interface
    - Universally supported
  - Web front ends
    - Flashy and ‘easy’ to use
    - Web browser already installed
  - Simple Network Management Protocol (SNMP)
    - de facto system management tool
    - Supported by all major operating systems
  - Proprietary end-to-end management
    - Manages almost everything on the supported system
Traditional Enterprise Management

- Problems with traditional solutions
  - Resource (inventory) oriented, e.g., telnet/Web front end:
    - Unique tools from each vendor
    - Different data formats
    - Multiple tools required to manage various data
  - Task oriented, e.g., SNMP:
    - Limited functionality
    - Limited expandability to new products
  - System Administrators need to juggle both partial solutions.

- Problems with proprietary System Management Solutions
  - Vendor Lock In
  - Limited availability of experienced developers
  - High cost for customization
Traditional Enterprise Management

- Summary of issues with traditional approaches
  - Lack of scope
    - Customized for single vendor, product, or problem.
  - Lack of interoperability
    - Cannot interact with other vendors products.
    - Data does not conform to standard model.
  - Lack of expandability
    - Not designed for end-user customization or extensibility
What is happening today?

- Organizations have:
  - Moved toward e-business
  - Moved toward more management of ‘business function’ or ‘business process’

- Current Trend
  - Virtualization of Business and Computing
  - Cloud Computing
Virtualization of Business and Computing

- The Internet has enabled the rise of virtual businesses and services
  - Restructuring of value chains as businesses exploit the economies of scale provided by new service providers
  - New entrants go after narrow value opportunities
    - Existing businesses are forced to create new eBusiness spin-offs to compete
  - Every business must decide where to focus and where it has unique competitive strengths

- Virtualization has been a real game changer!
  - Application Service Providers (ASPs) virtualize computing
  - Business Process Outsourcers (BPO) virtualize business
The Virtualization of Computing

- The web is a platform for business computing and inter-enterprise systems

- With the Internet, it provides a global addressing scheme spanning private and public networks
The Virtualization of Computing

- The web architecture separates information and services (logical) from infrastructure (physical)
  - Enables movement of servers out of local environment
    - Server farms
    - Use of remote services
  - Allows re-engineering of IT infrastructure for maximum cost-effectiveness and reliability
    - Using server-centric, thin-client application software architectures
    - Exploit the scale of broadband networks and high performance server clusters
What Happens to Enterprise IT?

- Servers and operations centralized into a few large-scale server centres to gain economies of scale
- Infrastructure gradually turned into services managed by others
- Internal groups organized and measured as service providers
- Applications become services accessible via secure browser sessions
  - First generic applications, then industry applications
- Business runs securely on the internet as virtual private network (VPN) technology matures
- More applications and processes provisioned externally
  - More data, applications and processes are inter-enterprise
IT Becomes a Service Integrator

- IT becomes a service integrator, architect, and manager
  - Learns to integrate and manage a diverse set of internal and external services providers: the multi-service enterprise
  - Shifts headcount to higher value activities and out of IT operations

- Service management: manage services, not just boxes or systems, even when services provisioned externally
  - Move beyond component and technology silos to service-oriented end-to-end processes and management
  - Avoid being squeezed between greater business accountability and unresponsive service providers
Who will define interoperability in Management of Enterprises?

- Internet Management — IETF
- Telecom & Service Management — ITU-T, TMF
- Enterprise Management — DMTF
Distributed Management Task Force

- Industry organization that is seeking to lead the development, adoption and unification of management standards for desktop, enterprise, Internet environments.
- Composed of (predominantly) technology vendors and affiliated standards groups
- Claims to “...enable a more integrated, cost effective, and less crisis-driven approach to management through interoperable management solutions”.
DMTF Standards

- **WBEM** – Web based Enterprise Management
- **CIM** - Establishing a common model for the whole computing environment
- **DMI** - Instrumenting the Desktop and Server
What is WBEM

- Web-Based Enterprise Management is a set of management and Internet standard technologies developed to unify the management of enterprise computing environments.
What is WBEM (contd.)

- **WBEM** is:
  - Web-Based Enterprise Management
  - A DMTF standard
  - Founded in 1996 by: BMC Software, Cisco, Compaq, Intel, Microsoft
  - A standard way to get management data:
    - Schema, Transport, Protocol
What is WBEM (contd.)

- **CIM**
  - provides a data modelling process and language (Managed Object Format). Includes standard models (schemata) for systems, applications, networks, devices, etc. Enables description of management data in a standard way.

- The xmlCIM Encoding Specification which encodes commands and responses which can be used to represent WBEM entities:
  - The definition of XML elements in DTD
  - The representation of CIM in XML specification

- The ‘CIM Operations over HTTP’ specification
  - HTTP access, the HTTP encapsulation (CIM-XML) the transport mechanism for carrying commands and responses across a network, including the ‘CIM operations over HTTP’
Enabling Enterprise Management

Consistent view of the managed environment results in an ability to manage the business rather than just its components.
Why Implement WBEM?

- WBEM is extensible, facilitating the development of platform-neutral, reusable infrastructure, tools and applications.
- In addition to its use by vendors, end users and the open source community
  - WBEM is enabling other industry organizations to build on its foundation in areas including Web services, security, storage, grid and utility computing.
- Reduced Development Cost using and re-using existing standards models, no need to “re-invent the wheel” every time
What is CIM?

- A model for describing the overall management information in a network/enterprise environment
- Provides a consistent definition and structure of data, using object oriented techniques
- Includes expressions for common elements that must be presented to management applications
  - E.g. object classes, properties, methods and associations
- Uses the Management Object Format (MOF) to define elements
CIM Overview

- CIM is:
  - Hierarchical, object oriented architecture
    - Supports tracking and depicting of the complex interdependencies and associations among objects
  - An information model - a conceptual view of the managed environment that attempts to unify and extend the existing standards (SNMP, CMIP, etc.) using OO constructs and designs
CIM Overview

- CIM Specification:
  - Includes the meta schema and the meta schema elements
  - The Managed Object Format (MOF)
  - How UML is used to diagram CIM Models.

- CIM schema:
  - Core and common models
CIM Object Oriented Overview

- CIM OO Modelling is a formal way of representing something in the real world, based upon set and classification theory.
  - **Classes** are types of things
  - **Subclasses** are subtypes of things
  - **Properties** are attributes
  - **Relationships** are pairs of attributes
  - **Instances** are things
CIM Object Oriented Overview

- **Abstraction**: The essential characteristics of an object
- **Modularity**: Decomposition of abstractions into discrete units
- **Encapsulation**: Compartmentsalization of elements of abstraction that constitute its structure and behavior
- **Hierarchy**: Ranking order of abstractions
CIM Specification

- Defines syntax and rules
  - Meta Schema
  - Meta Schema Elements
  - Rules for each element
  - Syntax based on MOF
  - CIM naming mechanism
- Does NOT describe
  - CIM implementations, APIs or communication protocols
  - Or the core and common models
CIM Managed Object Format (MOF)

- Many ways CIM information can be represented to exchange information.
- MOF is based on the Interface Definition Language (IDL).
- The MOF syntax is a way to describe object definitions in textual form.
  - It establishes the syntax for writing definitions.
- The main components of a MOF specification are textual descriptions of classes, associations, properties, references, methods and instance declarations and their associated qualifiers.
  - Comments are permitted.
- A MOF file can be encoded in either Unicode or UTF-8.
CIM Managed Object Format (MOF)

- Some rules apply:
  - Comments take the C++ and C forms // or /* */
  - Names are case sensitive
  - Datatypes are better defined than C/C++ being signed or unsigned 8, 16, 32 and 64 bit integers, and 4 and 8 byte floating point numbers. Supports Booleans, strings, and datetimes as basic datatypes.
  - As with C++, constant strings can be continued over a line by closing quotation marks and re-opening them at the beginning of next line.
CIM Managed Object Format (MOF)

- The MOF file is basically made up of a series of class and instance declarations.

Example: MOF definition of class CIM_ManagedElement
[Abstract, Version ("2.7.0"), Description ("ManagedElement is an abstract class that provides a common superclass (or top of the inheritance tree) for the non-association classes in the CIM Schema.") ]
class CIM_ManagedElement {

[MaxLen (64), Description ("The Caption property is a short textual description (one-line string) of the object.") ]
string Caption;

[Description ("The Description property provides a textual description of " "the object.") ]
string Description;

[Description ("A user-friendly name for the object. This property allows " "each instance to define a user-friendly name IN ADDITION TO its " "key properties/identity data, and description information. \
"Note that ManagedSystemElement's Name property is also defined " "as a user-friendly name. But, it is often subclassed to be a " "Key. It is not reasonable that the same property can convey " "both identity and a user friendly name, without inconsistencies. " "Where Name exists and is not a Key (such as for instances of " "LogicalDevice), the same information MAY be present in both " "the Name and ElementName properties."]) ]
string ElementName;
}
Schemas, Classes, Properties and Methods

- CIM model documents generally follow the convention of using **blue** lines for inheritance, **red** lines for associations and **green** lines for aggregation.