

TECHNOLOGY BRIEF

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Web-Based Enterprise Management—An Ongoing Initiative

Distributed enterprise computing has drastically changed the way users work. As organizations implement client-server computing, they reap many benefits through improved access to distributed resources. However, current enterprise management systems have several major shortcomings. Web-based enterprise management (WBEM) is an ongoing industry initiative to integrate current enterprise management technology with the latest advances in web technology, providing organizations with an easy-to-use, cost-effective, proactive, automated method for managing enterprise systems.

This technology brief identifies customer challenges with current enterprise management solutions and defines how the WBEM initiative overcomes those challenges. This brief examines WBEM standards as they exist today and explains the direction Compaq and other vendors are taking in relation to the industry initiative.

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Web-Based Enterprise Management—An Ongoing Initiative

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INTRODUCTION

The enterprise management community is experiencing a paradigm shift—an effort to unify existing enterprise networked systems management technologies and integrate them with the latest advances in web-based technology.

Concurrent with the deployment of enterprise management platforms, the Internet developed into an easy-to-use, universal network of networks. The general acceptance of the worldwide Internet, the proliferation of intranets, and the increase in electronic commerce enable businesses to adopt a low-cost, open-architecture, user-friendly management framework.

These factors and the long-standing challenges encountered with traditional enterprise management solutions spawned the WBEM initiative. Compaq, Microsoft, Cisco, BMC and Intel are leading this initiative to develop industry-wide standards for WBEM. This ongoing, industry-wide effort augments current enterprise management solutions and protects business investments. The WBEM effort will develop an open architecture that will be the integration point for organizations worldwide, providing easy access to management data from a variety of sources. The WBEM initiative increases corporate information technology agility with simplified enterprise solutions and increases the overall benefits derived from improved access to distributed resources at the lowest possible cost.

CURRENT ENTERPRISE MANAGEMENT

Distributed enterprise computing has drastically changed the way users work. Connected to a network, users can draw on applications and data distributed across networks, including those on servers thousands of miles away, to make timely business decisions. Figure 1 illustrates a current standards-based enterprise system. For an overview of network management, see the white paper titled *Network Management Overview*, document number 043A/0996.

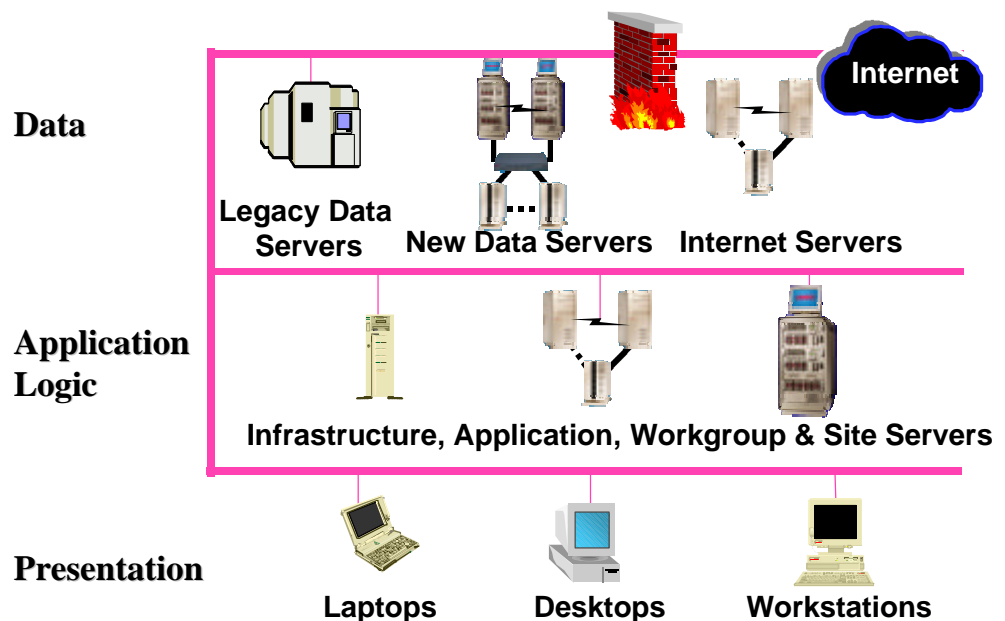


Figure 1: Standards-based enterprise system. Using managed elements (laptops, desktops, workstations), users draw on applications and data distributed across networks that include infrastructure, application,

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workgroup, and site servers, legacy data servers, new data servers, and internet servers. The many disparate pieces create a complex and challenging system.

As organizations implement client-server computing, they reap many benefits through improved access to distributed resources. With those advantages, however, comes the burden of managing these diverse resources. The systems available today for management of a heterogeneous enterprise have several important shortcomings:

- Available management systems compile data in inconsistent formats, complicating the comparison of data from different management platforms and, as a result, limiting the value of the data collected.
- The widely differing approaches used for networks, systems, and applications management have created incompatible infrastructures. These platform-dependent and very complex infrastructures make systems and network management very costly by requiring system administrators to deal with multiple technologies.
- Software developers must create applications for multiple management environments. Because there are so many disparate environments, developers cannot effectively integrate their applications with other solutions and their ability to provide innovative solutions is restrained.
- Vendor-specific management solutions are highly specialized system tools that require large investments. The costs of planning, implementing, and deploying these expensive proprietary systems, combined with limited product offerings, often result in slower return on investment, limited scalability, and higher cost than necessary.

Figure 2 depicts the challenges faced by today's network and system administrators.

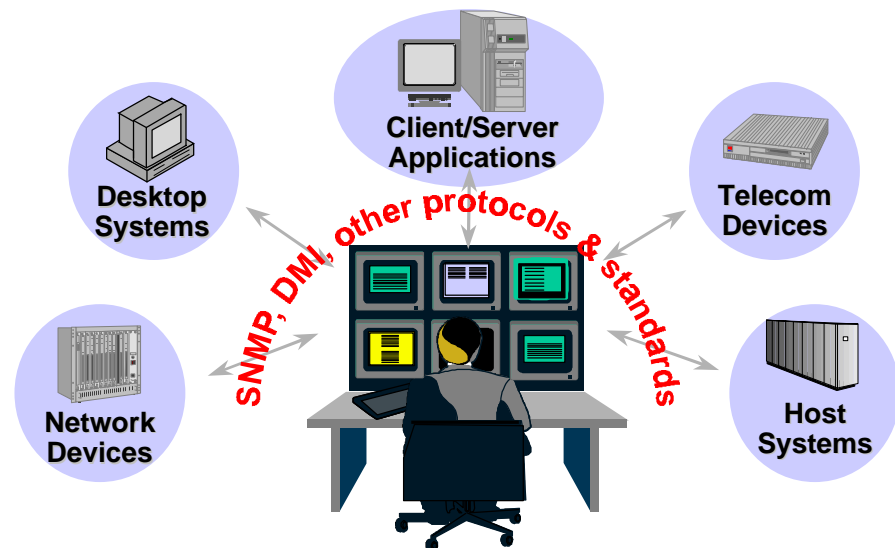


Figure 2: Today's enterprise management challenges: many proprietary frameworks, no common foundations, and no consistent view. Network and system managers must understand simple network management protocol (SNMP) and desktop management interface (DMI), as well as other protocols and standards.

INDUSTRY LEADERS SELECT WEB TECHNOLOGY FOR ENTERPRISE MANAGEMENT

While the popularity of distributed computing has grown, so has the Internet. In an amazingly short time, the World Wide Web (WWW) has dramatically affected the dissemination of information regarding many aspects of life including commerce, education, politics, and scientific research. The WWW, in fact, is now the most popular internet application next to electronic mail.

The WWW is an internet technology that is layered on top of basic transmission control protocol/internet protocol (TCP/IP) services. Like most successful internet technologies, the underlying functionality of the WWW is rather straightforward:

- File naming mechanism—the universal resource locator, or URL
- A typed, stateless retrieval protocol—hypertext transfer protocol (HTTP)
- A minimal formatting language with hypertext links—hypertext markup language (HTML)

HTML is relatively easy to learn and manipulate, and HTTP is relatively lightweight. The real benefit, however, lies in the easy-to-use web browser. These benefits have generated a rapid global penetration of web technology.

Customers have already invested heavily in SNMP- and DMI-enabled systems and devices, and they are eager to use web technology to access the wealth of management information provided by those systems. To achieve the integration customers are seeking, the interface between web-based technologies and existing standards must be optimized for interoperability.

In July 1996, five major vendors announced an initiative to define standards for WBEM. Compaq, Microsoft, Cisco, BMC, and Intel spearheaded this initiative, and more than 60 other vendors now publicly endorse the effort. The initiative defines an architecture for WBEM that removes several hurdles to distributed systems management. The strength of the proposal lies in its simplicity. It draws on pervasive internet technology to provide a common base for networked systems management, using the web browser as the primary user interface. WBEM provides an easy-to-use, cost-effective, proactive, automated way of presenting and accessing consistent management data.

Using a web-based interface, the WBEM standards identify a consistent way to work with a wide range of management information. Applications and devices that comply with these standards will be accessible and controllable from a client system equipped with a web browser. As a result, network and system management will benefit from the richness of internet technology, which affords abundant, easily accessible content and incorporates innovative technologies at a rapid rate.

The WBEM initiative directly addresses these issues, providing three key advantages:

- *Scalability.* With a simple web browser as the interface, organizations can use networking technology already in place to manage a wide range of network resources such as routers, hubs, PCs, workstations, distributed applications, and databases. When the same technologies used for building networks are used to create management applications, the scalability of the applications can match that of the network. The proposed WBEM standards provide such scalability by allowing a system administrator to learn and implement just one interface to monitor and maintain low-end devices and systems, as well as mainframes and everything in between. The standards will support a broad range of management solutions and will build on internet innovations to meet the demanding requirements of the most complex heterogeneous computing environments.
- *Increased choice in applications and greater functionality.* The proposed WBEM standards offer a single foundation on which to build management applications, eliminating the need to

Lightweight protocol – a communications protocol designed with less complexity to reduce overhead.

MVS – Multiple Virtual Storage, the operating system for older IBM mainframes.

VMS – Virtual Memory System, a multi-user, multitasking, virtual memory operating system that runs on DEC's VAX line of minicomputers and workstations.

design different versions for different management platforms and making applications more efficient and cost-effective. This frees developers to concentrate on innovative functionality rather than system differences and allows them to bring applications to market quicker. Significant benefits for users will be a greater selection of management applications and added functionality that takes advantage of rapidly evolving web technology.

- *Lowered costs for setup and operation.* A single interface for managing all networks, systems, and applications will greatly reduce the complexity that currently frustrates system administrators. The proposed WBEM standards will eliminate the need for specially outfitted consoles. Instead, a web-enabled client system based on a web browser interface will provide access to management data for networks of UNIX, Microsoft Windows NT, MVS, Open VMS, and NetWare platforms.

The goal of the new networked systems management paradigm is to make the whole enterprise network much greater than the sum of its individual parts. The architecture of the enterprise management system, or WBEM, is key to delivering that value.

WBEM TECHNOLOGY

WBEM shifts the focus from the infrastructure of network management to the content and processes. Administrators require the ability to track network problems from the user or application level through the system and various network layers to the remote service or servers. Based on industry standards, the new WBEM architecture combines existing and new management elements and presents them through web browsers. Instead of a two-tier architecture (management console and managed device), WBEM uses a three-tier architecture that includes a management server, managed devices, and a web browser. Figure 3 illustrates the WBEM architecture.

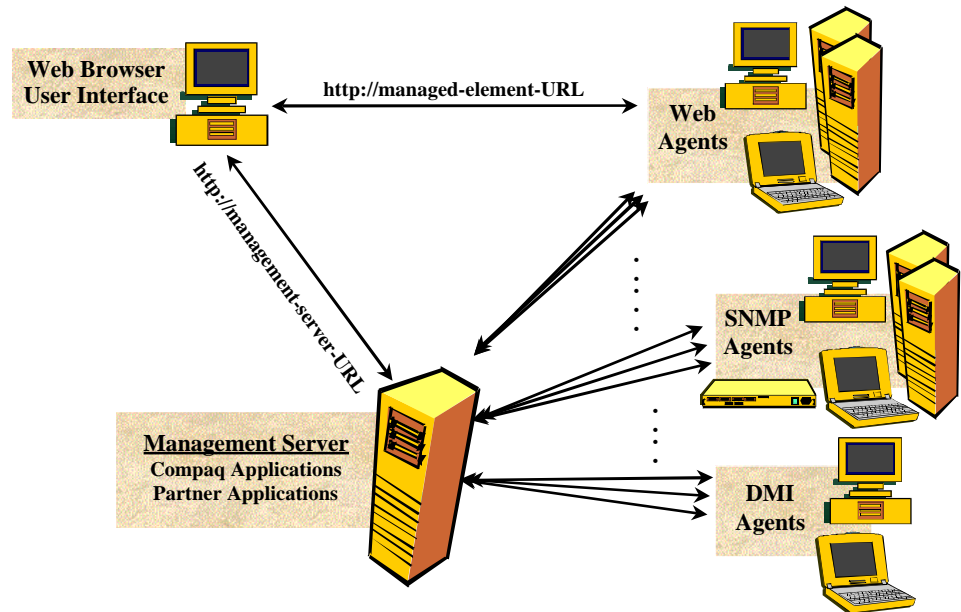


Figure 3: WBEM architecture model. A browser uses web-type connections to communicate with the server or managed elements over an intranet.

In this new architecture, the web browser replaces the standard management console, providing access to either the web agents or the management server. The management server facilitates the web access to web-enabled, SNMP, or DMI managed elements. The management server also performs the functions required to logically aggregate multiple managed objects sharing some common action, fault, or configuration of interest. Self-describing web agents use common web-enabling components to provide registration, discovery, security, HTTP communications, and a home page. The agents render information in HTML for viewing by a browser or send information directly to the management server.

For additional information on the basic components of the WBEM initiative, visit <http://wbem.freerange.com>.

COMMON INFORMATION MODEL

WBEM technology will be enhanced with the implementation of the common information model (CIM). The Desktop Management Task Force (DMTF) CIM is an object-based data model for management information. The CIM schema originated from the Microsoft HyperMedia Management Schema. So the schema would become a widely adopted industry standard, Microsoft entrusted further development to the DMTF. With the help of Compaq and several other industry partners, the DMTF is advancing the CIM specification.

The CIM is a single inheritance object model that is based on the unified modeling language (UML). It incorporates associations as a way to indicate relationships between data items. The CIM, as defined by the DMTF, is an implementation-independent data model. Key contributors to the DMTF CIM process are Compaq, Hewlett-Packard (HP), Intel, Microsoft, Novell, Sun, and Tivoli. Many other companies are also contributing to the process.

The CIM can be used to describe a wide range of management information: device, application or system software, physical components, system, network, trouble ticket, or user support. One of the motivations behind the CIM is to have a data model of management information that can be interpreted and manipulated by a wide range of management software from multiple vendors. The CIM addresses the issue of incompatible data formats for management information.

Another key element of the CIM is the managed object format (MOF) language. MOF is used to define object classes as well as instances of objects. It provides an extendable qualifier definition facility to accommodate different implementation requirements. Like the CIM schema, MOF was originated by Microsoft and entrusted to the DMTF to be incorporated in the CIM specification. MOF can be used to interchange CIM data between different implementations of management applications.

For additional information on the common information model, visit <http://www.dmtf.org/>.

INDUSTRY ROADMAP

Compaq, Microsoft, BMC Software, Cisco, and Intel will promote the adoption of the proposed standards in several ways. Working together, and with other organizations that support the effort, they will communicate the benefits of a web-browser-based framework to the industry. The five sponsors have invited other parties interested in easing the cost and complexity of systems management to participate in the effort.

Compaq and several other vendors are working to advance WBEM technology and incorporate existing standards into new technologies. Microsoft, Intel, Cisco, Computer Associates, BMC, Tivoli, and HP are all involved in defining the CIM through their participation in the DMTF. Other efforts are highlighted below.

Inheritance – a characteristic of object-oriented programming that allows the programmer to create a new object that “inherits” some properties from an existing object.

Object-oriented programming – a method of programming using “objects” that possess certain properties defining not only what the object is, but also what it does.

Class – a collection of objects that share characteristics.

Compaq

As a key architect of the WBEM framework, Compaq is actively pursuing the development of new open-platform management solutions. Compaq is adopting WBEM to provide value-added, feature-rich management products to its industry leading commercial platforms and options.

Compaq is incorporating WBEM technology into existing products such as Compaq Insight Manager, Compaq SmartStart, and Integration Server. Insight Manager will become a network-centric management application that supports HTTP and other existing or emerging management protocols and implementations. It will use a web browser to address and control platform devices such as SNMP or DMI agents that will also output HTML. Integration Server will evolve to include browser access to Integration Server files, automatic software updates through the Internet, and Internet-based software version control information.

Microsoft

Microsoft has developed an object management software component known as the Common Information Model Object Manager (CIMOM). CIMOM will be shipped as a part of Microsoft Windows 98 and Microsoft Windows NT 5.0. Additionally, it will be made available for Microsoft Windows NT 4.0. Microsoft used the acronym WBEM to refer to CIMOM and its components. Early versions of the CIMOM software development kit are available for download at <http://wbem.freerange.com/wbemsdk/>.

Microsoft has also launched an initiative called the Zero Administration Initiative for Windows (ZAW). ZAW equates to establishing a management infrastructure in Microsoft Windows, exposing this infrastructure, and building the tools to use it. ZAW includes: infrastructure components such as Windows Management Instrumentation and WBEM; management tools such as Systems Management Server and Microsoft Management Console; new developments such as policy management in Windows NT Version 5.0 operating system; and interfaces for enterprise management vendors.

Intel

Intel is implementing the Wired for Management (WfM) Initiative. The WfM initiative is standards-based and comprises products, technologies, and industry alliances that immediately reduce total cost of ownership and deliver interoperability without sacrificing performance. WfM-enabled platforms combine the latest in management technology with high-performance desktops to deliver availability, control, and agility.

Cisco Systems

Cisco will deliver Cisco Assured Network Services (ANS), a new end-to-end network management product line based on the WBEM architecture. ANS is a distributed system of network management modules, foundation services, automated agents, web-based electronic services, and professional services to meet the network management needs of enterprise customers. Products and services in ANS are based on network management and internet standards, including SNMP, RMON, Java, CORBA, and HTTP/HTML.

Cisco is moving quickly to take advantage of the new internet technologies to simplify network management products, their development, and delivery. Cisco will make all management software modules browser-accessible and all reports publishable in HTML. Extensive use of hyperlinks will be the norm for applications in the new enterprise. All management modules will be delivered electronically via Cisco Connection Online.

Cisco Systems' WBEM direction is already evident in key features of Cisco network management products such as Cisco Resource Manager (CRM), the Cisco Netsys Service-Level Management

RMON – Remote Monitoring, extensions to the SNMP that provide comprehensive network monitoring capabilities. In standard SNMP, the device has to be queried to obtain information. RMON is proactive and can set alarms on a variety of traffic conditions, including specific types of errors.

CORBA – Common Object Request Broker Architecture, a standard for communicating between distributed objects. CORBA provides a way to execute programs written in any language no matter where they reside in the network or what

(SLM) suite, Cisco-Works for Switched Internetworks (CWSI), and Cisco Enterprise Accounting. CRM is already available to the marketplace. The core technologies for the common management foundation for ANS reside in CWSI, CRM, and the SLM suite.

BMC Software

BMC Software is working on the next generation of enabling technology that complies with the WBEM specification. The new technology enables users to view PATROL data transparently through any browser by translating to HTML information that would normally be passed between the PATROL agent and console.

Computer Associates

Computer Associates (CA) will use Microsoft Active X Technologies and Microsoft Internet Explorer as the basis of internet and intranet access to CA-Unicenter TNG. CA is currently shipping a version of Unicenter TNG that uses a VRML-enabled front end for its user interface. HP and CA announced a global agreement under which HP will bundle CA's Unicenter TNG Framework with all HP-UX servers and workstations.

Tivoli

Tivoli chairs the DMTF technical committee that is developing the CIM. Tivoli is planning to release Global Enterprise Manager (a completely Java-based master console for the TME 10 framework) and is also developing a browser interface for TME 10 NetView for Windows NT.

Hewlett-Packard

HP plans to incorporate standardized WBEM technology, including the CIM, into the HP OpenView management product.

HP and CA announced a global agreement under which HP will bundle CA's Unicenter TNG Framework with all HP-UX servers and workstations. By providing out-of-the-box manageability of HP systems through the Unicenter TNG Framework, HP and CA reduce dramatically the single-largest component of enterprise computing costs—the management and administration of distributed heterogeneous environments.

The implementation of HP's new OpenView Ready employs today's industry-standard management technologies, such as SNMP and DMI, and is expected to incorporate future management specifications and technologies, such as Windows Management Instrumentation, the Microsoft Management Console, and the emerging WBEM standard.

CONCLUSION

WBEM is an aggressive industry-wide effort to leverage PC, internet, and web technologies for tomorrow and to effectively remove several hurdles to enterprise networked systems management.

Compaq is a leader in systems management, with products such as Compaq Netelligent Management Software and Compaq Insight Manager. Consistent with an established history of strong management solutions, Compaq is incorporating powerful manageability feature sets in all of its hardware product lines.

Compaq constantly researches new ways to improve its enterprise network management offerings and continues that trend by aggressively developing standards-based management solutions. In cooperation with industry leaders, Compaq remains out front by providing end-to-end solutions and delivering products that adhere to the WBEM standards. The open architecture of the

*VRML – Virtual Reality
Modeling Language, a
3-D graphics language
used on the Web.*

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· WBEM initiative unlocks the management capabilities previously locked by closed proprietary systems.