IT Service Management Standards

A Reference Model for Open Standards-Based ITSM Solutions

An IBM White Paper

Abstract

This paper describes the critical importance of open standards[1] for IT Service Management (ITSM).

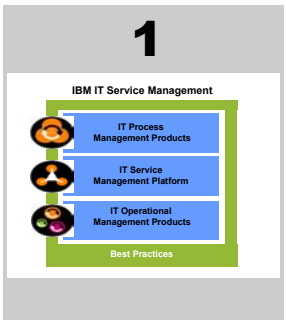
We present:

- an overview of ITSM, including underlying elements such as ITIL® and autonomic computing;
- an architecture for the realization of ITSM;
- many of the key standards – existing, emerging and yet to be developed – that are relevant to ITSM and needed for its effective implementation; and
- how those standards are employed in the ITSM architecture.

In addition, we describe various types of standards that are representative of those used in ITSM and offer a summary of the important standards to look for when investing in ITSM.

This paper will help you understand ITSM, the relevant ITSM standards and the importance of standards for maximizing your business value with ITSM.

[1] Publicly available and implementable standards



IT Management Standards

Change, compliance, complexity and cost: these "four Cs" are placing tremendous pressure on information technology (IT) organizations. Enterprises rely on their IT systems to execute their business processes, and these "four C" business pressures place increasing demands on the IT infrastructure, particularly in the area of managing that infrastructure. IT organizations face:

- **Change**: variability in market demands, workloads and service levels
- **Compliance**: the need to conform to regulations and security requirements and provide audit capabilities
- **Complexity**: heterogeneity of resources, composite applications and traditional functional "silos" for managing them
- **Cost**: increases in the time and expense required to manage and administer the IT system, in conflict with the business pressure to reduce the cost of doing business

This "four C" environment introduces challenges in managing IT cost and responsiveness across IT "silos" – vertical towers of specialized expertise and tools associated with managing one "slice" of the IT environment (such as servers, network, applications, databases and so on). Managing composite applications and services[2] in such silos is a struggle.

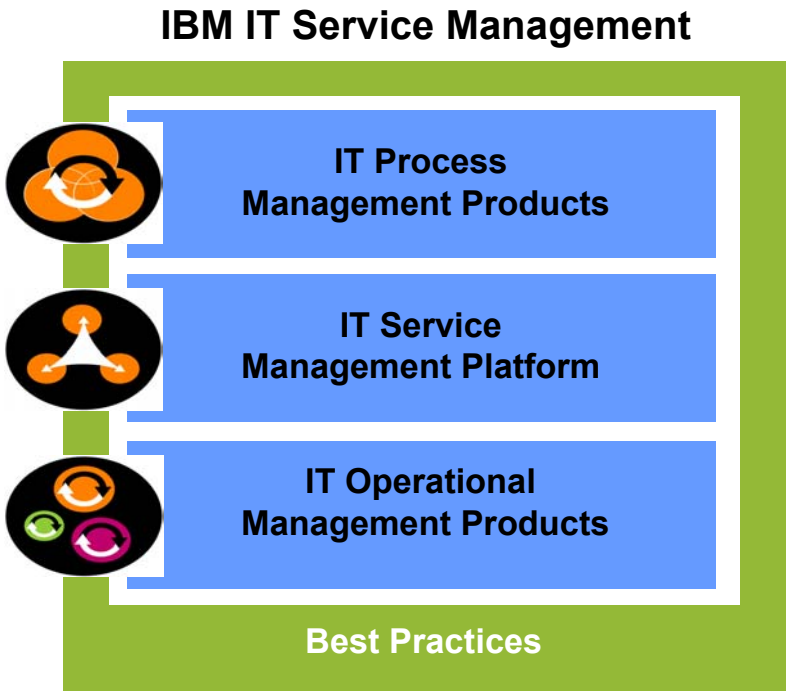
[2] IT Service: A collection of IT components (including hardware, software, facilities, people, processes, and procedures) that meet a standard, well-known business need of IT customers. A service is what the customer experiences, whereas a solution is the set of resources that work together to provide a service.

IT service management (ITSM) is about integrating those silos – not only the technology, but also the people, processes [3] and information associated with horizontal IT services such as availability management, change management, security management, incident management and others. The characteristics of an optimal intersection of people, processes, information and technology realized by ITSM are:

- **People**: interconnected and productive (no longer in silos)
- **Processes**: based on best practices, automated and customizable
- **Information**: standardized, federated and secure
- **Technology**: integrated, virtualized and role-based

This intersection enables the *business of IT* to be managed in a service-oriented manner, employing service-oriented architecture (SOA) to deliver the IT services that are relevant to the business they serve. This concept is detailed in [7].

A comprehensive approach to ITSM requires standards for information, processes and services so that people and technology can interact in an effective, efficient way. Figure 1 shows such an approach.



[3] Process: A collection of related activities with a common goal that take inputs, transform them, and produce outputs toward achieving that goal.

Figure 1 Approach to IT Service Management

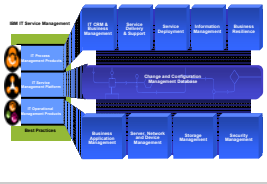
IT operational management products enable the business of IT to be managed in a standardized, automated, infrastructure-aligned way, as embodied in the IBM® autonomic computing architecture (described later). The IT service management platform incorporates entities such as an open, standard-based *configuration management database* (CMDB) and workflow engines. IT process management products employ automated workflows aligned with the *IT Infrastructure Library*® (ITIL®, detailed later). Best practices offer the foundation for definition of a standard way for people to interact with technology in an ITSM environment.

To achieve the optimal intersection of people, processes, information and technology and achieve interoperability in a heterogeneous environment, standards are a necessary component of ITSM (more about the business value of standards is presented in Chapter 7). This paper details those standards, how they work together for ITSM and how they are employed in the ITSM solution architecture.

The remainder of this document is organized as follows:

- Chapter 2 presents additional background on ITSM and autonomic computing.
- Chapter 3 introduces the IT management architecture used to realize ITSM.
- Chapter 4 discusses the role of standards in ITSM and describes several types of standardization.
- Chapter 5 describes the standards landscape associated with ITSM and lists a set of standards that IBM promotes as important to ITSM.
- Chapter 6 relates the IT management architecture to the ITSM standards, resulting in an open standards-based IT management system.
- Chapter 7 summarizes the standards that ITSM customers should value, offering a standards “checklist” and a description of IBM products that employ those standards.
- Chapter 8 offers concluding thoughts.

2



IT Services Management

The business of IT Management – ITSM – was introduced in the preceding chapter. This chapter presents additional details about some of the important building blocks employed in ITSM solutions, namely the *Information Technology Infrastructure Library* (ITIL) and Autonomic Computing.

ITIL

ITIL is a set of best practices for IT Service Management. As described in [1]:

> *ITIL (Information Technology Infrastructure Library) is a process-based methodology that delivers a set of IT service management best practices that can help you align your IT with your business requirements, improve service quality, and lower the long-term cost of IT service provision. These best practices are applicable to all IT organizations, no matter what their size or what technology they use. Originally developed by the British government in the late 1980s, today ITIL is the world's most widely accepted approach to IT service management.*

ITIL, developed in the late 1980s with IBM's assistance, was based on the Information Systems Management Architecture (ISMA) developed by IBM in the 1970s. Today, ITIL includes contributions from major software vendors, including IBM, consultancies and customers.

In addition, a formal standard based on the ITIL best practices has been published: *ISO/IEC 20000-1:2005* [2], from the International Organization for Standardization, formalizes IT service management as defined by ITIL. As described in the abstract [2]:

> *ISO/IEC 20000-1:2005 promotes the adoption of an integrated process approach to effectively deliver managed services to meet business and customer requirements. For an organization to function effectively it has to identify and manage numerous linked activities. Co-ordinated integration and implementation of the service management processes provides the ongoing control, greater efficiency and opportunities for continual improvement.*

A recent initiative, known as ITIL v3 or the ITIL Refresh project, is underway. ITIL v3 will refresh the current ITIL best practices documentation, according to [3], "to improve the usefulness and applicability of ITIL by addressing the changing needs of users as the technology base and business requirements continue to evolve" and "to apply and improve its applicability to small organisations". ITIL v3 will increase the focus on services to better meet the needs of businesses that use and deliver those services. As described in [3], a new set of core books will be developed to describe the service lifecycle; the working titles of these new books are:

- *Service Strategies*
- *Service Design*
- *Service Introduction*
- *Service Operation*
- *Continuous Service Improvement*

In ITSM, ITIL is employed to provide the foundation for the IT process management components of the IT management architecture detailed in the next chapter, including process definitions, service catalog, service desk and the CMDB. Although ITIL v3 is not yet available, IBM has created an integrated process reference model for IT, using the foundation of ITIL v2 as inspiration. This model will be updated continuously to adhere to ITIL v3 and other future updates. It is open and incorporates IBM's own experience gained from managing the largest IT environments in the world, along with hundreds of smaller customers' IT operations.

Autonomic Computing

Autonomic computing provides the ability for IT systems to become self-managing through self-configuring, self-healing, self-optimizing and self-protecting mechanisms. As described in [4]:

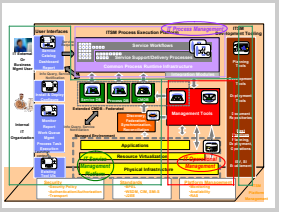
> *Autonomic computing helps to address complexity by using technology to manage technology. The term autonomic is derived from human biology. The autonomic nervous system monitors your heartbeat, checks your blood sugar level and keeps your body temperature close to 98.6°F without any conscious effort on your part. In much the same way, self-managing autonomic capabilities anticipate IT system requirements and resolve problems, with minimal human intervention. As a result, IT professionals can focus on tasks with higher value to the business.*

The term "autonomic computing" was conceived by IBM but self-management is an industry initiative, with a growing number of companies adopting self-managing autonomic technologies and industry leaders, including IBM, working on standards for autonomic computing. In addition, autonomic computing has much interest from academia, with many research projects underway and with autonomic computing emerging as a computer science discipline (see, for example, [14], [15] and [16]. Academic and industry conferences on autonomic computing grow each year.

Based on this industry initiative, IBM is incorporating self-managing autonomic concepts into all of its products. As described in [5], IBM has hundreds of autonomic features available in numerous products in the marketplace. These products combine to form a set of self-managing autonomic technologies based on open standards.

ITSM is IBM's initiative for for defining and modeling the processes associated with IT management, incluing the incorporation of best practices based on ITIL. In ITSM, autonomic computing architecture and technologies are employed to provide management functions for the IT infrastructure, using standards-based management interfaces and data formats. Autonomic computing provides important IT operational management components of the IT management architecture detailed in the next chapter, including management tools, resource management, user interface components, tooling and knowledge for the CMDB. Autonomic computing is critical to ITSM, because the ultimate goal for ITSM is not just to define and execute best practice IT processes, but also reduce the complexity of IT management processes and enable tasks within those processes to be automated..

3



IT Management Architecture

Management standards such as ISO 20000-1:2005 and best practices such as ITIL provide a framework for IT management, but to realize an implementation, an IT management system architecture is required. As described in the previous chapter, ITSM offers the foundation for defining and modeling processes using ITIL best practices, and the autonomic computing industry initiative provides self-management capabilities to enable these IT processes to become self-managing.

The touchstone architecture for IT management combines IT process management with the platform for IT service management (as described in Chapter 1) with the backdrop of ITIL best practices and self-managing autonomic technologies for operational management (as described in chapters 1 and 2).

Figure 2 illustrates the IT Management system architecture that incorporates all of these concepts and components.

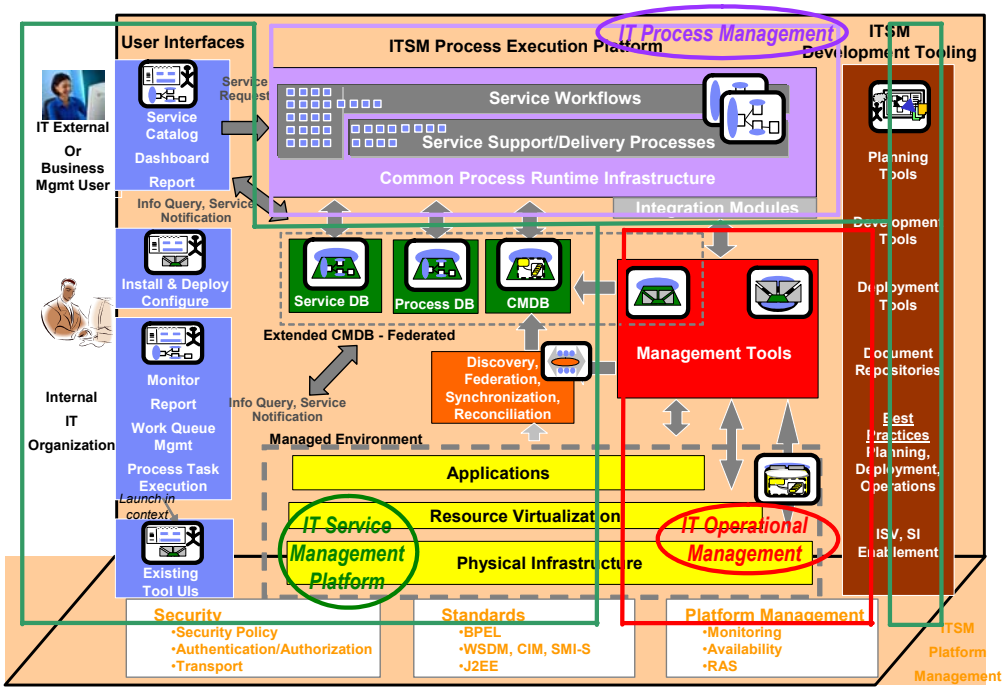


Figure 2 IT Management system architecture

This IT management architecture instantiates ITSM as shown in Figure 2 by the purple, green and red outlines for IT process management, IT services management platform and IT operational management, respectively.

For the IT process management partition, ITIL provides the basis for the CMDB and the process models embodied in the process runtime environment and services. Process managers in the purple layer use the service management platform and operational management components to carry out the processes and services that comprise the business of IT.

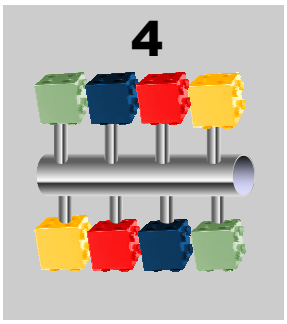
Autonomic computing defines the key operational management standards for a self-managing system, including management tools and managed resources in the IT infrastructure, as well as technologies for integrated user interfaces found in the service management platform.

As indicated by the orange backdrop in Figure 2, security and monitoring are pervasive throughout the ITSM architecture and are applied in IT process management, the IT service management platform and IT operational management.

Development tooling is used to produce and deploy the other components and help to build the standard interfaces and data formats that enable them to interoperate.

All of these components are integrated using standard interfaces and data formats. This standardization enables these heterogeneous components to interoperate

As we will show in Chapter 5, open standards – publicly available and implementable standards – are critical in the IT management system architecture.



Role and Types of Standards

Not every standard that is relevant for IT management is necessarily produced and ratified by an accredited standards body. Standards can take many forms, as described in the following sections. This chapter discusses the role of standards in an IT management system and several important types of standards used in such solutions.

The Role of Standards

In [6], the United States government's National Institute of Standards and Technology (NIST) notes:

> *Standards are essential elements of information technology – hardware, software, and networks. Standard interfaces, for example, permit disparate devices and applications to communicate and work together. Standards also underpin computer security and information privacy, and they are critical to realizing many widespread benefits that advances in electronic and mobile commerce are anticipated to deliver.*

Without standards, enterprises are dotted with islands of interoperability, causing complexity and stagnation of value. Just like the IT infrastructure itself, standards also are essential elements of the IT management system, allowing all of the building blocks and components that make up ITSM to interoperate.

Types of Standards

Although “standards” often are equated with the output of formal, accredited standards bodies, in fact several approaches to and forms of standardization exist. Any of these standards approaches might be used in

a particular situation, and no one form of standardization is necessarily "better" than another. Moreover, a particular topic might be addressed with multiple forms of standardization, and a particular standard might take different forms over time. For example, a set of best practices might be normatively defined as a de jure standard, or a de jure or de facto standard might spawn a set of best practices or an open source reference implementation.

The types of standardization described next are not an exhaustive list of standardization approaches, but are relevant for ITSM-based solutions. Notable types of standardization are discussed next; the examples provided are illustrative of these types of standards. Not all of the examples come from the ITSM or even the IT domain, but they serve to exemplify various sorts of standards and how they can be applied.

De Jure Standards

De jure (literally "by right") standards produced by bodies that have assumed authority to issue standards. This authority might come from government, international agreements, industry agreements, accreditation or other sources, but it is widely acknowledged that the organization has the authority to issue standards within its domain.

Participation in de jure standards bodies might be limited (by invitation or by membership) or it might be open to anyone who wishes to participate. De jure standards bodies typically are formed when there is wide, usually international, agreement that standards are required to maintain or advance the state of the art in areas that affect important aspects of the lives of many people. Such standards organizations often are the outgrowth of professional organizations that realize a need for formalized standards for their profession and agree to delegate the authority for generating those standards to a separate organization. De jure standards bodies are likely to be recognized by governments, professional organizations and companies as having the authority to specify standards that they use. Governments and professional organizations may organize and accredit their own standards bodies.

Examples

The **International Organization for Standardization** (ISO; see http://www.iso.org), the **Internet Engineering Task Force** (IETF; see http://www.ietf.org) and the **Institute of Electrical and Electronics Engineers** (IEEE®; see http://standards.ieee.org/) are some well-known examples of de jure standards bodies. As noted earlier, ISO offers a de jure

standard (ISO 20000-1:2005 [2]) that formalizes the ITIL de facto (described next) best practices.

Other well-known standards bodies in the IT industry include:

- The **Worldwide Web Consortium**® (W3C®), responsible for developing interoperable standards and technologies for the worldwide Web. See http://www.w3c.org for more information about W3C.
- The **Organization for the Advancement of Structured Information Standards** (OASIS) is a non-profit consortium that develops e-business standards. See http://www.oasis-open.org/home/index.php for more information about OASIS.
- The **Distributed Management Task Force** (DMTF) develops standards for distributed desktop and networked environments. See http://www.dmtf.org for more information about DMTF.
- The Telemanagement Forum (TMF) develops standards for the telephony networks industry. See http://www.tmf.org for more information about TMF.

The distinction between de jure and de facto (described next) standards bodies can be subjective; the preceding examples are generally recognized as the standards authorities for their respective domains and their products carry the weight of de jure standards.

De Facto Standards

De facto (literally, “by fact”) standards are those that have become widely used even if they are not de jure standards. Many de facto standards have wide industry acceptance and represent significant investment by companies; hence, they might be considered by some to be de jure standards.

De facto standards often begin with a small group of individuals, companies or organizations, all of whom are interested in solving a common problem. They may organize themselves and work collectively to develop a solution to the problem that garners additional interest within their industry. Participation in industry standards bodies often is by invitation, at least in the initial stages of the organization, and usually requires membership of some sort. De facto standards are recognized within an industry, but may have varying degrees of recognition of their authority to issue standards (for example, another similar organization might issue a competing standard).

Consortia and Special Interest Groups

Consortia and special interest groups have become commonplace within the IT industry. Often, a consortium is formed to develop a de facto standard while trying to overcome some of the disadvantages associated with a de jure standards body (particularly the slow and cumbersome processes typically associated with de jure standards bodies).

Usually, consortium members are peers with equal rights and responsibilities within the organization, although this is not always the case. A primary motivation for forming a consortium is the realization that a common solution to a problem that has been agreed upon by several companies is superior to a proprietary solution from a single company.

Examples

The **Bluetooth™ Special Interest Group** (SIG; see http://www.bluetooth.com), the **OSGi Alliance** (see http://www.osgi.org), the **Universal Plug and Play (UPnP™) Forum** (see http://www.upnp.org), the **USB Implementers Forum** (USB-IF; see http://www.usb.org) and **The Open Group™** (see http://www.opengroup.org) are examples of special interest group standards bodies.

Many consortia and special interest groups exist within the IT industry. Numerous consortia have formed but later disbanded, although many have been successful and are vibrant today. The examples just cited illustrate several of the many variations of and reasons for forming special interest groups and consortia.

Other Types of Standards

Accepted Best Practices

Sometimes accepted best practices can become de facto standards. Typically, these evolve from a set of people, perhaps including one or more experts, who all are interested in the same problems, issues or technologies and who share information about how they address the problem and issues or use the technologies. When the merits of these practices are acknowledged, they are emulated and over time they may become the standard.

Examples

The **United States Golf Association** (USGA™) performs research that results in best practices for golf course maintenance and turf grass management. These are shared with USGA members, and golf course

professionals treat them as standards. See http://www.usga.org for more information about the USGA.

Various organizations whose members practice **civil engineering and land use planning** frequently share best practices; many of these have evolved to de facto and de jure standards and even to laws. For one example, see http://www.asce.org/community/.

In the IT industry, two organizations mentioned earlier, the **Bluetooth SIG** and the **IEEE Standards Association**, have collaborated to produce best practices to allow the Bluetooth and IEEE 802.11 technologies to coexist in harmony (see the published Recommended Practices at http://standards.ieee.org). Implementers of products for both technologies treat these best practices as standards. Sun™, IBM and others publish internal or external best practices for **Java™ technology**; many other technologies have similar associated best practices that are disseminated to practitioners.

Open Source Standards

One way to achieve de facto standards is to release the implementation of the component(s) to be standardized as open source software. The open source implementation serves as the reference implementation and in that respect, it becomes a de facto standard. By allowing access to the source code, the party that released the code enables a community of developers to use, extend and enhance the standard implementation; as this process iterates, new and improved versions of the standard are generated.

Open source software might be motivated by other reasons besides standardization. However, open source software is growing in popularity, and it can be considered as one vehicle for standardization.

Examples

Linux® (see http://www.linux.org) and the **Apache Software Foundation** (see http://www.apache.org) are well-known open source initiatives that focus on collaborative software development that often results in software versions that are viewed as “standard” implementations.

Testing, Certification and Interoperability Standards

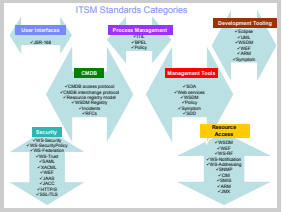
Organizations that produce standard tests and interoperability guidelines often are the outgrowth of other standards efforts. These organizations validate the conformance of implementations to existing standards; often, they include a certification program that allows implementations that pass the testing to make certain claims or display certain logos that indicate to their customers that they are certified by the testing organization.

Examples

The **Wi-Fi Alliance®** (see http://www.wi-fi.com/OpenSection/index.asp?TID=1), the Storage Networking Industry Association (SNIA; see http://www.snia.org/home) and the **Web Services Interoperability** organization (WS-I; see http://www.ws-i.org) are examples of organiztions pursuing standards interoperability.

The Open Group offers testing and certification services for various standards. The **UPnP Implementers Corporation** (UIC) certifies UPnP implementations. Standards organizations that develop their own testing, certification and interoperability standards include the **Bluetooth SIG** and **OSGi**.

5



IT Management Standards Landscape

The business of IT Management using ITSM and the IT management architecture relies on open standards, as described Chapter 3. Numerous standards are required to realize the IT management architecture and these standards take all the forms described in the preceding chapter (*de jure* standards, *de facto* standards and other types of standards). This chapter describes key standards for IT management, including existing standards, those being developed in standards bodies, best practice and open source standards, and some others that still need to be developed. In addition, the relationships among all these various standards are discussed, laying the foundation for the open standards-based IT management system discussed in the next chapter.

Key Standards

A robust IT management system employs and relies on numerous standards. This section presents many of the relevant and important standards associated with IT management.

These standards might already exist and be well understood, so that they can immediately be incorporated into ITSM solutions. Other standards for IT management are currently being developed in standards bodies. Still others are recognized as required but may not yet have an industry standards effort associated with them.

This section presents existing, developing and future IT management standards in no particular order; the next section then relates all of these standards to each other. This is not an exhaustive list of important IT management standards, but rather an enumeration of many that are

relevant and that IBM promotes as important to the successful implementation of ITSM.

Existing Standards

- **IT Infrastructue Library (ITIL)**: a set of best practices for the management of IT services, from the UK Office of Government Commerce. http://www.ogc.gov.uk/index.asp?id=2261 See also [1]
- **ISO/IEC 20000-1:2005**: the de jure international standard based on ITIL (just described), from ISO. http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=41332&scopelist=PROGRAMME See also [2]
- **Web Services Distributed Management (WSDM)**: operational management standards for Web services environments (management of Web services and management using Web services), from the Organization for the Advancement of Structured Information Standards (OASIS). http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsdm See also [7] and [8].
- **WSDM Event Format (WEF)**: operational management standard for a common representation of events (used for IT management events, business events, security events and others). IBM's initial implementation of WEF is called Common Base Event. WEF is incorporated within WSDM from OASIS; see "WSDM" described earlier.
- **Web Services Resource Framework (WS-RF)**: standard for a framework for modeling and accessing stateful resources using Web services, from OASIS. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsrf
- **Web Services Notification (WS-Notification)**: standard method for Web services to interact using events, from OASIS. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsn

A note about Web services management standards

As described in this paper, one noteworthy standard for IT management is WSDM. Another competing Web service management standard is WS-Management. As described in [12] and [13], an effort is underway to harmonize these two Web services management standards. This paper focuses on WSDM for Web services management, with the assurance from [12] that "Customers and vendors should continue investing in solutions and products based on the implementations of the current specifications related to this work. The vendors are assuring that this harmonization of the competing specifications will be a smooth evolution from today's environment and provide a simplified technology base for the future".

The full roadmap for this planned convergence is available from [12] and [13].

- **Web Services Addressing (WS-Addressing)**: specification for identifying Web services endpoints in a transport-neutral manner, from W3C. http://www.w3.org/Submission/ws-addressing/
- **Common Information Model (CIM)**: operational management standard for modeling resource information from the Distributed Management Task Force (DMTF). http://www.dmtf.org/standards/cim/
- **Simple Network Management Protocol (SNMP)**: operational management standard for network devcies, from the Internet Engineering Task Force (IETF). http://www.ietf.org/html.charters/OLD/snmp-charter.html
- **Storage Management Initiative (SMI-S)**: operational management standard for storage devices, from the Storage Networking Industry Association (SNIA). http://www.snia.org/smi/tech_activities/smi_spec_pr/spec/
- **Aperi**: an open-source community for storage management that builds upon the SMI-S standard, established by leading storage vendors. Information available at http://www-03.ibm.com/press/us/en/pressrelease/7944.wss
- **Application Response Measurement (ARM)**: standard for instrumenting transactions (any unit of work) in applications and middleware, from The Open Group. http://www.opengroup.org/tech/management/arm/
- **Java Management Extenions (JMX):** extensions to the Java language for managing and monitoring components, from Sun Microsystems, http://java.sun.com/products/JavaManagement/
- **Unified Modeling Language™ (UML™)**: modeling language that can be used to model the behavior and structure of business processes and data, from the Object Management Group (OMG). http://www.uml.org/
- **Business Process Execution Language (BPEL)**: language for describing business processes as Web services, from OASIS. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel See also [9]
- **Eclipse**: an open-source community for building development tools, from eclipse.org. http://www.eclipse.org/
- **Java Specification Request (JSR)-168**: standard for portlets for portal UIs in Java environments, from Sun's Java Community Process. http://www.jcp.org/en/jsr/detail?id=168
- **WS-Policy**: a specification of a model and syntax for describing and communicating the policies of a Web service, from BEA Systems Inc., International Business Machines Corporation, Microsoft® Corporation, Inc., SAP® AG, Sonic Software, and VeriSign® Inc., submitted to W3C, information and specification available at

http://download.boulder.ibm.com/ibmdl/pub/software/dw/specs/ws-polfram/ws-policy-2006-03-01.pdf

- **WS-Security**: a standard for message integrity, confidentiality, authentication and security token association for Simple Object Access Protocol (SOAP) messages, from OASIS, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss
- **WS-SecurityPolicy**: specification for policy assertions used with WS-Security (just described), from OASIS, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=ws-sx
- **WS-Trust:** specification that builds on WS-Security (described earlier) to define how to issue, exchange and validate security tokens and credentials in different trust domains, from OASIS, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=ws-sx
- **WS-Federation:** specification that enables security information, including identity, account, authentication and authorization, to be federated across different trust realms, from BEA Systems, Inc., International Business Machines Corporation, Microsoft Corporation, RSA Security Inc., and VeriSign Inc., http://specs.xmlsoap.org/ws/2003/07/secext/WS-Federation.pdf
- **Security Assertion Markup Language (SAML):** standard for creating and exchanging security information among online partners, from OASIS, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=security#overview
- **eXtensible Access Control Markup Language (XACML):** standard for representing authorization and entitlement policies, from OASIS, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml
- **Java Authentication and Authorization Service (JAAS):** standard Java-2 APIs for access control, incorporated into the Java-2 SDK (see http://java.sun.com/products/jaas/; see also http://www-128.ibm.com/developerworks/java/jdk/security/142/).
- **Java Authorization Contract for Containers (JACC):** standard authorization model for granting permissions in a J2EE environment, as defined in JSR-115, http://www.jcp.org/en/jsr/detail?id=115
- **HTTPS/SSL/TLS:** protocols to provide authenticated and encrypted communication among components (see, for example, http://www.ietf.org/rfc/rfc2818.txt).

Developing Standards

- **Solution Deployment Descriptor (SDD)**: standard for representing installable software packages and their configuration, dependency and lifecyle information, from OASIS. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=sdd See also [10].

- **Policies**: Common Information Model – Simplified Policy Language (CIM-SPL) is a CIM-compliant language for expression of IT management policies, from DMTF, http://www.dmtf.org .
- **Resource models**: Today there are multiple ways to model resources – CIM (described earlier), SMI-S (described earlier), SNMP (described earlier), OSGi (describe earlier) and others all incorporate resource models for various environments. All of these need to be recognized; some can be bridge to other standards (see WS-CIM, described next). A common resource model for ITSM is desirable.
- **WS-CIM**: specification for translating the MOF representation of the CIM mode into XML Schema (used by WSDM-CIM Mapping and WS-Management), from DMTF, http://www.dmtf.org. See also [11].
- **WSDM-CIM Mapping**: specification for using WSDM (described earlier) to manage resources that expose a CIM (described earlier) model, from DMTF, http://www.dmtf.org. See also [11].

Required New Standards

- **Services**: To deliver the ultimate IT services to the business that they serve, standards are required in the areas of service definition format and content; services taxonomy and service catalog structure. The ITIL refresh project described in Chapter 1 is likely to play a role in establishing service standards.
- **Symptoms**: standard for representing conditions that can be recognized as a result or correlating events and other operational management data. See [2]
- **CMDB**: To enable the creation and use of a common CMDB, standards are needed for CMBD interchange and access protocols as described next. Such standardization efforts have begun; see [18].
    - **CMDB Interchange**: Common data types and identification semantics necessary to interchange information from multiple CMDBs in a heterogeneous environment.
    - **CMDB Access Protocol**: Operations and notifications for the CMDB, along with along with administration considerations and composibility with security specifications.

Standards Relationships and Use

The preceding sections discussed many different standards, of various types and from multiple standards bodies. Each standard addresses one or more aspects of IT management, but it is the integration and appropriate positioning of all of these standards that result in the ability to compose an IT management solution.

Figure 3 illustrates the key standards for IT Management and their relationships to each other and to the major building blocks of an IT Management system.

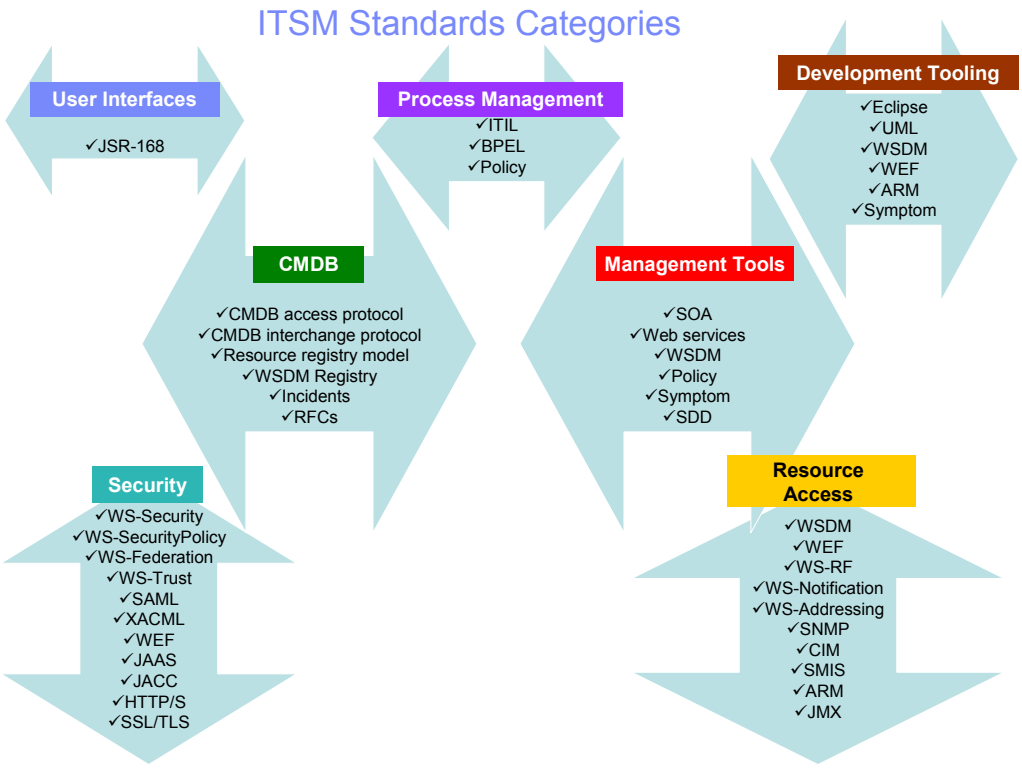


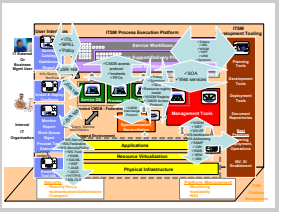
Figure 3 Standards relationships and their use in the IT Management system architecture

As illustrated in Figure 3, certain standards are important for each of the main partitions of the IT Management architecture, including:

- JSR-168 is important for user interfaces for process, CMDB, management tool and resource control and interaction. User interfaces that use this standard can be incorporated into portals from different vendors.
- Eclipse is an open-source platform standard for tooling that can be used to develop components and interfaces. Standards-based tooling can assist with implementing other standards and accelerating the availability of interoperable deployed components.
- As described earlier, ITIL or ISO 20000-1:2005 is a key standard for ITSM that defines processes. Those processes can be modeled with UML and instantiated with activities specified as workflows using BPEL. Policies govern process operation.

- The CMDB requires standard methods for accessing and interchanging the configuration management information among other ITSM components. Certain types of management data, such as Requests for Change (RFCs), symptoms, policies and others, should have standard formats and schema associated with them so that they can be used in an interoperable manner by multiple management tools in heterogeneous environments. See [18] for information about CMDB standardization.
- WSDM is a key standard for manageability interfaces, including resource management interfaces and the management interfaces for the management tools themselves, which in turn can be managed by other management tools, process flows and humans via user interfaces.
- Several standards are popular for representing and accessing resource details. These include (but are not limited to) CIM, SNMP, and SMIS. Such standards may be transformed into other forms (such as is done with WS-CIM, for example); even more advantageous is transformation to a common CMDB representation, using CMDB access and interchange protocols. Another technique for addressing multiple standards for resource representation and access is virtualization; see, for example, [17].
- Another standard related to resources, ARM, measures transactions end-to-end. It is useful for measuring transaction response times and the percentage of successful transactions. Using its end-to-end tracing capabilities, one can discover how business workload is flowing through the IT infrastructure, aiding in problem diagnosis.
- Numerous security standards are employed in the IT management architecture, from transport-level authenticated and encrypted communications with HTTPS, SSL and TLS, to cooperating standards for Web service security, including WS-Security, WS-SecurityPolicy and WS-Trust, to XACML for access control policy federation, to JAAS for authentication and JACC for authorization, to WEF for describing security events.

6



Standards-Based IT Management

Now we can apply the key standards identified in the preceding chapter to the IT Management architecture presented in Chapter 3 to describe a service-oriented, open standards-based IT Management solution. The architecture by itself provides the foundation for IT management solutions, but without open standards, the architecture is not composable with heterogeneous building blocks. The standards by themselves promote interoperability, but without a unifying context, the standards cannot be composed together into a unified IT management system. This chapter describes how the open standards can be overlaid on the IT management architecture to produce the open standards-based IT management solutions that customers demand.

Leveraging Standards in the Architecture

In the absence of open standards, management technologies from various providers cannot interoperate. Consider the IT infrastructure and managed resources building block in the IT management architecture. In any enterprise, these resources will undoubtedly be heterogeneous – servers, networks, storage devices, application programs, middleware and other components of the IT infrastructure surely will be provided by various suppliers. When every resource must be managed uniquely, the management tools add to system complexity rather than helping to address complexity. Open standards such as WSDM provide standard interfaces and data representations for managing these diverse resources.

Similarly, the CMDB is a central component of an IT management solution. Without agreement on standards for CMDB access and interchange protocols, the information in the CMDB will become a virtual "Tower of Babel" and the management tools and process runtime components that interact with the CMDB will grow overly complex. Standards are required to support the interchange of information among heterogeneous CMDBs from multiple vendors.

Open standards for interfaces and data formats enable the IT management architecture to be realized in the most suitable way for each customer. So long as components comply with standards, customers can put together components and building blocks from multiple suppliers and can leverage open-source software and tooling if they so choose. Successful IT management solutions, just like the Internet, electromechanical systems and many other solutions, are built on open standards.

Figure 4 illustrates an open-standards based IT Management solution that employs the key standards introduced earlier within the IT Management architecture introduced earlier. This figure shows IT management components in a multi-vendor, heterogeneous environment and the use of standards (interfaces and data formats) in such a system.

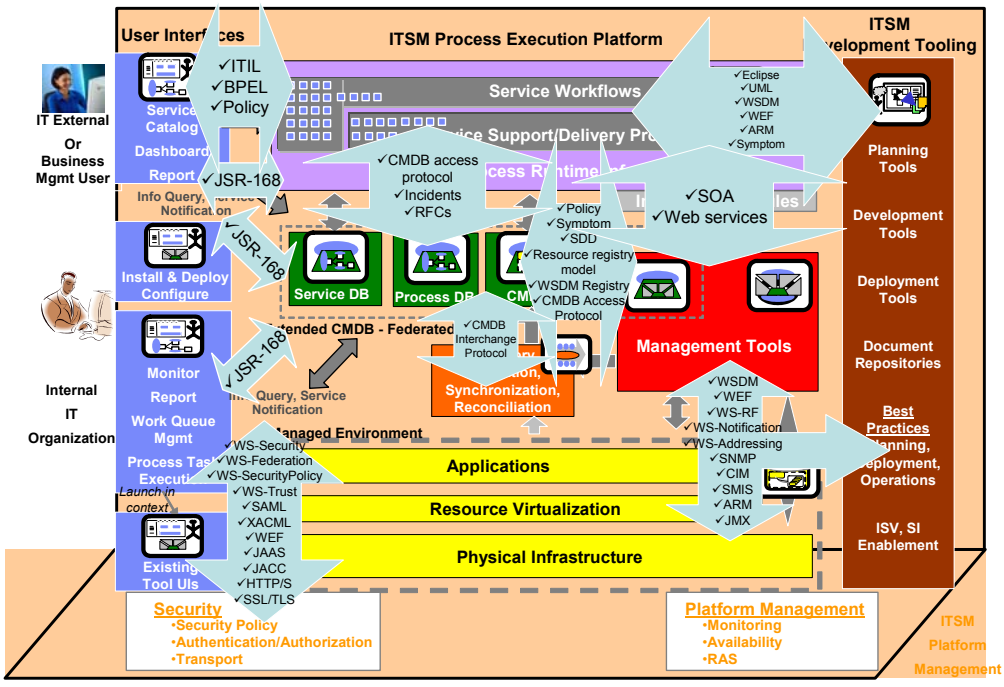
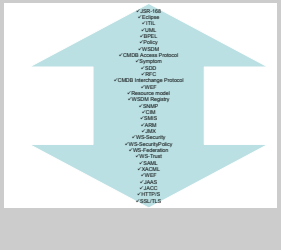


Figure 4 An open standards-based IT Management solution

The standards introduced in the previous chapter can be overlaid on the IT Management reference architecture to enable that architecture to be integrated through the standards. As Figure 3 illustrates, the user interface, tooling, security, process, CMDB, mangement tool and resource components of the management architecture interact using the standards associated with those components.

7



IT Management Standards Summary

One way to evaluate IT Management solutions is to determine the extent to which they employ open standards. The architecture and standards outlined in the previous chapters illustrate the benefits of an open standards-based IT management solution. To realize those benefits, the solution components need to implement the standards. This chapter describes the business value that results from standards for IT components and offers a "checklist" for standards support that can be used to evaluate IT management solution components.

Business Value of Standards

The fundamental nature of IT systems precludes any one company from delivering a total IT management solution. Enterprises have heterogeneous IT infrastructures and must deal with heterogeneous environments outside of the enterprise. A single proprietary implementation is a thing of the past. Today's IT systems require pervasive deployment of IT management components from a diverse range of suppliers throughout the IT infrastructure, and these components need to interoperate. These components include management tools, resources, CMDB, process runtime, user interfaces, tooling and others; therefore, they must be based on open industry standards.

Standards and Web services deployment enable SOA-based management, increasing the flexibility of management systems and the reuse of management procedures. Consistent management interfaces enable simpler, interoperable integration of components to accomplish business processes, including the business of IT as embodied by ITSM.

Standards also can help to reduce the costs for developing and deploying systems and the management applications for these systems. Standards protect customers' investments, obviating any requirement to be bound to a proprietary IT management solution and allowing them to choose the most suitable IT management products and components from a broad array of suppliers.

What to Look For

To realize this business value associated with open standards, customers will seek solutions, products and components for IT management that employ those standards. Table 1 recaps the important IT management standards, describes how those standards are used in the IT management architecture and lists examples of IBM products, services and offerings that can play a part in IT management solutions. The products listed in the table are illustrative of the functions enabled by the associated standard; the table does not imply that each product fully supports all of the corresponding standards, but rather that these products can play a role in realizing the standards-based architecture described in the previous chapter.

IT Management Standard	Associated IT Management Architecture Building Block(s)	Relevant IBM Products and Technologies
IT Process Management		
ITIL / ISO 20000-1:2005	Process runtime and services	IBM Tivoli® ITSM Process managers for Availability Management, Release Management, Information Lifecycle Management (Note 1)
BPEL	Process workflows	• Workflow engine (Note 2) • Automated process workflows (Note 2)

Policy	Process runtime and services	
IT Service Management Platform		
CMDB access and intercchange protocols, resource models, registry, process artifacts	CMDB	IBM Tivoli ITSM CMDB (Note 2)
Eclipse (including Eclipse Test and Performance Tools Platform, TPTP)	Development Tooling	• Autonomic Integrated Development Environment (AIDE) • IBM Rational® Application Developer • IBM Rational Systems Developer • IBM Rational Web Developer • IBM Rational Software Architect • IBM Rational Software Modeler • IBM Rational Functional Tester • IBM Rational Manual Tester • IBM Rational Performance Tester • IBM Rational Method Composer
UML	Process runtime and services, process modeling	• IBM Rational Software Architect • IBM Rational Software Modeler

IT Operational Management		
✓ WSDM ✓ WEF ✓ WS-RF ✓ WS-Notification ✓ WS-Addressing ✓ JMX ✓ ARM	Business application management	• IBM Tivoli Composite Application Manager • IBM Tivoli Business Systems Manager • IBM Tivoli Intelligent Orchestrator • IBM Tivoli Service Level Advisor • IBM Tivoli License Manager • IBM Tivoli License Compliance Manager for z/OS • IBM Tivoli Contract Compliance Manager • Micromuse® (an IBM company) NetCool® products and solutions • IBM Virtualization Engine Enterprise Workload Manager
✓ WSDM ✓ WEF ✓ WS-RF ✓ WS-Notification	Server, network and device management	▪ IBM Tivoli Enterprise Console • IBM Tivoli Monitoring • IBM Tivoli OMEGAMON • IBM Tivoli NetView

✓ WS-Addressing ✓ CIM ✓ SNMP ✓ SMIS ✓ JMX		• IBM Tivoli Remote Control • IBM Tivoli Systems Automation • IBM Tivoli Workload Scheduler • IBM Tivoli Provisioning Manager • IBM Tivoli Configuration Manager • IBM Tivoli Decision Support for z/OS • IBM Director • IBM Virtualization Engine Resource Dependency Services
✓ WSDM ✓ WEF ✓ WS-RF ✓ WS-Notification ✓ WS-Addressing ✓ CIM ✓ SNMP ✓ SMIS ✓ JMX	Storage management	• IBM Tivoli Storage Manager • IBM Tivoli Continuous Data Protection for Files • IBM TotalStorage Productivity Center • IBM Director

✓ WS-Security ✓ WS-SecurityPolicy ✓ WS-Trust ✓ XACML ✓ JAAS ✓ JACC ✓ WEF ✓ HTTPS/SSL/TLS	Security management	• IBM Tivoli Access Manager • IBM Tivoli Identity Manager • IBM Tivoli Federated Identity Manager • IBM Tivoli Directory Server • IBM Tivoli Directory Integrator • IBM Security Compliance Manager • IBM DataPower SX40 • Micromuse® (an IBM company) NetCool® products and solutions • IBM WebSphere®
JSR-168	Integrated user interfaces	• Integrated Solutions Console • WebSphere Portal

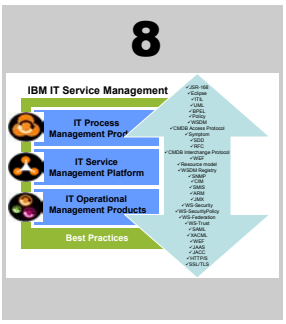
IT Management Best Practices Support

ITIL /
 	
ISO 20000-1:2005
	Process runtime and services, process modeling	• IBM Tivoli Unified Process (ITUP)
		• Open Process Automation Library (OPAL)
		• IBM Global Services
		  • Innovation Workshops
		  • Infrastructure Services Readiness Engagement
		  • IT Service Management Design
		  • Implementation Services

Table 1 IT Management Standards Checklist

Notes:

1. Phase 1 process managers planned availability in June 2006. Additional process managers targeted for 3Q 2006.
2. Planned availability June 2006.



Conclusion

This paper has described the critical importance of open standards for ITSM. Beginning with underlying elements such as ITIL and autonomic computing, we described an archtiecture for the realization of ITSM, many of the key standards – existing, emerging and yet to be developed – that are relevant to ITSM and how those standards are employed in the ITSM architecture.

We also presented a summary of the important standards to look for when investing in ITSM and discussed the associated business value that can be derived from adopting standards-based ITSM solutions.

We conclude with a summary of the key directions and values that this paper establishes..

- The **"four C"** environment of change, complexity, compliance and cost business pressures drives requirements for a service-oriented approach to the business of IT. ITSM offers a solution for such an environment.
- **ITSM** can provide an optimal intersection of people, processes, information and technology based on:
    - IT **process management** products that employ automated workflows aligned with ITIL and ISO 20000-1:2005.
    - An IT **service management platform** that incorporates open, standard-based components such as a CMDB and workflow engines

  - IT **operational management** products that enable the business of IT to be managed in a standardized, automated, infrastructure-aligned way
  - **Best practices** that offer a standard way for people to interact with technology in an ITSM environment

- **ITIL**, a set of best practices for IT service management (and its corresponding standard, **ISO/IEC 20000-1:2005**) provides the foundation for processes and services for IT management. **Autonomic computing** offers self-managing capabilities to ITSM solutions.
- The **IT management architecture** embodies IT process management, the IT service management platform and IT operational management with the backdrop of ITIL best practices. This architecture specifies ITSM building blocks including:
  - CMDB
  - Resource access
  - Management tools
  - User interfaces
  - Development tooling
  - Security
  - Process management and services
- **IT management standards** enable the various components of the IT management architecture to interoperate in heterogeneous environments. ITSM-related standards consist of both de jure and de facto standards and include existing, emerging and yet to be developed standards.
- Employing the key IT management standards within the IT management architecture enables an **open standards-based IT management architecture** that increases flexibility and resilience and enables service-oriented IT management.

Businesses that adopt open standards-based ITSM could realize the benefits of the optimal intersection of people, processes, information and technology and could achieve these business values:

Effectively and efficiently deliver IT services – Aligned with business priorities

Quantifiable process performance – End-to-end process measurements and quantification

Extract Greater value of existing investments – Tighter Integration across technology, information and people

Increase IT organizational productivity – Alignment of IT silos through data and workflow integration

IBM has demonstrated **ITSM leadership** through participation in defining IT management standards, including ITIL, Web Services, SOA and many of the particular standards cited earlier in the document.

IBM offers **ITSM innovation** through a unique approach to defining a framework and solutions for ITSM, including extending self-managing autonomic computing to IT services. IBM is implementing ITIL and our own best practices for IT services in our architectures, products, offerings, services and and tools to assist customers in making the vision a reality.

IBM is in the forefront of **ITSM execution**, delivering leading-edge technology and products based on IBM's leading cross-brand capabilities, including the IT service management platform CMDB and IT process management solutions. We also are delivering a vibrant ecosystem of partners to share this technology with our customers.

Through ITSM leadership, innovation and execution, IBM offers a broad array of open standards-based products for IT management. IBM's approach to IT service management offers businesses a better way to manage IT.

Cited References

For more information

[1] IBM Corporation, *ITIL – The Key to Managing IT Services*, http://www-306.ibm.com/software/tivoli/resource-center/security/wp-itil.jsp

[2] International Organization for Standardization (ISO), *ISO/IEC 20000-1:2005*, http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=41332&scopelist=PROGRAMME

[3] Office of Government Commerce, ITIL IT Service Management, *ITIL® Refresh Statement*, http://www.itil.co.uk/refresh.htm

[4] IBM Corporation, *An Architectural Blueprint for Autonomic Computing*, http://www-03.ibm.com/autonomic/pdfs/AC%20Blueprint%20White%20Paper%20V7.pdf

[5] IBM Corporation, *IBM Autonomic Computing: Creating Self-Managing Computing Systems*, http://www-03.ibm.com/autonomic/

[6] National Institute of Standards and Technology, "Information Technology Standards", http://www.nist.gov/public_affairs/standards.htm#Information

[7] IBM Corporation, Hewlett-Packard Company, Computer Associates, *Management Using Web Services: A Proposed Architecture and Roadmap*, ftp://www6.software.ibm.com/software/developer/library/ws-mroadmap.pdf

[8] IBM Corporation, WSDM Information, http://www.ibm.com/autonomic/wsdm

[9] IBM Corporation, BEA Systems, Microsoft Corporation, SAP AG, Siebel Systems, *Business Process Execution Language for Web Services version 1.1*, http://www-128.ibm.com/developerworks/library/specification/ws-bpel/

[10] SDD Technical Committee, http://xml.coverpages.org/SDD-Announce2005.html

[11] Baldwin, Duane, IBM developerWorks, *Grid Storage and Open Standards*, http://www-128.ibm.com/developerworks/grid/library/gr-storstan/index.html

[12] Hewlett-Packard Corporation, IBM Corporation, Intel Corporaion, Microsoft Corporation, *Evolving Web services standards for managing system resources: a roadmap to harmonize current management web services specifications*, http://www-128.ibm.com/developerworks/webservices/library/specification/ws-roadmap/

[13] IBM Corporation, *Converging WSDM and WS-Management*, http://www-03.ibm.com/autonomic/wsdm/convergence/

[14] Shivnath Babu, Duke University, Self-Managing Systems, http://www.cs.duke.edu/courses/spring06/cps296.2/index.html

[15] Fabián E. Bustamante, Northwestern University, Autonomic Computing Systems, http://www.cs.northwestern.edu/~fabianb/classes/cs-495-w06.html

[16] Cardiff University, MSc Strategic Information Systems, http://www.cs.cf.ac.uk/courses/mscsis/courseinfo.php

[17] IBM Corporation, IBM Virtualization Engine, http://www-03.ibm.com/servers/eserver/about/virtualization/

[18] Press release, *Technology Leaders to Create Specification for Federating and Accessing IT Information*, http://biz.yahoo.com/iw/060411/0122436.html

Other Related Reading

For more information

- IBM Corporation, *SOA Management*, http://www-306.ibm.com/software/tivoli/features/soa/soa-mgmt.html
- IBM Corporation, *IT Service Management: A Better Way to Management the Business of IT*, http://www-306.ibm.com/software/sw-events/webcast/Y591664L15282D13.html
- Organization for the Advancement of Structured Information Standards (OASIS), http://www.oasis-open.org/home/index.php
- Organization for the Advancement of Structured Information Standards (OASIS), Web Service Distributed Management (WSDM) Technical Committee, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsdm
- Distributed Management Taskforce, *Common Information Model*, http://www.dmtf.org/standards/cim/
- Internet Engineering Task Force (IETF), *Simple Network Management Protocol,* http://www.ietf.org/html.charters/OLD/snmp-charter.html
- Storage Networking Industry Association (SNIA), *SNIA Storage Management Initiative Specification*, http://www.snia.org/smi/tech_activities/smi_spec_pr/spec/
- Global Grid Forum , http://www.gridforum.org/
- The Open Group, *Application Response Measurement* (ARM), http://www.opengroup.org/tech/management/arm/
- Sun Developer Network, *Java Management Extensions*, http://java.sun.com/products/JavaManagement/
- Object Management Group, *UML Resource Page*, http://www.uml.org/
- Organization for the Advancement of Structured Information Standards (OASIS), Web Services Business Process Execution Language (WSBPEL) Technical Committee, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel
- Eclipse organization, http://www.eclipse.org/
- Java Community Process, *JSR-168*, http://www.jcp.org/en/jsr/detail?id=168
- Organization for the Advancement of Structured Information Standards (OASIS), Web Services Security (WSS) Technical Committee. http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss
- IBM Corp., Microsoft Corp., RSA Security Inc. and Verisign, Inc., *Web Services Security Policy Language* (WS-SecurityPolicy), http://specs.xmlsoap.org/ws/2005/07/securitypolicy/ws-securitypolicy.pdf
- BEA Systems Inc., IBM Corp., Microsoft Corp., RSA Security Inc. and Verisign, Inc., *Web Services Security Policy Language* (WS-SecurityPolicy), http://specs.xmlsoap.org/ws/2005/07/securitypolicy/ws-securitypolicy.pdf
- IBM Corp. et al, , *Web Services Federation Language* (WS-Federation), hhttp://specs.xmlsoap.org/ws/2003/07/secext/WS-Federation.pdf

- IBM Corp. et al, , *Web Services Trust Language* (WS-Trust), http://specs.xmlsoap.org/ws/2005/02/trust/WS-Trust.pdf

- Organization for the Advancement of Structured Information Standards (OASIS), Extensible Access Control Markup Language (XACML) Technical Committee, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=xacml

- Organization for the Advancement of Structured Information Standards (OASIS), Security Services (SAML) Technical Committee, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=security#overview

- Sun Developer Network, *Java Authentication and Authorization Service* (JAAS), http://java.sun.com/products/jaas/

- IBM developerWorks, *Security Information*, http://www-128.ibm.com/developerworks/java/jdk/security/142/

- Java Community Process, *JSR-115*, http://www.jcp.org/en/jsr/detail?id=115

- Internet Engineering Task Force (IETF), *HTTP Over TLS,* http://www.ietf.org/rfc/rfc2818.txt

- Organization for the Advancement of Structured Information Standards (OASIS) Solution Deployment Descriptor (SDD) Technical Committee, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=sdd

IBM United States of America

Produced in the United States of America