The CMDB: The “Brain” Behind IT Business Value

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EXECUTIVE SUMMARY

The human brain is an amazing organ. It gathers and stores information. It processes information into knowledge. The brain then orchestrates action based on that knowledge. The configuration management database (CMDB) also gathers and stores information, processes information into knowledge, and orchestrates action based on that knowledge. Consequently the CMDB has become, in essence, the very brain of IT service management and contributes value on its own.

Today’s CMDB is enhanced with several advanced technologies: federation, auto discovery, dependency mapping, dynamic service modeling, dashboards, predictive analytics, and process orchestration. These technologies bring several important capabilities to the CMDB.

Federation enables the consolidation of data from across the enterprise into a single repository, without having to move all the data to or replicate it in a single database. Through federation, a CMDB can reach into other important data stores — human resource (HR) databases, ERP databases, user identity databases, and other CMDBs — to provide a rich source of information.

Auto discovery, dependency mapping, and service modeling enable the CMDB not only to discover all the assets in the IT infrastructure, but also to discover their physical and logical dependencies and the relationships of the resources to the services that they support. These capabilities also enable the CMDB to continuously update itself to ensure that its asset and dependency information remains accurate in the face of rapid and continuous change.

Dashboards and predictive analytics enable IT management to leverage the information in the CMDB to move proactively in addressing problems and to make better-informed decisions in several areas, including capacity planning and data center consolidation and virtualization. Process orchestration enables the CMDB to coordinate automation of end-to-end processes based on policies and other information contained in the CMDB.

With these enhanced capabilities, the CMDB offers a strong foundation for Business Service Management (BSM), a comprehensive and unified platform for running IT. BSM solutions can leverage the CMDB’s advanced capabilities to benefit both IT operations and IT support groups. The CMDB eliminates the need to maintain multiple data stores and grapple with multiple disparate tools. Now all IT groups can work with a single source of comprehensive, accurate, and consistent information, as well as a single set of BSM solutions and tools.

This paper examines the evolution of the CMDB, its increased capabilities, and how the CMDB works with other technologies to deliver value. It discusses the implications of these capabilities with respect to BSM and the resulting value to the IT organization and the business.
THE CMDB UNIFIES I.T. SERVICE MANAGEMENT

The CMDB was conceived to support IT service management processes and is an integral part of the IT Infrastructure Library® (ITIL®). It provided the IT staff the ability to gain a complete view of the IT environment enterprise wide. The CMDB is described in the ITIL books as a core component of the Configuration Management System (CMS), an ecosystem that feeds, manages, analyzes, and presents the information contained in the CMDB. (It’s interesting to note that a well-architected, federated CMDB implements much of the functionality of the CMS.)

The CMDB stores each component as a Configuration Item (CI) and includes a description of each CI, such as its configuration and location. It describes the relationships of the CIs to each other, such as their physical and logical dependencies. It also describes the relationships of the CIs to users.

Prior to the use of a CMDB, IT had to deal with a patchwork of multiple separate databases and tools with complex connections. (See Figure 1). This had led to fragmenting processes and information across multiple silos, tools, and databases, resulting in myopia and inconsistencies.

The CMDB, a critical part of helping IT organizations achieve BSM, provides a single source of truth about IT infrastructure for all IT processes to share. It also offers a central platform for the integration of processes, enabling IT to centralize key areas of work so they need to be done only once.

IT quickly recognized the value of the CMDB, especially the CI relationship information, and BSM solutions evolved to increasingly leverage the CMDB. For example, BSM incident and problem management solutions leverage the IT infrastructure topology mapping maintained by the CMDB to zero in on root causes of problems. In addition, the service mapping maintained by the CMDB permits
IT to quickly assess the business impact of issues and prioritize actions based on business implications. Today, the CMDB is a critical component of BSM solutions.

**FEDERATION — AN ESSENTIAL CAPABILITY**

The CMDB has to provide access to a vast amount of information on the people, processes, and technology in the IT environment. The more data to which IT has access, the more informed decisions IT can make.

Much of the needed information is stored in multiple data stores scattered across the enterprise. These include department data stores such as HR, purchasing, security, and facilities, and application data stores such as SAP and Oracle. It is neither practical nor desirable to move all this data to or replicate it in the CMDB. For one reason, database owners have to retain authority and control over many of the databases.

As Figure 3 on the next page illustrates, a CMDB built on a federated architecture provides access to a wide range of information without having to move all the data to or replicate it in the CMDB. The CMDB acts as a reference to the data that remains in authoritative data stores. Owners of these data stores retain authority and control. The federated CMDB translates all information into a common data model that permits easy sharing by data consumers, such as BSM solutions as well as other tools and solutions. Federation must be fundamental to the architecture of the CMDB and cannot be added as an afterthought.

A critical requirement for federation is a strong data reconciliation capability to ensure that data aggregated from multiple sources is accurate and consistent. Data reconciliation eliminates duplicates so that there is only one CI for each entity. Data reconciliation also ensures that data aggregated from multiple sources are attached to the correct CIs. For example, it ensures that role data retrieved from the HR system and access data retrieved from the Role Based Access Control (RBAC) system are attached to the correct users.

Some IT organizations have already implemented more than one CMDB to accommodate different service management solutions from different vendors. For example, some organizations have implemented one CMDB for IT service support solutions and another for IT operations solutions. However, separate CMDBs often result in data inconsistencies and impede smooth process workflow across groups.

With a federated CMDB, the IT organization can provide singular access to multiple CMDBs without having to physically consolidate the CMDBs. This consolidation allows all groups to share consistent information. It permits smooth process workflow across various IT groups. Federation also permits IT organizations to continue to utilize databases that they have already implemented, such as other CMDBs, while still having a single, central data repository.

The CMDB should provide out-of-box federation with popular databases such as those associated with ERP and HR systems. It should also leverage tools that facilitate integration of the CMDB with other databases.

**THE CMDB EVOLVES**

BSM solution providers, such as BMC, are continuing to enhance the capabilities of the CMDB through the integration of supporting technologies, including the following:

» Automatic discovery and dependency mapping
» Dynamic service modeling
» Inventory and configuration management
» Dashboards and predictive analytics
» Orchestration
These enhancements expand the role of the CMDB from a passive data repository to an active participant in BSM processes. With these enhancements, the CMDB becomes a source of substantial value on its own. It provides decision support to IT management in that it offers access to a wealth of data and gives managers tools to help them interpret and leverage the data. With the information provided by the CMDB, IT management can make better-informed decisions to minimize business risk.

With these enhancements, the CMDB becomes the very brain of BSM in that it gathers, stores, and updates data; synthesizes the data into meaningful information to support decision making; and orchestrates the actions of other BSM solutions based on that information.

**AUTOMATIC DISCOVERY AND DEPENDENCY MAPPING**

The enterprise IT environment is highly complex. It comprises a huge amount of IT assets and highly complex relationships of people, processes, and technology. What’s more, the IT environment is in a continual state of flux. IT infrastructure components and dependencies change. People come, go, and change roles. Processes change. Virtualization greatly accelerates the rate of change.

Consequently, populating and updating the CMDB manually is not practical. Yet it’s essential that the CMDB not only contain all the needed information but also ensure that it’s current. To meet this need, the CMDB must be supported by a robust automatic discovery capability that discovers all assets in the IT infrastructure, including the following:

- **Physical assets** — Discover all hardware assets, including clients, servers, mainframes, and network devices, and discover details about them such as configuration, heat dissipation, and power consumption
- **Virtual assets** — Discover all virtual assets and support all major virtualization platforms
- **Software assets** — Discover all software assets, including applications and databases

The CMDB must also discover all services and business processes supported by the IT infrastructure. In addition, automatic discovery must discover and map dependencies, including the following:

- Physical topologies
- Logical topologies
- Application dependencies, including custom applications
- Service dependencies, mapping services to business processes as well as to IT infrastructure assets and users

![Federated CMDB](image-url)
Dependency mapping allows IT to see and understand the IT environment, from the business process level all the way down to the supporting infrastructure. (See Figure 4.)

![Dependency Mapping Diagram](image)

The automatic discovery capability must also periodically scan the IT environment to detect any changes and update the CMDB accordingly. This is especially important in virtualized environments where changes occur frequently. A well-architected CMDB provides comprehensive, automatic discovery capabilities out-of-the-box.

**DYNAMIC SERVICE MODELING**

IT organizations are making the necessary transition from managing the IT infrastructure from a technology perspective to managing it from a service perspective. That’s a central theme in ITIL V3. Consequently, IT needs to understand the relationships of services to the IT environment and to the business environment. That requires an understanding of the mapping of services to the underlying IT infrastructure components that support them, the mapping of services to users, and the mapping of services to business processes.

This dependency mapping requires the capability to create models that describe these relationships. The modeling capability must simplify the modeling process, such as by integrating with the CMDB automatic discovery capability that discovers service mapping. Because the IT environment is constantly changing, the service model must be dynamic and automatically update models as relationships change.

**INVENTORY AND CONFIGURATION MANAGEMENT**

To minimize risk, IT must maintain control of the configuration of the IT infrastructure. This requires effective configuration management, such as by ensuring that only standard configurations are deployed and maintained.

The CMDB provides the foundation for configuration management. It maintains a library of standard configurations including a Definitive Media Library (DML) for software and a Definitive Hardware Library (DHL) for hardware. It also maintains the configuration management policies. BSM provisioning solutions can access the standard configurations and policies from the CMDB to ensure that only standard configurations are deployed and always according to policy.
Provisioning of standard configurations is only part of the story. It is also important to ensure that the IT infrastructure components do not drift from standard configurations. Here again, the CMDB plays an important role by providing the capability to detect and correct drift from standard configurations. Here's an example of how:

1. The automatic discovery solution detects a change.
2. It determines that the change has resulted in a nonstandard configuration.
3. The CMDB triggers the appropriate actions, such as to log the change for auditing purposes, obtain the appropriate approvals, and perform any required remedial actions.

It's important that the CMDB maintain change history data to enable it to track drift over time. This data permits IT to correlate problems with particular changes and to roll back configurations if necessary.

**DECISION SUPPORT — DASHBOARDS AND ANALYTICS**

The CMDB maintains a wealth of data that can be leveraged to support decision making. With a dashboard capability, the CMDB can present at-a-glance views of important metrics. For example, a dashboard can show the performance and availability of critical business services relative to SLAs. Through this view, an IT operations manager can quickly see issues in service delivery, such as when the performance of a critical service is threatening to drop below SLA levels. With this information, the manager can move proactively to address issues before they result in service disruption and before users report the problem. The dashboard can also show the business priority of the affected service, enabling the manager to take actions based on business priorities.

It is also important that the CMDB provide IT managers with predictive analytics capabilities that enable the managers to make meaningful inferences from the CMDB data to support decision making. Here are some examples:

- An operations manager uses the predictive analytics tool to determine, in advance, the impact of a proposed change to an IT infrastructure component on other components.
- A capacity planning manager uses the tool to analyze workload trends to predict future capacity requirements.
- An infrastructure engineering manager uses the tool to perform “what if” analyses on various combinations of physical and virtual servers to determine the optimum mix.

**PROCESS ORCHESTRATION**

IT organizations are under intense pressure to improve service levels while at the same time cutting costs. They also have to ensure continuous compliance with internal policies and external regulations. In response, IT organizations are transitioning to a process-oriented approach to service management. That requires implementing and enforcing the use of best-practice processes. Many organizations are turning to ITIL in this endeavor.

In implementing changes, for example, IT must perform a sequence of change, configuration, and release management processes. Only in that way can IT ensure that all changes are made in compliance with internal policies and external regulations. Yet IT also has to ensure that the processes do not impede speed or efficiency. This is especially important in the virtualized environment in which changes must be executed rapidly as virtual machines are created, moved, and retired.

Policy-based process automation provides the solution. The automation greatly speeds process execution while enforcing the use of best-practice processes. The CMDB plays a pivotal role in process automation. For example, in executing an end-to-end change process, it is necessary to orchestrate the sequencing of automated change, configuration, and release management processes. That's where the process orchestration capability of the CMDB comes in. It maintains the process models as well as the orchestration engine.
PUTTING THE CMDB TO WORK

The CMDB — one that is based on a federated architecture and includes the supporting technologies just described — provides the foundation for a unified BSM architecture built on a single platform. All BSM solutions are integrated on this platform and share a single source of truth, permitting integration of BSM processes that span multiple IT groups. As such, the CMDB helps IT improve service management and deliver value in several areas, including service support, operations support, asset management, and service impact analysis.

SERVICE SUPPORT

The process integration enabled by the CMDB allows different IT service support groups to work closely together through closed-loop incident, problem, and change processes. As a result, the IT service support organizations can increase efficiency and reduce risk.

Incident and Problem Management

Through the dependency mapping provided by the CMDB, the incident and problem management staff gain greater insight into root causes of incidents, speeding problem diagnosis and resolution. The staff also gains greater insight into the impact of incidents on the business, permitting greater efficiency through closer alignment of service support activities to business priorities. In addition, service support managers can leverage the data aggregated in the CMDB to gain greater insight into service desk operation through such metrics as incident resolution times, incident-to-problem ratios, and response time trends for phone, email, and web requests.

Change Management

Using the predictive analytics capability of the CMDB, the change management staff can better plan changes by determining, in advance, the impact of planned changes on the infrastructure and services, as well as on each other (change collision). Armed with this information, the staff can execute changes with confidence and track all change activities for audit purposes.

Configuration and Release Management

Configuration and release management personnel can use the device configuration information maintained by the CMDB to understand in advance the ability of devices to absorb planned releases. They can also leverage the DMLs and DHLs kept in the CMDB to ensure that only authorized configurations are deployed. In addition, the configuration-drift detection capability of the CMDB helps the staff ensure that configurations remain in compliance with internal policies and external regulations.

OPERATIONS SUPPORT

The CMDB helps IT operations management optimize performance and value though several capabilities.

Predictive Impact Analysis

The CMDB data and predictive analytics capability enable operations managers to perform predictive impact analysis to minimize risk. Here's an example:

A data center manager is tasked with consolidating three separate data centers into a single data center. With the IT infrastructure view provided by the CMDB, the manager can determine such things as what assets are involved, where they are located, which are under maintenance, which are leased, and what the utilization rates are. With the predictive analytics capability from the CMDB supporting technologies, the manager can optimize performance and cost through workload and capacity analysis. The manager can perform “what if” analyses to determine optimum mix of workloads, physical servers, and virtual servers and can analyze trends to determine capacity requirements. Armed with this wealth of information, the manager can make a well-informed decision.

Configuration Management

The CMDB enables IT operations to link with IT service support processes. This linking permits IT operations to confidently make changes in two ways.

First, the operations staff can make changes using BSM change tools. These tools guide the staff through the change management process, ensuring that changes are made in compliance with internal policies and external regulations. What's more, the change tools record in the CMDB all change activities for auditing purposes.
Certainly, the operations staff should make every effort to make changes through the normal change management process, but that’s not always possible. In some cases, the operations staff has to make emergency fixes to address problems that are affecting critical business services. The staff may have to make these fixes out-of-band of normal change processes. With the CMDB, IT still retains configuration control of the IT infrastructure and maintains compliance, even when emergency changes are made out-of-band. Here’s how:

Through the automatic discovery capability, the CMDB detects the emergency change. It updates the CI information and the dynamic service model to reflect the change. It then forwards the change information to the BSM change management solution for any required action. The BSM change management solution records the necessary change information for auditing and compliance purposes. If the change conflicts with policies or regulations, the change management solution triggers the appropriate remedial action.

As a result, the IT operations staff can move quickly in emergency situations, knowing that the CMDB and its supporting technologies are working in the background to ensure that the actions taken are backed with the necessary reporting and compliance assurance.

**Proactive Performance Management**

Through the CMDB’s dashboard capability, IT operations can monitor service delivery with respect to service quality commitments and can move proactively to address issues before they result in service degradation. In addition, by leveraging the dependency mapping capabilities of the CMDB, the operations staff can gain insight into the impact of events on the infrastructure and on service and use that insight to correlate events. Consequently, operations can meet and exceed service quality commitments.

**ASSET AND SOFTWARE LICENSE MANAGEMENT**

By supporting effective asset and software license management, the CMDB helps IT optimize asset spend, maximize asset utilization, and reduce the cost and effort of software license management.

**Optimize Asset Spend**

To optimize asset spend, IT management has to align asset spending with business priorities. IT also has to perform effective vendor management, such as by consolidating vendors and vendor contracts to gain maximum benefit from volume purchases and to take out poor performers.

First, IT has to know the true and full amount of asset spend; that is, the total cost of ownership (TCO) of IT assets. The CMDB maintains comprehensive asset cost information that includes acquisition costs, maintenance and support costs, and software license costs. With this information, IT can determine asset lifecycle costs from procurement through retirement.

IT also must have access to vendor information. Through integration with a BSM service resource planning solution, the CMDB also provides this access. With this information, IT can gain insight into vendor spend and evaluate vendor performance.

In addition, IT has to know the relationships of assets to services and how asset performance levels stack up to service level agreements (SLAs). The CMDB shows mapping of assets to business services and also maintains information on asset performance relative to SLAs. This information enables IT to quickly zero in on underperforming assets.

With this TCO, vendor, SLA, and asset performance information, IT can make better-informed decisions to optimize asset spend and to communicate asset spend to the business.

**Maximize Asset Utilization**

To maximize asset utilization, IT has to know what assets are out there and what they are doing. That means knowing what services the assets support and what the resulting asset workloads are.

The CMDB provides a complete view of assets and inventory across the enterprise. It automatically discovers all assets (mainframe, distributed, and virtual) and maintains details such as configurations, power consumption, heat dissipation, and usage data. The CMDB also shows the relationships of assets to each other, to users, and to the services they support. In addition, the CMDB enables IT to perform predictive analysis enabling the staff to consolidate and virtualize resources. The IT staff can leverage the information and predictive analytics capabilities of the CMDB to maximize asset utilization without negatively impacting service quality.
**Improve Software License Management**

To perform effective software license management, IT has to know what licenses it has and how the licenses are being used. The CMDB maintains this information and can present it in meaningful displays as well as in audit and compliance reports.

Through the information provided by the CMDB, IT can eliminate software license violations and avoid costly penalties while at the same time reducing the time and cost of maintaining software license compliance. In addition, IT can leverage software usage data to harvest and reassign unused licenses to maximize software license utilization.

**A REAL-WORLD EXAMPLE**

Intermountain Healthcare, a nonprofit health system based in Salt Lake City, Utah, has implemented a BMC Atrium CMDB and is reaping significant benefits. The organization has more than 30,000 employees within a system of 21 hospitals and 162 clinics. Intermountain Healthcare, widely recognized for its use of technology in healthcare, has been referred to by United States President Barack Obama as a system that “offer(s) high-quality care at costs below average.”

The Intermountain IT organization is responsible for all aspects of the IT infrastructure, including data centers, networks, communications, servers, storage, and 28,000 desktop devices. Because of the critical nature of the services it provides, IT has to ensure high availability and averages greater than 99.9 percent availability on most systems.

Faced with a rapid growth rate that averages 60–70 new application systems per year, IT set out to boost its efficiency. Knowing that significant efficiencies could be gained by better management of assets, the IT staff decided to begin by making an accurate assessment of their inventory. The problem was that the inventory data was scattered across thousands of databases and spreadsheets. Following ITIL guidelines, the staff decided to consolidate the inventory data into a single CMDB and selected the BMC Atrium CMDB because of its ability to maintain detailed data about each CI, as well as comprehensive CI relationship data.

The effort IT expended in the creation of the CMDB has paid off. IT now has accurate data on all its assets, including details about each asset and the relationships among assets. With this information, the IT staff has been able to achieve the following:

- **Better management of assets** through the availability of relationship information, such as “Supported By” and “Managed By” relationships that clarify responsibilities
- **Improved alignment with financial systems** though improved ability to reconcile assets
- **Improved quality of change implementations** by linking thought processes to CIs and their relationships, thereby uncovering potential issues early in the planning process
- **Improved problem investigation** because of the ability to see histories of related incidents, changes, and problems

**CONCLUSION**

The CMDB is no longer just a passive repository of IT environment data. Propelled by advanced technologies — such as automatic discovery and dependency mapping, dynamic service modeling, inventory and configuration management, dashboards and analytics, and process orchestration — the CMDB has become the very brain of BSM.

The enhanced CMDB delivers value on its own, such as by enabling better-informed IT decision making through greater visibility of the IT environment, predictive analytics, dashboards, and reports that leverage CMDB data. The result is lower risk, including lower risk of capacity overbuying or capacity shortfalls, problems due to virtualization, outages due to failed changes, and noncompliance with internal policies and external regulations.

When other BSM solutions are added to the CMDB foundation, its value multiplies through the integration of processes within and across IT groups, including IT service support, IT operations, and IT asset management. Now all these groups can operate with a single data repository, transform that data into knowledge, and use the knowledge to support decision making and orchestrate process automation. The result is greater efficiency, lower costs, higher resource utilization, and continuous compliance.

About the Author
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