BMC Atrium CMDB 7.6.04

# Data Modeling Guide

January 2011

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Have the following information available so that Customer Support can begin working on your issue immediately:

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  - Product version (release number)
  - License number and password (trial or permanent)
- Operating system and environment information
  - Machine type
  - Operating system type, version, and service pack
  - System hardware configuration
  - Serial numbers
  - Related software (database, application, and communication) including type, version, and service pack or maintenance level
- Sequence of events leading to the problem
- Commands and options that you used
- Messages received (and the time and date that you received them)
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- Submit a new issue at `http://www.bmc.com/support`.

# Contents

# Preface

The *BMC Atrium CMDB 7.6.04 Data Modeling Guide* describes how to model business entities in BMC Atrium CMDB 7.6.04. The guide uses the Common Data Model (CDM) and extensions to that model, and explores recommended practices for using new entities effectively.

The BMC Atrium Configuration Management Database (CMDB) enables you to store and manage information about products and services that are in your environment. The BMC Atrium CMDB uses the term *class* to describe a configuration item (CI) or relationship classification. Each CI is partially classified using some common *attributes* that describe the *base class* (`BMC_BaseElement`). Specific details about each class of CI are described by attributes of *subclasses* of `BMC_BaseElement`. Relationships are also modeled as a base relationship class (`BMC_BaseRelationship`) with subclasses for different types of relationships.

As a provider of BMC Atrium CMDB data, BMC Atrium Discovery products can discover large amounts of configuration data for use by data consumers. BMC Atrium Discovery products are natural enablers for the creation of service models because they can discover many of the components, or CIs, that ultimately make up the service models. These components include:

- Computer systems (including servers, routers, physical and virtual systems, and operating systems)
- Applications
- Software servers (including specialized elements such as SAP®, Sun, Siebel, and mainframe infrastructure components)
- Databases
- Business process definitions
- Network elements

# Audience

This guide is intended for configuration managers, application administrators, asset analysts, and related IT professionals.

# Conventions used in this guide

This guide illustrates how to use the classes that BMC provides for the BMC Atrium CMDB to model a particular business entity, focusing on how you use the entire model rather than on general information about a class or attribute. Although descriptions of classes and attributes are provided to give you context when determining how to model CIs, detailed information such as syntax and the type of attribute is not specified. For that level of information, see the BMC Atrium CMDB 7.6.04 Data Model Help.

This guide applies the following conventions to explain BMC Atrium CMDB concepts in both textual and graphical formats.

## Terminology

In many cases you will be modeling an entity using classes from the CDM, but you might also model part of that same entity using an extension to the CDM. For models that require extensions to the CDM, the term *data model* is used. This guide is organized so that the entities are introduced first in each section, including the recommended practice for that implementation. Any classes and attributes that can be included in the deployment of these business entities in an IT infrastructure are described in an architectural diagram. Where appropriate, recommendations are provided for setting specific attributes for a given class.

Attributes are defined as either *key* or *additional*. Key attributes are those that BMC recommends that you populate for a given class to model a specific CI. Additional attributes are optional attributes that you can populate to further classify a CI or relationship.

### Differentiating Name and ShortDescription attributes

A common misconception is that the caption for the CI on user interfaces and reports is represented by the `Name` attribute, when it is actually the `ShortDescription` attribute. In diagrams in this guide, the names that appear are not from the `Name` attribute, they are the `ShortDescription` attribute (which is usually just a user interface caption). Also, in modeling recommendations, `ShortDescription` is the more user-friendly label, and should always be provided and set with a value that makes sense to an end user.

## Diagrams

Illustrative model diagrams help explain the concepts and modeling recommendations in this guide, and also show how you might model an entity in a real-world business environment. In these diagrams, CIs are represented by single-line boxes that contain attributes of the class or its parent class. Where applicable, key attributes are shown in the box that depicts a specific class and, in some cases, include the recommended value of those attributes.

***NOTE***

Illustrative diagrams are just examples, and might not reflect every possible class, attribute, or relationship that you would use for modeling all types of the represented object.

## Relationships represented in illustrative model diagrams

In the diagrams, boxes illustrate how CIs in your environment should be mapped to the CDM, or how to extend the CDM to create your own data model. Lines are used to represent the type and direction of the relationship.

***NOTE***

Relationships in the diagrams in this guide are illustrated using Unified Modeling Language (UML) standards. The UML notation may not be consistent with the BMC Atrium CMDB 7.6.04 user interfaces (UI). Some of this discrepancy is due to the absence of a direct UML equivalent to the relationships represented, and some of it is the lack of alignment between the CDM, the UI, and UML standards.

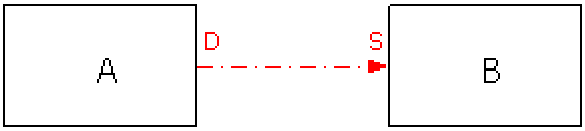
Although discrepancies may exist between the UML standards and the BMC Atrium CMDB UI, changes in the UI for future releases of BMC Atrium CMDB will enable the UI to more closely align with UML. In this guide, the conventions applied to the diagrams enable you to easily distinguish which relationship is used in a modeling scenario, regardless of how you might view them in the product.

For example, one major difference between UML standards and the BMC Atrium CMDB UI is that, in the UI, an arrow is always used to represent the source and destination of the relationship, whereas in UML, it is not. Therefore, in this guide, the diagrams more closely align with UML so that you can understand the semantic of the modeling scenario in the context of the corresponding best-practice modeling recommendations.

Although UML does not standardize colors in its rendering of relationships, they are used in the diagrams to help you easily distinguish at a glance which relationship type is recommended to model an example business object. Additionally, the source and destination of each relationship are represented by the letters S and D, respectively. The following section illustrates examples of each relationship type.

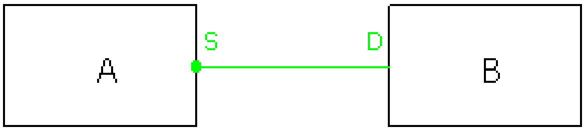
## Examples of dependency relationships (arrow)

Dependency relationships are represented by dashed red lines, and contain an arrow to show the direction of the relationship. In a BMC_Dependency relationship, the arrow starts at A, the dependent (Destination), and ends at B, the antecedent (Source) of the relationship. Entity A is dependent on Entity B.



## Example of a collection relationship (circle)

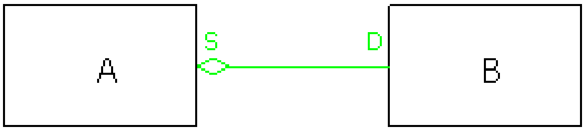
A BMC_MemberOfCollection relationship is represented by green lines with circle tips, as illustrated in the following diagram:



A is the collection class (Source), and B is the member class (Destination). The circle represents a collection relationship, where the collection class uses properties of the member class.

## Example of a component relationship (diamond)

In a component relationship, the source CI is a group that has a component or part; its destination. Entity A is a group (Source) that has a component B (Destination). In diagrams, component relationships are represented by green lines with diamond tips.



## Cardinality in relationships

Every relationship class has a cardinality that defines how many instances of the source class can be related to each instance of the destination class and vice versa. Where cardinality is specified in the diagrams, it is shown at the ends of the relationship lines as one of the following types:

- 1:1 (one to one)
- 1:* (one to many)
- *:1 (many to one)
- *:* (many to many)

## Weak relationships

Where a *weak relationship* exists between two instances, that relationship is indicated by the letter W in the illustrative model diagrams. If the relationship is a weak relationship, its destination member, called the *weak* member, cannot exist without its source member, called the *strong* member. A weak relationship creates a logical composite object consisting of both member CIs.

# BMC Atrium Core documentation

This section describes the complete set of BMC Atrium CMDB documentation, including manuals, help systems, videos, and so on.

Unless otherwise noted, documentation is available free of charge on the BMC Atrium CMDB documentation media (DVD or Electronic Product Download bundle) and on the BMC Customer Support site, at http://www.bmc.com/support.

To find this documentation on the BMC Customer Support site, choose Product Documentation > Supported Product A-Z List > BMC Atrium CMDB Enterprise Manager >7.6.04

| Title | Description | Audience |
|---|---|---|
| *Atrium Integrator 7.6.04 User's Guide* | Information about defining source and target connections, creating jobs and transformations, editing and monitoring jobs, and other Atrium Integrator concepts. | Users who are responsible for setting up data transfer integrations between external data stores and BMC Atrium CMDB. |
| *BMC Atrium CMDB 7.6.04 Administrator's Guide* | Information about setting permissions, configuring federation, modifying the data model, configuring an impact model, and other administrative tasks in BMC Atrium Configuration Management Database (BMC Atrium CMDB). | Configuration managers, application administrators, and asset analysts. |
| *BMC Atrium CMDB 7.6.04 Common Data Model Diagram* | Hierarchical diagram of all classes in the Common Data Model (CDM), including unique attributes and applicable relationships. | Configuration managers, application administrators, and asset analysts. |

| Title | Description | Audience |
|---|---|---|
| BMC Atrium CMDB 7.6.04 Data Model Help | Description and details of superclasses, subclasses, attributes, and relationship classes for each class. Contains only information about the CDM at first, but you can update it to include information about data model extensions that you install.<br>Note: This Help is provided in HTML and is available on the BMC Atrium CMDB media. It is not available on the BMC Customer Support site. | Configuration managers, application administrators, and asset analysts. |
| *BMC Atrium CMDB 7.6.04 Data Modeling Guide* | Best practices for using the classes that BMC provides for BMC Atrium CMDB (both the CDM and extensions) to model complex business entities, focusing on the use of multiple related CIs to model an entity rather than on general information about a class or attribute. | Configuration managers, application administrators, and asset analysts. |
| BMC Atrium CMDB 7.6.04 Javadoc Help | Information about Oracle Java classes, methods, and variables that integrate with BMC Atrium CMDB.<br>Note: This Help is provided in HTML and is available on the BMC Atrium CMDB media. It is not available on the BMC Customer Support site. | Application programmers. |
| *BMC Atrium CMDB 7.6.04 Normalization and Reconciliation Guide* | Information about normalizing data in BMC Atrium CMDB and reconciling CIs from different data providers into a single production dataset. | Configuration managers, application administrators, and asset analysts. |
| BMC Atrium CMDB 7.6.04 Online Help | Help for using and configuring BMC Atrium CMDB, including Atrium Integrator, BMC Atrium Product Catalog, Reconciliation Engine, Normalization Engine, and so on.<br>Note: This Help is provided in HTML and is available through the Help links in the BMC Atrium CMDB user interface. It is not available on the BMC Customer Support site. | Configuration managers, application administrators, asset analysts, and users that work with CIs and need to understand the relationships that exist within BMC Atrium CMDB. |
| *BMC Atrium CMDB 7.6.04 User's Guide* | Information about using BMC Atrium CMDB, including searching for and comparing CIs and relationships, relating CIs, viewing history, running impact simulations, and viewing federated data. | Users that work with CIs and need to understand the relationships that exist within BMC Atrium CMDB. |
| *BMC Atrium Core: Taking Your Data Into Production End to End* | End-to-end high-level steps for bringing data into BMC Atrium CMDB from a third-party source and making it available in your production dataset.<br>Note: This Flash video is available on the BMC Atrium CMDB media. It is not available on the BMC Customer Support site. | Configuration managers, application administrators, and asset analysts. |

| Title | Description | Audience |
|---|---|---|
| *BMC Atrium Core 7.6.04 Compatibility Matrix* | Information about the BMC Atrium CMDB configurations that are expected to work together based on design, testing, or general understanding of the interaction between products.<br>Note: Download the *BMC Atrium Core 7.6.04 Compatibility Matrix* from the BMC Customer Support site at `http://www.bmc.com/support/reg/remedy-compatibility-tables.html?c=n`. | Configuration managers, application administrators, and asset analysts. |
| *BMC Atrium Core 7.6.04 Concepts and Planning Guide* | Information about CMDB concepts and high-level steps for planning and implementing BMC Atrium CMDB. | Anyone who wants to learn about and understand BMC Atrium CMDB products, CMDBs in general, and the functionality of BMC Atrium CMDB in particular.<br>IT leaders, configuration managers, application administrators, and asset analysts are some who will benefit from this information. |
| *BMC Atrium Core 7.6.04 Developer's Reference Guide* | Information about creating API programs using C API functions and data structures. | Application administrators and programmers. |
| *BMC Atrium Core 7.6.04 Installation Guide* | Information about installing, upgrading, and uninstalling BMC Atrium Core features. | Application administrators. |
| *BMC Atrium Core 7.6.04 Master Index* | Combined index of all guides. | Everyone. |
| *BMC Atrium Core 7.6.04 Product Catalog and DML Guide* | Information about configuring the Product Catalog and DML, adding products, and creating aliases for products, manufacturers, and categorizations. | System administrators, IT managers, network managers, and other qualified personnel who are familiar with their computing and networking environment. |
| *BMC Atrium Core 7.6.04 Release Notes* | Information about new features, known issues, and other late-breaking topics. | Everyone. |
| *BMC Atrium Core 7.6.04 Troubleshooting Guide* | Information about resolving issues with BMC Atrium CMDB components, including API, filter, and console error messages and their solutions. | Application administrators, programmers, and BMC Support personnel. |
| BMC Atrium Core 7.6.04 Web Services Help | Information about using BMC Atrium Core Web Services, including how to publish and find interfaces in the Web Services Registry, set versions, disambiguate web services, configure security policies and encryption, and use BMC Atrium Core Web Services data structures and operations.<br>Note: This Help is provided in HTML and is available on the BMC Atrium CMDB media. It is not available on the BMC Customer Support site. | Application administrators and programmers. |

| Title | Description | Audience |
|---|---|---|
| *BMC Atrium Integration Engine 7.6.04 ADK Developer's Guide* | Information about how to build adapters that can transfer information between an external data store and either BMC Remedy AR System forms or BMC Atrium CMDB. | Developers who have a basic understanding of BMC Atrium Integration Engine and want to build adapters that can exchange data between two data sources. |
| BMC Atrium Integration Engine 7.6.04 Online Help | Help for using and configuring BMC Atrium Integration Engine.<br>Note: This Help is provided in HTML and is available through the Help links in the BMC Atrium Integration Engine user interface. It is not available on the BMC Customer Support site. | Users who are responsible for setting up data transfer integrations between external data stores and either BMC Atrium CMDB or BMC Remedy AR System. |
| *BMC Atrium Integration Engine 7.6.04 User's Guide* | Information about creating data exchanges and data mappings, defining rules and queries, activating event-driven data exchanges, defining connection settings, and other BMC Atrium Integration Engine concepts. | Users who are responsible for setting up data transfer integrations between external data stores and either BMC Atrium CMDB or BMC Remedy AR System. |
| *Mapping Your Data to BMC Atrium CMDB 7.6.04 Classes* | Spreadsheet that maps common IT objects to the appropriate class, whether part of the CDM or an extension. This spreadsheet also includes information about further categorizing instances using key attributes, and best practices for creating normalized relationships. | Configuration managers, application administrators, and asset analysts. |

# Chapter 1 Computer system modeling

This section describes how to use the CDM to model computer systems (servers, workstations, and network nodes such as routers, switches, and hubs). It details the classes, relationships, and attributes used to model computer systems, operating systems, hardware components, software inventory and patches, access points, and network interfaces.

For information on modeling applications, including modeling runtime versus installed aspects of applications, see Chapter 2, "Application modeling.".

The following topics are provided:

# Logical identity of BMC_ComputerSystem

BMC_ComputerSystem is a class that stores CIs relating to collections of managed system elements. This is the primary class that you use to model the computers in your organization. You can use the attributes in this class to identify the purpose of each computer CI in your organization.

For example, the class contains several attributes that represent any network-addressable system, such as a server, a workstation, or a network device (router, switch, hub, load balancer, firewall, and so forth), as well as mainframes, printers, and virtual systems. Table 1-1 shows the key attributes that identify an instance of BMC_ComputerSystem.

**Table 1-1: Key attributes for BMC_ComputerSystem**

| Attribute | Usage |
|---|---|
| Name,<br>NameFormat | Identifies a computer system. The Name attribute should be a unique instance identifier that may not be Human Readable. Because multiple valid naming conventions may exist and can be used according to specific contexts, set the NameFormat attribute with a value indicating the heuristic used to generate the Name value. For example, in some cases, an instance of BMC_ComputerSystem will be identified by an external DNS name (a name configured in a DNS server). In other cases, a static IP address will be used. The naming conventions for NameFormat are:<br>■ IP—a valid IP address (decimal bytes delimited with dots).<br>■ DNS—a fully qualified host name, formatted as a HostName and a DomainName delimited with dots (the DomainName can also be made of multiple components delimited with dots).<br>■ TOKEN—Name holds a value defined by the TokenId (see “Additional attributes for BMC_ComputerSystem” on page 20 for more information on the TokenId). |
| Domain | Identifies the domain name of the computer, as known by the end points. |
| HostName | Specifies the local name of the computer, as known by the end points. This value must be set according to BMC nationalization guidelines that specifies the algorithms and methods required to obtain the correct values. |
| SerialNumber | Specifies the serial number of the computer. |

## Key attributes of BMC_ComputerSystem

Table 1-2 show the attributes that further describe the role of an instance of `BMC_ComputerSystem`.

**Table 1-2: The role of an instance of BMC_ComputerSystem (Sheet 1 of 2)**

| Attribute | Usage |
|---|---|
| `CapabilityList` | Defines the main functions that the computer can perform.<br>This is a character attribute in which you can enter any value listed in the description. You can enter more than one of these values; however, make sure that multiple values are delimited by commas. A computer system can be dedicated to a single function, such as printing, routing, or switching packets, or it can perform several functions. Typically, the `PrimaryCapability` attribute is set to the first value specified in `CapabilityList`.<br>The following list illustrates the functions and values to assign to a `CapabilityList` attribute depending on the function of the computer.<br>■ Not Dedicated—0<br>■ Unknown—1<br>■ Other—2<br>■ Storage—3<br>■ Router—4<br>■ Switch—5<br>■ Layer 3 Switch—6<br>■ Central Office Switch—7<br>■ Hub—8<br>■ Access Server—9<br>■ Firewall—10<br>■ Print—11<br>■ I/O—12<br>■ Web Caching—13<br>■ Server—14<br>■ Management —15<br>■ Block Server —16<br>■ File Server —17<br>■ Mobile User Device —18<br>■ Repeater—19<br>■ Bridge/Extender—20<br>■ Gateway —21<br>■ LoadBalancer—22<br>■ Mainframe—23<br>■ SANSwitch—24<br>■ SANHub—25<br>■ SANBridge—26<br>■ SANRouter—27<br>■ SANDirector—28<br>■ RAIDStorageDevice—29<br>■ Virtual Tape Library—30<br>■ JBOD—31<br>■ Workstation—32<br>■ StorageSubsystem—33<br>■ Storage Virtualizer—34<br>■ Media Library—35<br>■ ExtenderNode—36<br>■ NAS Head—37<br>■ Self-contained NAS—38<br>■ UPS—39<br>■ IP Phone—40<br>■ Management Controller—41<br>■ Chassis Manager—42<br>■ Host-based RAID controller—43<br>■ Storage Device Enclosure—44<br>■ Desktop—45<br>■ Laptop—46<br>■ Virtual Library System—47<br>■ Blade System—48<br>■ Blade Server—49 |

**Table 1-2: The role of an instance of BMC_ComputerSystem (Sheet 2 of 2)**

| Attribute | Usage |
|---|---|
| PrimaryCapability | Describes the main function that the computer performs.<br>By convention, PrimaryCapability is the first item in the CapabilityList attribute. |
| ShortDescription | Specifies a short description for the instance when the value of the Name attribute is encoded. ShortDescription should always be provided and set with a value that makes sense to an end user. |

For example, a server with active firewall capabilities could have the values 14 (Server) or 10 (Firewall) for CapabilityList. PrimaryCapability would be set to Server if this is the main function of the system. However, a switch device would have CapabilityList = 5 (Switch) and PrimaryCapability = 5.

## Additional attributes for BMC_ComputerSystem

Table 1-3 describes the attributes that provide additional information about an instance of BMC_ComputerSystem.

**Table 1-3: Additional information for BMC_ComputerSystem**

| Attribute | Description |
|---|---|
| Description | The functions that the computer system can perform. |
| DHCPUse | Specifies whether the system is configured to use DHCP:<br>Enabled = configured to use DHCP<br>Disabled = not configured to use DHCP |
| ManufacturerName | The company that manufactured the computer. |
| Model | The model of the computer. |
| OwnerContact | The contact information that specifies how the primary system owner can be reached (such as phone number or email address). |
| OwnerName | The name of the primary system owner. |
| TokenId | A unique identifier populated by BMC Discovery products and used by the Reconciliation Engine (of the BMC Atrium CMDB) to identify instances. |
| TotalPhysicalMemory | The total physical memory, in kilobytes. |

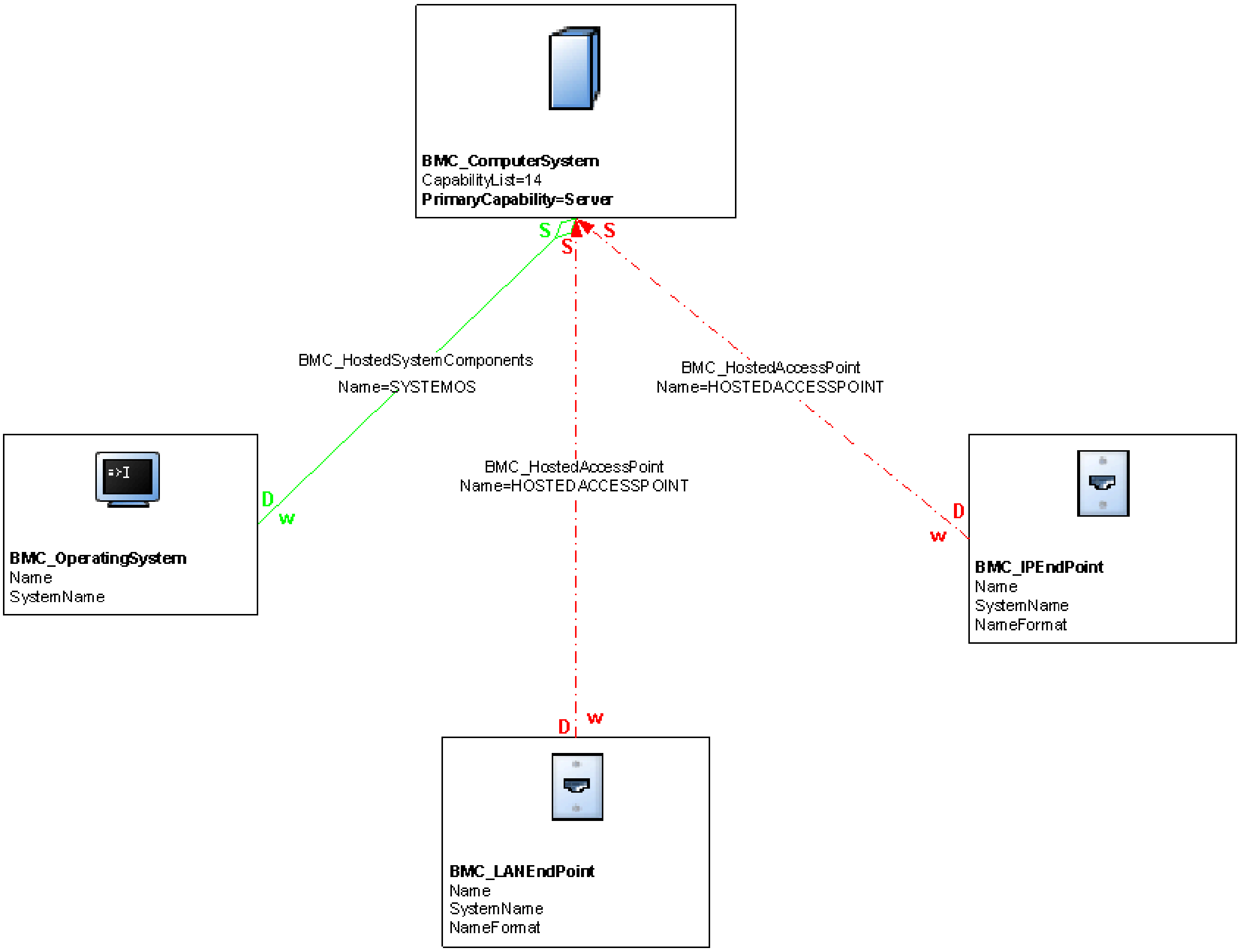
For more information about specific attributes, see the BMC Atrium CMDB 7.6.04 Common Data Model Help.

# Computer system modeling

Computer systems are parent objects that may be represented as an aggregation of component parts (such as operating systems, hardware, software inventory, or network addresses) that are child instances related to the `BMC_ComputerSystem` instance.

Systems provide computing capabilities and aggregate one or more of the these elements: file systems, operating systems, processors, and memory (including volatile and nonvolatile storage). Therefore, additional information about a computer system might not be part of a `BMC_ComputerSystem` instance but be available from instances of other classes connected to the `BMC_ComputerSystem` instance through relationships. For example, Figure 1-1 represents a model for a server, a network-addressable computer system.

**Figure 1-1: Illustrative model of a server**



Servers, workstations, network devices (such as routers, switches, hubs, load balancers, or firewalls) are all instances of `BMC_ComputerSystem`, the class representing all network addressable systems. `BMC_ComputerSystem` represents an entity made up of component parts that operate as a functional whole.

The PrimaryCapability attribute is crucial to identifying whether a specific instance is a server, a router, or something else. BMC Atrium CMDB planners might use the PrimaryCapability attribute to define a vendor-specific switch used in their network, making it easy to import this data from a vendor's environment as an industry-standard item in their BMC Atrium CMDB.

# Software inventory and patch modeling

Software inventory represents the products and patches that are installed on a computer. BMC_Product represents instances of installed products, whereas BMC_Patch represents instances of patches (operating system patches and product patches). Figure 1-2 illustrates an example model of a server with two installed products.

**Figure 1-2: Illustrative model of a software inventory containing two installed products**

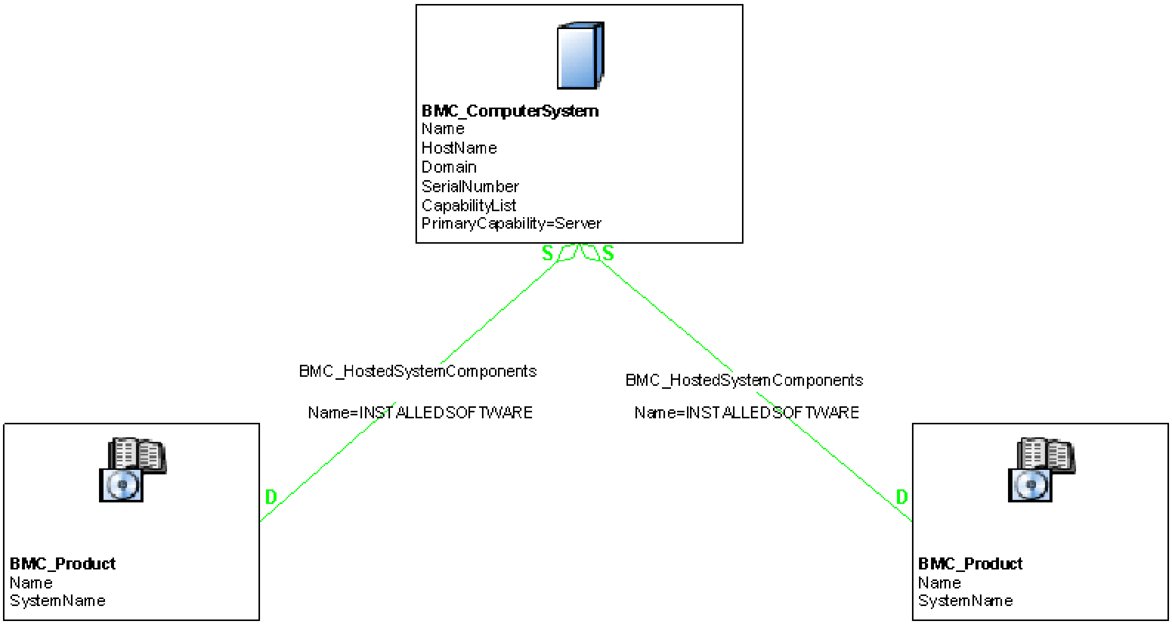
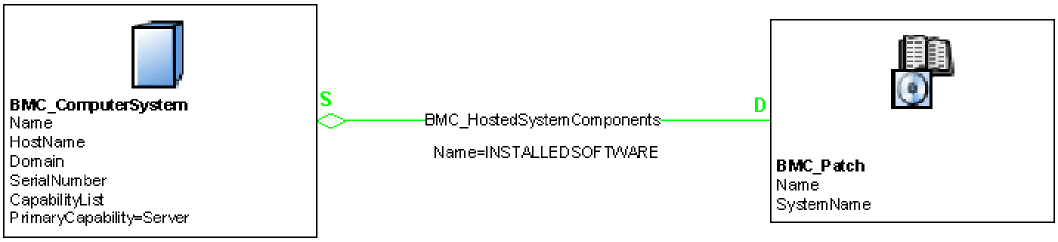


Figure 1-3 illustrates an example model of a server with one installed patch.

**Figure 1-3: Illustrative model of a software inventory with a patch**



You might not want to model patches in your BMC Atrium CMDB in all cases. For example, you might store patches for servers in the BMC Atrium CMDB, but it might not be necessary to do so for desktops and routers.

Both `BMC_Product` and `BMC_Patch` are subclasses of `BMC_Software` and `BMC_SystemComponent`. You should associate each instance of a product or of a patch to the parent instance of `BMC_ComputerSystem` by the `BMC_HostedSystemComponents` relationship. When modeling software inventory, be aware that the `BMC_Product` class captures only installed products or applications, not runtime aspects.

For more information about modeling runtime applications and using instances of `BMC_Product` for application modeling, see Chapter 2, "Application modeling.".

## Logical identity of BMC_ComputerSystem (for products or patches)

Like any child instance of `BMC_ComputerSystem`, a product or a patch is identified by the `Name` attribute in conjunction with the `SystemName` attribute that represents the name of the computer instance. Thus, the `Name` attribute represents the local name of the CI in the context of the computer that is hosting it, as described in Table 1-4.

**Table 1-4: Key attributes for BMC_ComputerSystem**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the child instance in the context of the parent instance of `BMC_ComputerSystem`. |
| `SystemName` | Specifies the name of the computer instance. This must be the same as the parent instance of the `BMC_ComputerSystem Name` attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the product or patch. |

## Additional attributes of BMC_ComputerSystem (for products or patches)

Table 1-5 describes attributes that provide additional information about products and patches.

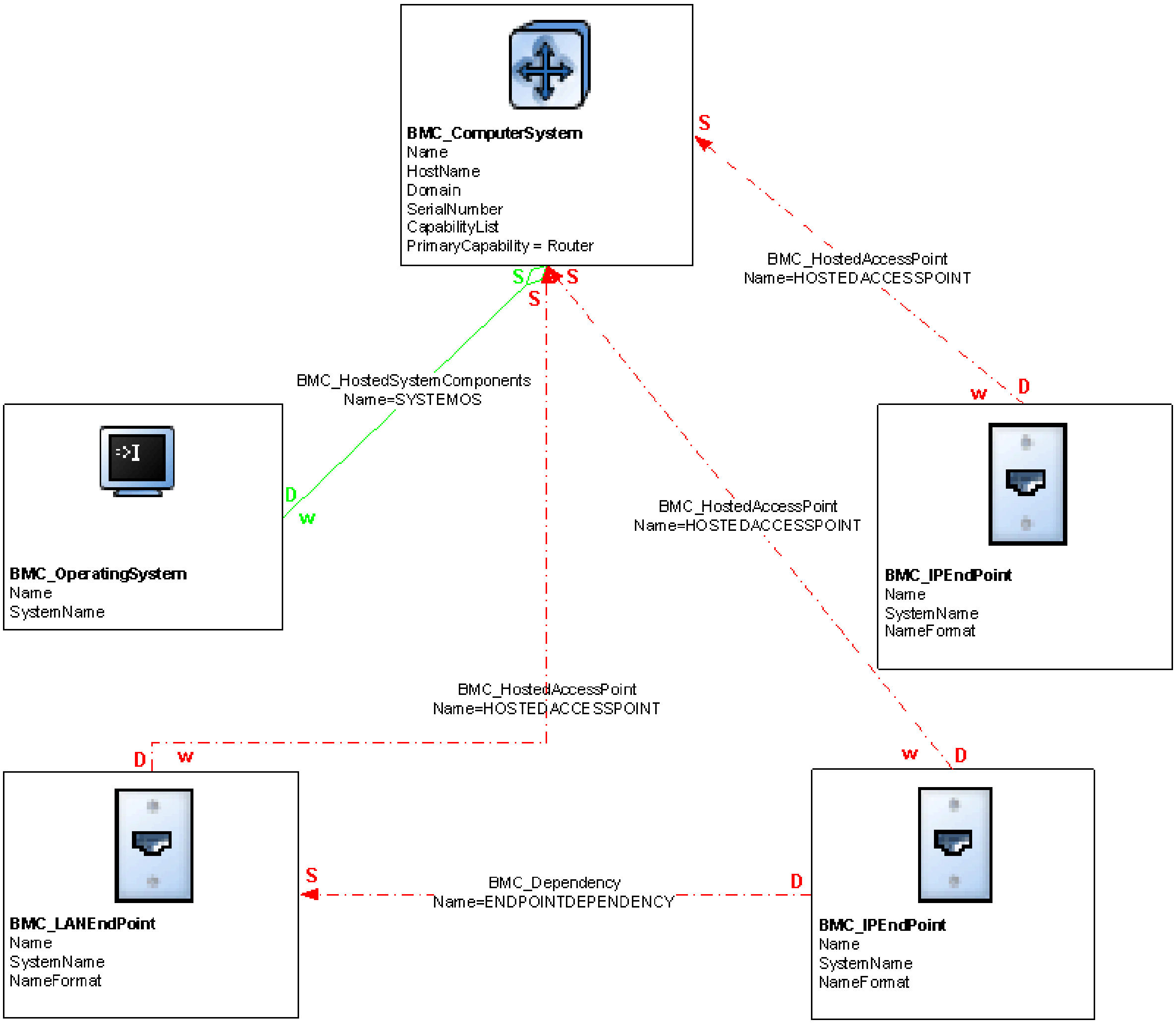
**Table 1-5: Additional information about products and patches**

| Attribute | Description |
|---|---|
| `Description` | The description for the component. |
| `ManufacturerName` | The company that manufactured the component. |
| `SerialNumber` | The serial number of the component. |
| `ShortDescription` | A caption for the component. |
| `PatchNumber` | The version number of the patch. |
| `VersionNumber` | The version number of the component. |

# Router modeling

Routers are modeled using the `BMC_ComputerSystem` class by setting the `PrimaryCapability` attribute to Router. Figure 1-4 illustrates an example model of a network router.

**Figure 1-4: Illustrative model of a router**



In the model, two `BMC_IPEndpoint` classes are used to represent the interfaces to the router.

# Virtual system modeling

Virtual systems represent one or more virtual machines that are hosted by a physical computer. A virtual system has the same relationships to subcomponents and applications that a physical system does. In other words, a virtual system has an operating system (such as Windows or UNIX®), network addresses, and software. The major difference is that these subcomponents, although captured as regular CIs, are all virtual. Additionally, virtual systems can have `BMC_Genealogy` relationships that define relationships between a parent virtual system and its child virtual systems. For example, If you have a virtual system named win2k-vm1 and a clone of that system named win2k-vm2, the win2k-vm1 system is the parent and the win2k-vm2 system is the child.

When modeling virtualization in your environment, represent the virtual computer system using the `BMC_ComputerSystem` class, and the virtualization software (such as Hypervisor or virtualization software), using the `BMC_VirtualSystemEnabler` class.

An example of a virtual system model is illustrated in Figure 1-5.

**Figure 1-5: Illustrative model of a virtual system without resource pools and settings**

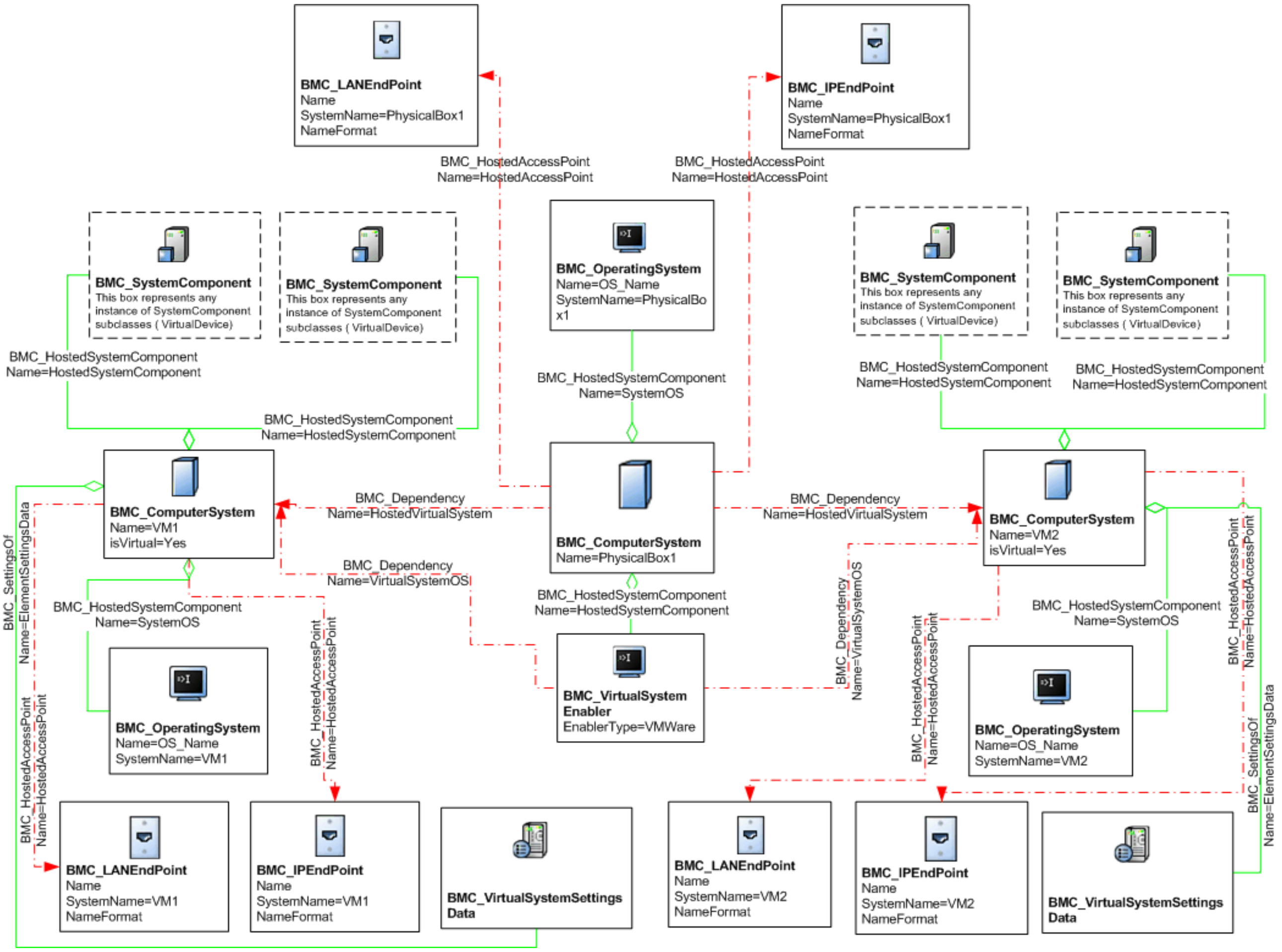


Figure 1-5 illustrates multiple virtual systems (virtual machines, or VMs), the physical computer system that hosts them, and the virtualization operating system, which is hosted on the physical system and runs the VMs. The diagram is simplified and does not contain resource pools.

## Logical identity of BMC_System and BMC_ComputerSystem (for virtual systems)

You model virtual systems as instances of `BMC_ComputerSystem`, a subclass of `BMC_System`. You should follow the same naming rules as for an instance of `BMC_ComputerSystem` class. For more information about this class, see "Logical identity of BMC_ComputerSystem" on page 18.

The key attributes for defining virtual systems are `VirtualSystemType` (for the `BMC_ComputerSystem` class) and `isVirtual` (for the `BMC_System` and `BMC_SystemComponent` classes and their subclasses). Both attributes are described in Table 1-6.

**Table 1-6: Key attributes for defining virtual systems**

| Attribute | Usage |
|---|---|
| `VirtualSystemType` | Identifies the type of virtual machine. Values are Other (0), Unknown (1), PR/SM (2), z/VM (3), VMWare (4), Xen (10), Hyper-V (15), Sun Solaris™ Container (20), VPar (25), NPar (30) and LPar (35). |
| `isVirtual` | Specifies whether the instance is virtual or physical. Values are NULL, No (0), or Yes (1). If you know that it is a virtual machine, use Yes. If you know that it is a physical machine, use No. If you are unsure, use NULL. |

***NOTE***

In BMC Atrium CMDB 7.6.00, the `isVirtual` attribute was moved from the `BMC_ComputerSystem` class to the `BMC_System` and `BMC_SystemComponent` classes. This move expands the virtualization scope beyond computer systems, enabling you to model potential future virtualizable entities, such as applications. Because `BMC_ComputerSystem` is a subclass of the `BMC_System` class, the `isVirtual` attribute is still available in the `BMC_ComputerSystem` class.

To ensure correct reconciliation with data created by BMC Software products, use NULL instead of No for the `isVirtual` attribute to represent an instance that is not virtual.

## Logical identity of BMC_VirtualSystemEnabler

The BMC_VirtualSystemEnabler class stores information about software that enables a collection of virtual computer systems to run on a single physical computer system (for example, VMware). This class is used to capture the virtualization OS, such as operating systems that run virtual machines (including VMware images, Solaris zones, IBM® AIX® logical partitions, HP-UX virtual partitions, and so forth).

The BMC_VirtualSystemEnabler class is associated to the parent computer system instance by the BMC_HostedSystemComponents relationship. As a subclass of BMC_ComputerSystem, any instance (representing a new business CI) of the BMC_VirtualSystemEnabler class is identified, at minimum, by the Name and SystemName attributes.

The key attribute for BMC_VirtualSystemEnabler is EnablerType, described in Table 1-7.

**Table 1-7: Key attributes for EnablerType**

| Attribute | Usage |
|---|---|
| EnablerType | Specifies the virtualization software or OS. The possible values are Other (0, the default), Unknown (1), PR/SM (2), z/VM (3), VMWare Server (4), Solaris Resource Manager (5), LPar (6), VPar (7), HP nPartitions (20), Integrity VM (25), Microsoft Hyper-V (30), VMWare ESX Server (35), VMWare Workstation (40), Xen Hypervisor (45), and LDOM Hypervisor (50). |

For a complete list of attributes for the BMC_VirtualSystemEnabler class, see the BMC Atrium CMDB 7.6.04 Data Model Help.

## Logical identity of BMC_VirtualSystemSettingData

The BMC_VirtualSystemSettingData class (derived from BMC_Settings) provides additional granularity about a virtual system's settings through a set of virtualization-specific properties.

Key attributes for defining the virtual aspects using the BMC_VirtualSystemSettingData class are described in Table 1-8.

**Table 1-8: Key attributes for BMC_VirtualSystemSettingData (Sheet 1 of 2)**

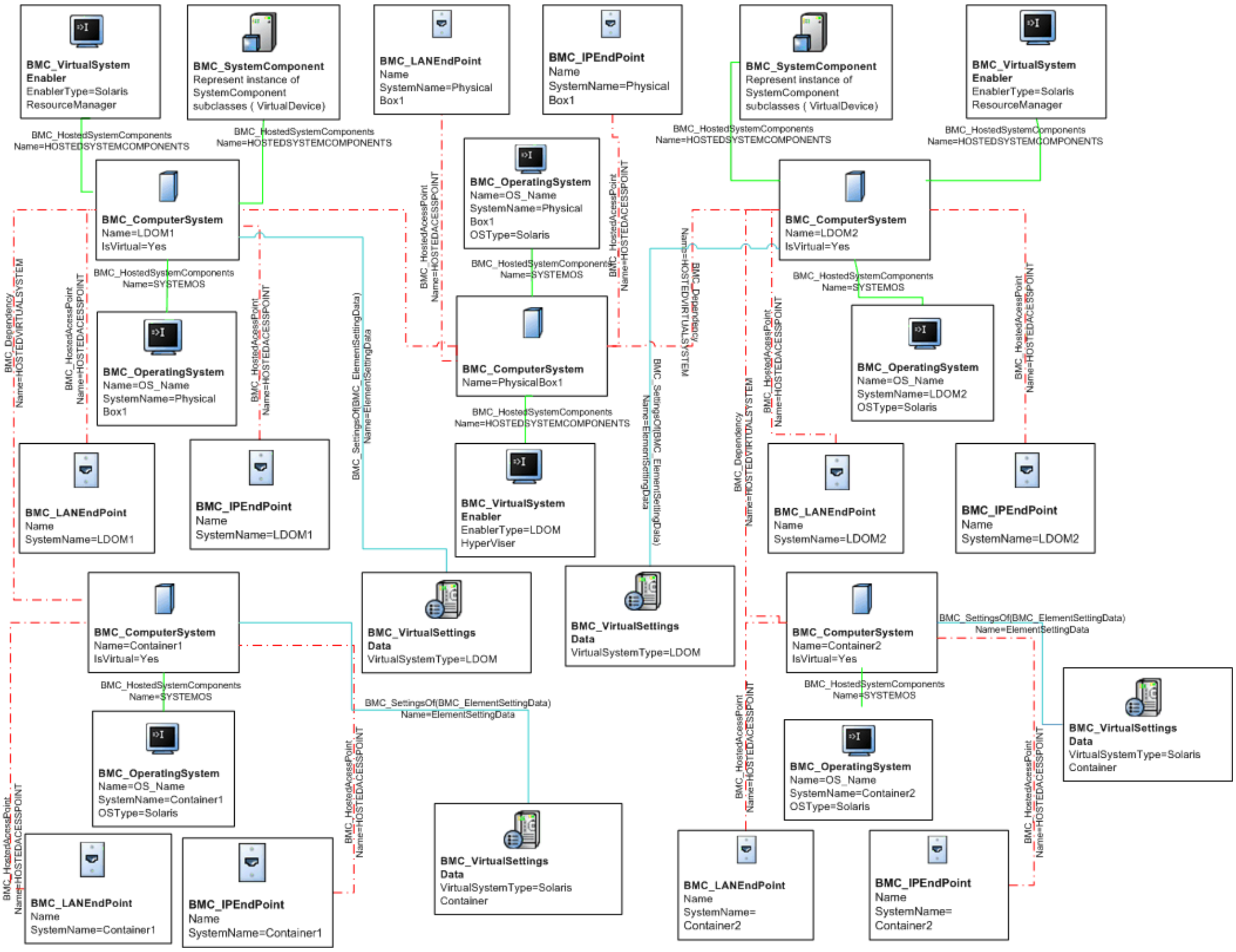
| Attribute | Usage |
|---|---|
| VirtualSystemState | Specifies the state of the virtual machine. Values are Other (0), Unknown (1), Active (10), InActive (15), Suspended (20), and Disabled (25). |
| VirtualSystemType | Specifies a type of virtual system.<br>Values are Other (0),Unknown (1), LPAR (2), VM/VM Guest (3), VMware (4),Xen (20), LDOM (25), Solaris Container (30), HP nPartitions (35), VPar (40), and Microsoft Hyper-V (45). |
| ActualProvisionDate | The date and time that a specific VM was provisioned. This attribute is important for enabling successful reporting on BMC Dashboards. |

**Table 1-8: Key attributes for BMC_VirtualSystemSettingData (Sheet 2 of 2)**

| Attribute | Usage |
|---|---|
| `ProposedDecommissionDate` | The date and time that the VM will be removed from the environment. One of the biggest problems causing virtual system sprawl is that organizations do not decommission VMs and track the information. This attribute helps to drive workflow actions such as:<br>■ Notifying users that their VM is about to be decommissioned and enabling them to extend the time before that occurs.<br>■ Automatically creating change requests to begin the decommissioning process.<br>■ Automatically starting a job in BMC BladeLogic, BMC Atrium Orchestrator, and other consuming applications to decommission the VM. |
| `ActualDecommissionDate` | The date of the actual decommission. There can be an extension to that date to enable you to report or track a VM.<br>You can also compare differences between the decommission date and actual decommission date, or block future updates to the extension date. |

Figure 1-6 displays an organization that has a virtual system environment, where a Solaris server is divided into two domains (LDOM1 and LDOM2), which are further divided into containers (Container1 and Container2).

**Figure 1-6: Logical domain virtual systems with settings and containers**



## Best Practice

The recommended best practice for modeling this scenario would be:

For the virtualization environment, use `BMC_ComputerSystem`, where the `isVirtual` attribute is set to Yes. The parent system, which is either virtual or physical has to be related to the virtual system with a `BMC_Dependency` relationship where the attribute `Name` has a value of HostedVirtualSystem. To model the virtualization technology, `BMC_VirtualsystemEnabler` is related to the host system with the appropriate `EnablerType` attribute is set to the correct type of software (for example, LDOM Hypervisor) and relationships are set to `BMC_ComputerSystem` (the physical computer).

For containers, create a relationship to `BMC_VirtualsystemEnabler` (Solaris Resource Manager) and relationships to the domain (or physical computer, depending on the configuration), and operating system.

## Logical identity of BMC_ResourcePool for virtual systems

The BMC_ResourcePool class serves as a logical entity (with associated controls) provided by the host system to allocate and assign resources. A resource pool may be used to allocate resources of a specific type. Hierarchies of resource pools may be created to provide administrative control over allocations. In cases where resources are subdivided, multiple resource pools may exist.

Key attributes for defining resource pools using the BMC_ResourcePool class are described in Table 1-9.

**Table 1-9: Key attributes for BMC_ResourcePool**

| Attribute | Usage |
|---|---|
| Primordial | Specifies how the ResourcePool is used in the activity of resource management. If set to true, this attribute indicates that the ResourcePool is a base from which resources are drawn and returned in the activity of resource management. It also indicates that this ResourcePool shall not be created or deleted by consumers of this model. However, other actions (whether they are modeled or not), may affect the characteristics or size of primordial ResourcePools. If set to false (the default), this attribute indicates that the ResourcePool serves as a concrete Resource Pool, meaning that is subject to resource allocation services functions.<br>This distinction is important, because higher-level ResourcePools may be assembled using the Component or ElementAllocatedFromPool associations. Although the higher-level abstractions can be created and deleted, the most basic, hardware-based ResourcePools (such as primordial pools) cannot. Instead, they are physically realized as part of the system, or are actually managed by some other system and imported as if they were physically realized. |
| ResourceType | Specifies the type of resource that the resource pool may allocate. Values are Other (0), Computer System (2), Processor (3), Memory (4), IDE Controller (5), Parallel SCSI HBA (6), FC HBA (7), iSCSI HBA (8), IB HCA (9), Ethernet Adapter (10), Other Network Adapter (11), I/O Slot (12), I/O Device (13), Floppy Drive (14), CD Drive (15), DVD drive (16), Disk Drive (17), Tape Drive (18), Storage Extent (19), Other storage device (20), Serial port (21), Parallel port (22), USB Controller (23), Graphics controller (24), IEEE 1394 Controller (25), Partitionable Unit (26), Base Partitionable Unit (27), Power (28), Cooling Capacity (29), Ethernet Switch Port (30), Logical Disk (31), Storage Volume (32), Ethernet Connection (33). |

In systems that support over-commitment, pools represent the reservable capacity, not an upper bound or limit on the maximum amount that can be allocated. Admission control during power-on may detect and prevent systems from powering due to resource exhaustion. For example, over-commitment on a resource pool with `ResourceType` set to Memory would require that sufficient space be available in a backing store that might be managed through a storage resource pool. Figure 1-7 on page 34 illustrates an example virtual system model including resource pools.

## Logical identity of BMC_ResourceAllocationSettingData for virtual systems

The `BMC_ResourceAllocationSettingData` class (derived from `BMC_Settings`) represents settings that specifically relate to an allocated resource.

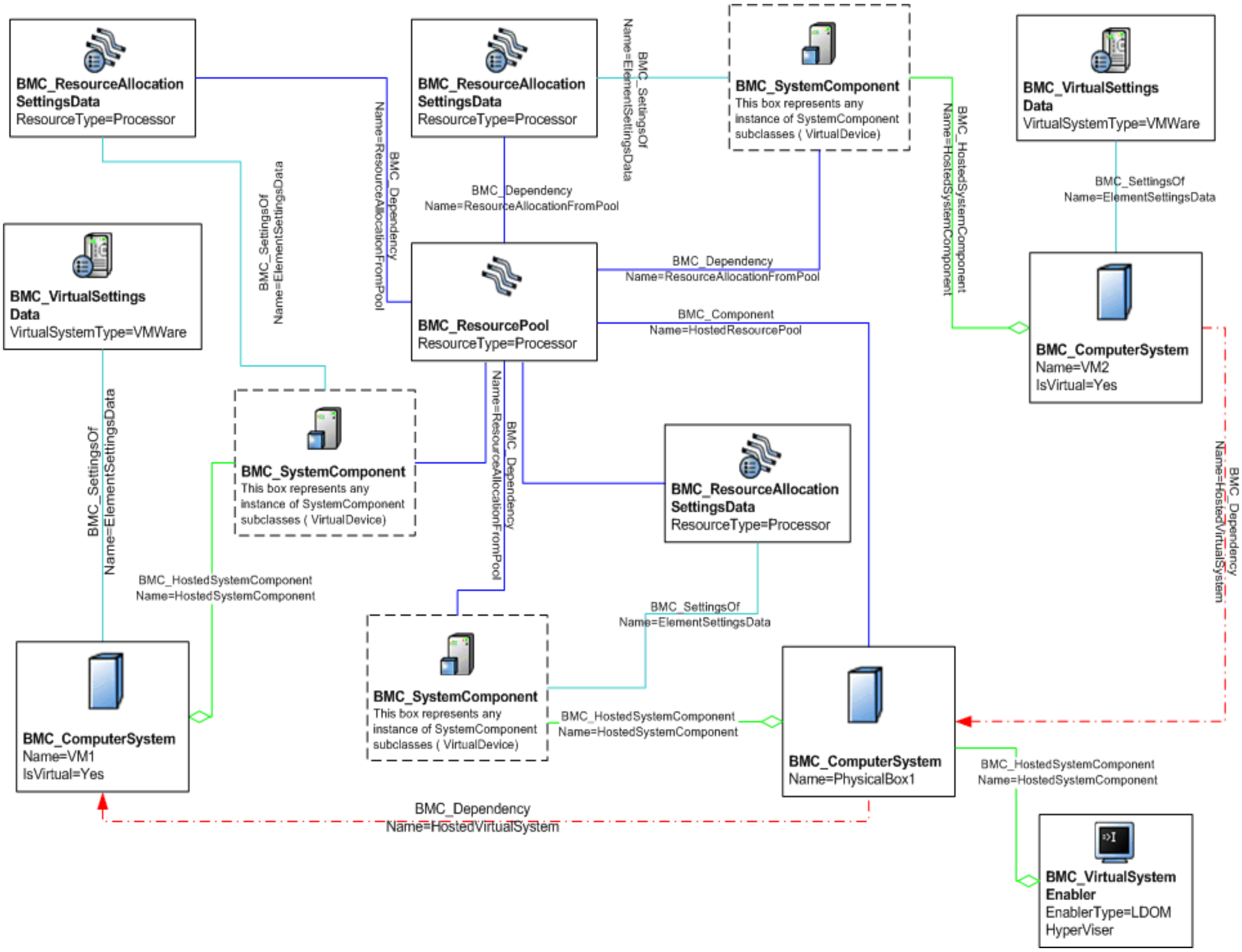
Use `BMC_VirtualSystemSettingData` and `BMC_ResourceAllocationSettingData` to represent virtual system settings, and `BMC_ResourcePool` to model resource pools. Figure 1-7 illustrates an example virtual system model including settings

The key attribute for defining settings using the `BMC_ResourceAllocationSettingData` class is `ResourceType`, described in Table 1-10.

**Table 1-10: Key attribute for ResourceAllocationSettingData**

| Attribute | Usage |
|---|---|
| `ResourceType` | Specifies the type of resource that this allocation setting represents. Values are Other (0), Computer System (2), Processor (3), Memory (4), IDE Controller (5), Parallel SCSI HBA (6), FC HBA (7), iSCSI HBA (8), IB HCA (9), Ethernet Adapter (10), Other Network Adapter (11), I/O Slot (12), I/O Device (13), Floppy Drive (14), CD Drive (15), DVD drive (16), Disk Drive (17), Tape Drive (18), Storage Extent (19), Other storage device (20), Serial port (21), Parallel port (22), USB Controller (23), Graphics controller (24), IEEE 1394 Controller (25), Partitionable Unit (26), Base Partitionable Unit (27), Power (28), Cooling Capacity (29), Ethernet Switch Port (30). |

Figure 1-7: Model of a virtual system with one resource pool and resource allocation



Using Figure 1-7 as an example, a physical box is related to BMC_ResourcePool by BMC_Component where the Name attribute is set to HostedResourcePool. Use the relationship class BMC_MemberOfCollection, where the Name attribute is set to isMemberofPool to allocate resources and resource pools. You can use the relationship class BMC_Dependency, where the Name attribute is set to ElementAllocatedFromPool to allocate resources and resource pools. You can also use the relationship class BMC_Dependency, where the Name attribute is set to ResourceAllocationFromPool to allocate resources and resource pools.

## Deprecated classes for virtual systems

The following classes were deprecated in BMC Atrium CMDB 7.5.00, and are no longer used for modeling virtualized environments:

- BMC_VirtualSystem (including all subclasses)
- BMC_VMWare
- BMC_VMWareVirtualSystem

- BMC_UnixVirtualSystem
- BMC_MFVirtualSystem
- BMC_MFVirtualSystemEnabler
- BMC_LPAR

## Relationships used for virtual systems

Table 1-11 describes the relationships for virtual systems.

**Table 1-11: Relationships used for virtual systems**

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Managed elements and setting data | BMC_SettingsOf | ELEMENTSETTINGDATA |
| Allocated resource and resource pool | BMC_MemberOfCollection | ISMEMBEROFPOOL |
| Resource allocated from a pool | BMC_Dependency | ELEMENTALLOCATEDFROMPOOL |

# Operating system modeling

An operating system is software or firmware that controls the operation of a computer and directs the processing of programs. This section describes how to model Windows and UNIX operating systems.

To model a Windows or UNIX operating system, create an instance of the BMC_OperatingSystem class. Associate the instance to the parent BMC_ComputerSystem instance by a BMC_HostedSystemComponents relationship.

***NOTE***

This class is not reserved for servers and workstations only but is used to capture any type of operating system, such as the IOS for a Cisco network switch or router.

## Logical identity of BMC_OperatingSystem

As with any related component of BMC_ComputerSystem, an operating system is identified by the Name attribute in conjunction with the SystemName attribute that represents the name of the parent instance of the computer. Therefore, the Name attribute represents the local name of the operating system CI in the context of the computer that is hosting it, as described in Table 1-13.

**Table 1-12: Key attributes for BMC_OperatingSystem**

| Attribute | Usage |
|---|---|
| Name | Identifies the name of the child instance in the context of the parent instance of BMC_ComputerSystem.<br>If multiple operating systems are installed on the same computer, Name must be structured so that the multiple instances have different names. |
| SystemName | Specifies the name of the system. This must be the same as the parent instance of the BMC_ComputerSystem Name attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the operating system and a computer system. |

## Additional attributes for BMC_OperatingSystem

Table 1-14 describes additional attributes of BMC_OperatingSystem.

**Table 1-13: Additional attributes of BMC_OperatingSystem**

| Attribute | Usage |
|---|---|
| Description | The description for the operating system. |
| ManufacturerName | The company that manufactured the operating system. |
| SerialNumber | The serial number of the operating system. |
| ShortDescription | A caption for the operating system. |
| VersionNumber | The version number of the operating system. |

# Hardware component modeling

The hardware components that make up a computer system are captured by subclasses of BMC_HardwareSystemComponent. Generally, one subclass represents one type of hardware component. Examples of hardware components include:

- Disk drive—Machine that reads data from and writes data to a disk.
- Disk partition—Logical allocation of space on a disk drive.
- Monitor—Video device attached to computer systems that displays computer operations.
- Keyboard—Set of typewriter-like keys that enables you to enter data into a computer.
- Memory—Stores information about internal storage areas in a computer.

- Processor—Device that interprets a machine instructions in a computer.
- Network port—Interfaces that connect network drives to computer systems.

For example, you might identify a specific processor as an instance of BMC_HardwareSystemComponent. Each instance representing a hardware component is associated to the parent BMC_ComputerSystem instance by the BMC_HostedSystemComponents relationship.

## Logical identity of BMC_HardwareSystemComponent

Like any child instance of BMC_ComputerSystem, a hardware component is identified by the Name attribute in conjunction with the SystemName attribute that represents the name of the parent computer instance. Therefore, the Name attribute represents the local name of the hardware CI in the context of the computer that is hosting it, as described in Table 1-15.

**Table 1-14: Key attributes for BMC_HardwareSystemComponent**

| Attribute | Usage |
|---|---|
| Name | Identifies the child instance in the context of the parent instance of BMC_ComputerSystem. |
| SystemName | Specifies the name of the system. This must be the same as the parent instance of BMC_ComputerSystem Name attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the operating system. |

## Additional attributes for BMC_HardwareSystemComponent

Table 1-16 describes additional attributes of BMC_HardwareSystemComponent.

**Table 1-15: Additional attributes of BMC_HardwareSystemComponent**

| Attribute | Description |
|---|---|
| Description | The description for the component. |
| ManufacturerName | The company that manufactured the component. |
| SerialNumber | The serial number of the component. |
| ShortDescription | A caption for the component. |
| VersionNumber | The version number of the component. |

Because each hardware component contains attributes specific to its type, see the BMC Atrium CMDB 7.6.04 Data Model Help for a complete list of BMC_HardwareSystemComponent types and attributes to ensure you can accurately and completely represent your specific hardware CIs.

# Access point modeling

A computer provides functions for other entities to use. Access points represent those available functions. Each access point represents the configuration of access to a function or the ability to invoke a service and is modeled by the BMC_AccessPoint class. This characteristic is further defined by BMC_ProtocolEndpoint, the only direct subclass of BMC_AccessPoint. Among other types of access points, a network address such as an IP address, MAC address, or IPX address, is captured as a subclass of BMC_AccessPoint.

Instances of the BMC_AccessPoint class are related to a computer system through a BMC_HostedAccessPoint dependency relationship. Access points exist within the context of a computer system, and are associated to their parent instance of the system through the BMC_HostedAccessPoint dependency relationship.

For example, Figure 1-4 on page 25 illustrates an example of a computer system's relationship to an IP endpoint, in the context of modeling a router.

## Logical identity of BMC_IPEndpoint

An IP address is modeled as an instance of BMC_IPEndpoint. Like any child instance of BMC_ComputerSystem, an instance of BMC_IPEndpoint is identified by the Name attribute in conjunction with the SystemName attribute that represents the name of the parent instance of the computer. Therefore, the Name attribute represents the local name of the CI in the context of the computer that is hosting it, as described in Table 1-17.

**Table 1-16: Key attributes for BMC_IPEndpoint**

| Attribute | Usage |
|---|---|
| Name | Identifies the child instance in the context of the parent instance of the BMC_ComputerSystem. Name must be an IPv4 or IPv6 address, and must be formatted as decimal numbers delimited by a period, with no leading zeros. |
| NameFormat | Sets the heuristic used to generate the Name value. This value must be set to IP. |
| SystemName | Specifies the name of the system. This must be the same as the parent instance of the BMC_ComputerSystem Name attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the operating system. |

## Additional attributes for BMC_IPEndpoint

Table 1-18 describes additional attributes of BMC_IPEndpoint.

**Table 1-17: Additional attributes of BMC_IPEndpoint**

| Attribute | Description |
|---|---|
| Address | The IP address. This value must be compliant with AddressType. |
| AddressType | The enumeration that defines the type of address. This value must be set to either 0 (Unknown), 1 (IPv4), or 2 (IPv6). |
| DNSName | The system name based on its DNS name. The DNS name corresponds to the IP address; therefore, when you want to search a system by DNS name, you should look up the IPEndpoint CIs, and then the parent computer. |
| ProtocolType | The enumeration that categorizes and classifies instances of this class. |
| ShortDescription | A caption of the IP address. |
| SubnetMask | The IP address subnet mask. |
| ManagementAddress | The selection that defines if the IP address is a management address such as a Discovered Address or an SNMP address. |

## Logical identity of BMC_LANEndpoint

A MAC address is modeled as an instance of BMC_LANEndpoint. Like any child instance of BMC_ComputerSystem, a MAC address is identified by the Name attribute in conjunction with the SystemName attribute that represents the name of the parent instance of the computer. Therefore, the Name attribute represents the local name of the CI in the context of the computer that is hosting it, as described in Table 1-19.

**Table 1-18: Key attributes for BMC_LANEndpoint**

| Attribute | Usage |
|---|---|
| Name | Identifies the MAC address. The value must be an address suffixed by an index. The index uniquely identifies a MAC address for situations where multiple identical MAC addresses are configured within the same system.<br>The index is generally the index of the MAC address entry in the SNMP MIB. |
| NameFormat | Specifies the heuristic used to generate the Name value. This value must be set to MACAddress:Index. |
| SystemName | Specifies the name of the system. This must be the same as the parent instance of the BMC_ComputerSystem Name attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the operating system. |

## Additional attributes of BMC_LANEndpoint

Table 1-20 describes additional attributes of BMC_LANEndpoint.

**Table 1-19: Additional attributes of BMC_LANEndpoint**

| Attribute | Description |
|---|---|
| Address | The MAC address. |
| ProtocolType | The enumeration that categorizes and classifies instances of this class, such as for 14 (for Ethernet). |
| ShortDescription | A caption of the MAC address. |

## Access point binding

Some access points use the services provided through another access point. You can use access point binding to establish a layering of two protocols, with the upper layer represented by the dependent and the lower layer represented by the antecedent.

This binding is modeled in the CDM by the BMC_Dependency relationship with the Name attribute set to BindsTo.

# Network interface and address modeling

Network interfaces are captured by instances of BMC_NetworkPort. Although model extensions might define subclasses (like a FiberChannel port), the class that you should use for network interfaces is BMC_NetworkPort. Like other hardware components, each instance of a network port is associated to the parent instance of the BMC_ComputerSystem by the BMC_HostedSystemComponents relationship.

Network addresses are captured by BMC Discovery products as access points (inherited from BMC_AccessPoint) and therefore must always be associated to their parent instance of the computer through the BMC_HostedAccessPoint relationship. Also, a network address can have a relationship to the network interface for which it is configured. This relationship is modeled by a BMC_Dependency relationship in which the network interface is the antecedent (source) and the network address is the dependent (destination).

For more information on modeling network addresses, including an illustration of the relationships used in the model, see Chapter 5, “Network topology modeling.”.

## Logical identity of BMC_NetworkPort

Like any child instance of BMC_ComputerSystem, a network port is identified by the Name attribute in conjunction with the SystemName attribute that represents the name of the parent instance of the computer. Therefore, the Name attribute represents the local name of the CI in the context of the computer that is hosting it, as described in Table 1-21.

**Table 1-20: Key attributes for BMC_NetworkPort**

| Attribute | Usage |
|---|---|
| Name | Identifies the network address. This must be an address suffixed by an index. The index uniquely identifies a MAC address for situations where multiple identical MAC addresses are configured within the same system.<br>The index is generally the index of the MAC address entry in the SNMP MIB. |
| NameFormat | Specifies the heuristic used to generate the Name value. For instance, in many cases, network interfaces are best discovered and identified using SNMP information. |
| PhysicalIndex | Specifies the index, which must be a valid SNMP index relative to the SNMP IF Table of the computer. |
| SystemName | Identifies the name of the system. This must be the same as the parent instance of the BMC_ComputerSystem Name attribute. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the operating system. |

## Additional attributes for BMC_NetworkPort

Table 1-22 describes additional attributes of BMC_NetworkPort.

**Table 1-21: Additional attributes for BMC_NetworkPort (Sheet 1 of 2)**

| Attribute | Description |
|---|---|
| AutoSense | The Boolean value that indicates whether the port can automatically determine the speed or other communications characteristics of the connected network media. |
| Description | The description for the component. |
| FullDuplex | The Boolean value that indicates whether the port is operating in full duplex mode (carrying signals in both directions). |
| LinkTechnology | The enumeration of the types of link technologies, with values such as Unknown, Other, Ethernet, IB, FC, FDDI, ATM, Token Ring, Frame Relay, Infrared, BlueTooth, or Wireless LAN. |
| ManufacturerName | The company that manufactured the component. |
| MaxSpeed | The maximum bandwidth of the port in bits/second. |
| NetworkAddresses | The list of strings specifying the network addresses for the port. |

**Table 1-21: Additional attributes for BMC_NetworkPort (Sheet 2 of 2)**

| Attribute | Description |
|---|---|
| `PermanentAddress` | The network address hard-coded into the port. This address can be changed by a firmware upgrade or software reconfiguration. If it is changed, update this field. If no hard-coded address exists for the network port, leave this attribute blank. |
| `PhysicalDescription` | The physical description or location for the port, such as slot3/port4. |
| `PortType` | The enumeration of the types of ports, with values such as Ethernet, FDDI, Token Ring, WAN, or Unknown. |
| `ShortDescription` | A caption for the component. |
| `SerialNumber` | The serial number of the component. |
| `SpeedConfigured` | The maximum bandwidth of the port in bits/second. |

# Software and hardware cluster modeling

Use the `BMC_Cluster` class to classify or update groups of software or hardware. Clusters are modeled using the `BMC_Cluster` class, which stores information about the cluster in relation to the `BMC_System` component.

Clusters help increase the performance of resources by storing groups of two or more computer systems or applications so that they operate together as a functional whole. Using clusters helps to improve and maintain the reliability, serviceability, and availability of your operating-system environment.

For example, an accounting department might create a cluster and link it with relationships to specific computer systems to obtain a complete picture of their business environment and assess the performance of computers individually and collectively.

Chapter

# 2 Application modeling

This section describes how to model software business entities, including applications, software servers, databases, and middleware.

The following topics are provided:

- Application characteristics (page 44)
- Application infrastructure and hosting environment (page 47)
- Relationships for applications (page 48)
- Business applications and services (page 49)

# Application characteristics

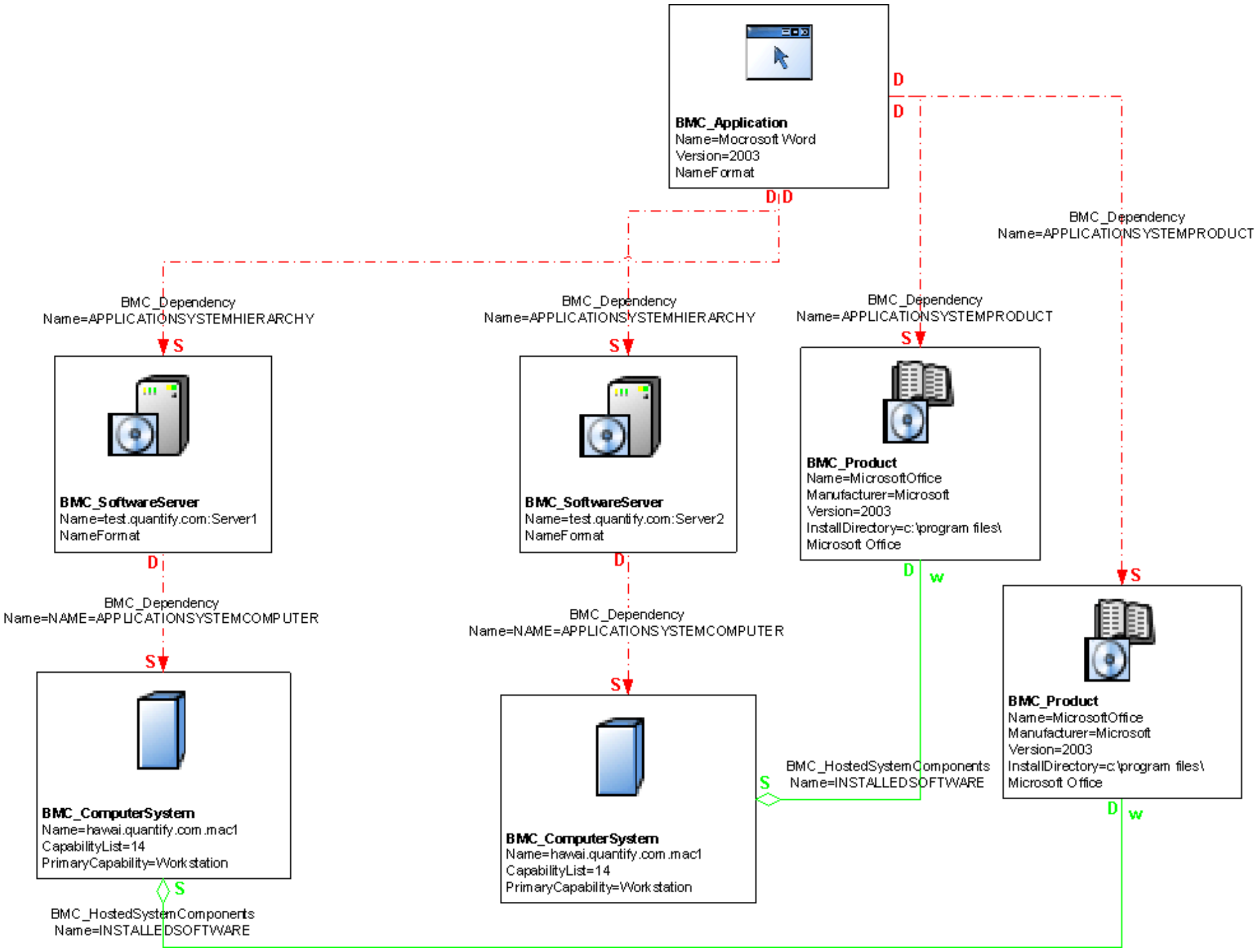
Applications have characteristics that help you determine how to best use the CDM in your modeling strategy. Table 2-1 maps the characteristics of an application to the type of class you would use to model that application. Note that not all objects and relationships are required to model certain types of applications. For example, patch information may not be required in the case of software license management.

**Table 2-1: Mapping application characteristics to a class**

| Characteristic | Description | Class |
|---|---|---|
| Runtime aspect | Running instances of applications and software servers | `BMC_SoftwareServer`<br>`BMC_Application`<br>`BMC_ApplicationInfrastructure` |
| Installation aspect | Identifies the product that is installed, its version, and any patch | `BMC_Product` |
| Service aspect | Business applications. (For business applications supporting a particular function such as payroll and trading, use the `BMC_BusinessService` class.) | `BMC_Application`<br>`BMC_BusinessService` |

Figure 2-1 on page 47 illustrates how the installed, runtime, and service aspects of an application relate to each other.

**Figure 2-1: Illustrative representation of multiple application aspects**



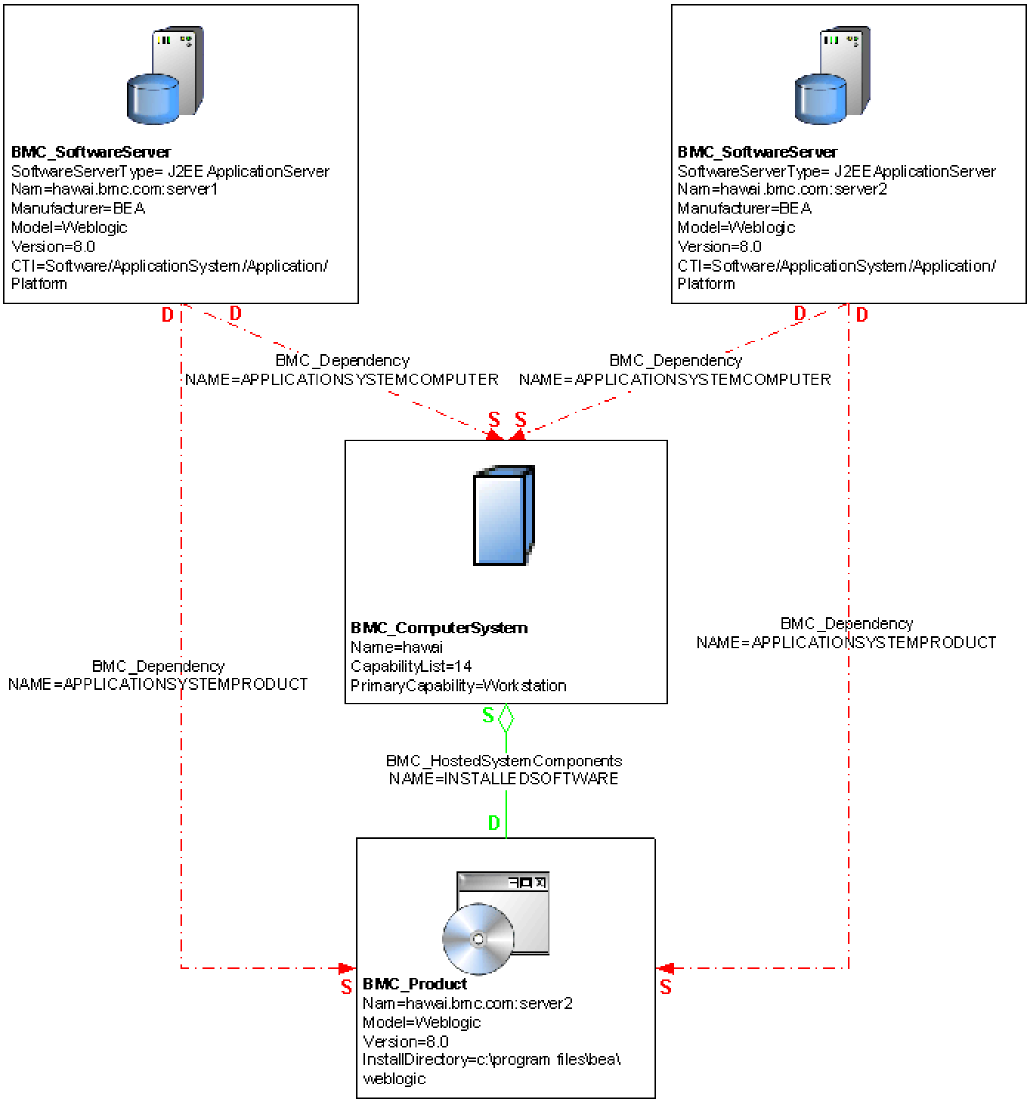
The BMC_SoftwareServer class represents the deployed, runtime aspects of applications; in other words, the instances of software actually running on a server. You instantiate this class to capture long-lived, server-type applications in your environment. When modeling applications, you must remember this distinction. To model static, installed components such as Microsoft Excel or Microsoft Word, create a BMC_Product instance.

You can also use the BMC_Product class to model noncommercial products, such as in-house software. One application can be installed once, yet have multiple instances running. For example, you can create a BMC_Product instance to represent the installed version of WebServer and create several BMC_SoftwareServer instances to represent actual instances of WebServer, one listening on port 80, another on port 8000, and a third on port 8080.

As another example, you would model Weblogic first by instantiating the BMC_Product class (to indicate where it is installed, the number of licenses, product name, and version). To add the runtime aspect, you would instantiate a BMC_SoftwareServer class.

Figure 2-2 illustrates an example of this model, where two instances of a Weblogic application server (server1 and server2) are actually instances of the same installed product.

**Figure 2-2: Illustrative model of a Weblogic application**


BMC_SoftwareServer
SoftwareServerType= J2EE ApplicationServer
Nam=hawai.bmc.com:server1
Manufacturer=BEA
Model=Weblogic
Version=8.0
CTI=Software/ApplicationSystem/Application/Platform
BMC_SoftwareServer
SoftwareServerType= J2EE ApplicationServer
Nam=hawai.bmc.com:server2
Manufacturer=BEA
Model=Weblogic
Version=8.0
CTI=Software/ApplicationSystem/Application/Platform
D
D
D
D
BMC_Dependency
NAME=APPLICATIONSYSTEMCOMPUTER
BMC_Dependency
NAME=APPLICATIONSYSTEMCOMPUTER
S
S
BMC_ComputerSystem
Name=hawai
CapabilityList=14
PrimaryCapability=Workstation
BMC_Dependency
NAME=APPLICATIONSYSTEMPRODUCT
BMC_Dependency
NAME=APPLICATIONSYSTEMPRODUCT
S
BMC_HostedSystemComponents
NAME=INSTALLEDSOFTWARE
D
S
S
BMC_Product
Nam=hawai.bmc.com:server2
Model=Weblogic
Version=8.0
InstallDirectory=c:\program files\bea\weblogic

Accounting for the runtime aspect of the application in this context is very important for understanding the impact of an application on a business service. You must consider capturing Weblogic patches (using the `BMC_Patch` class), because the patch will then be connected to the service through the installed product, runtime, applications and, ultimately, the service and its relationships. Consequently, an IT administrator responsible for updating patches on Weblogic would understand how the change relates to the business that Weblogic supports.

For complete descriptions of the classes described in this section for modeling applications, including examples of usage, see the BMC Atrium CMDB 7.6.04 Data Model Help. For more information about using the `BMC_Product` class to model components, see“Software inventory and patch modeling” on page 22.

# Application infrastructure and hosting environment

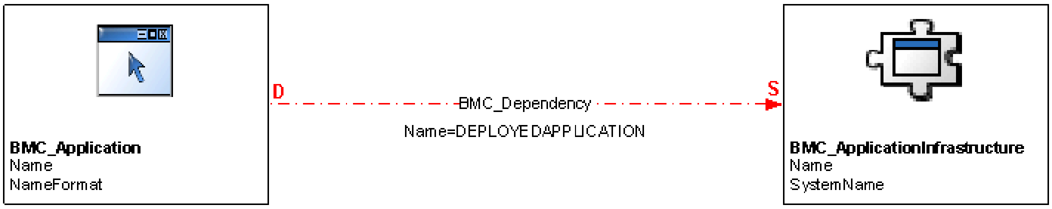
The BMC_Application class stores information about standalone applications, applications deployed on servers (such as SAP), and applications deployed on distributed systems (such as SAP).

The BMC_ApplicationInfrastructure class stores information about the framework that supports applications in a distributed or composite system. This class represents the platform to model your applications. For example, you would model SAP® as an instance of BMC_ApplicationInfrastructure. After an application is deployed in that platform, it can run on any application server in the SAP environment. An application can be hosted by different types of environments: an application server or application system, or a physical or virtual system.

## Applications running on application servers or application systems

To model applications to run directly on top of an application server or application system, relate an instance of the BMC_Application class to a hosting BMC_ApplicationInfrastructure instance. In this model, the application has only one relationship: a dependency on the application infrastructure hosting the application. This dependency is modeled by a BMC_Dependency relationship, as illustrated in Figure 2-3. When using the relationship, set the Name value to DEPLOYEDAPPLICATION.

**Figure 2-3: Illustrative model of applications running on application systems**



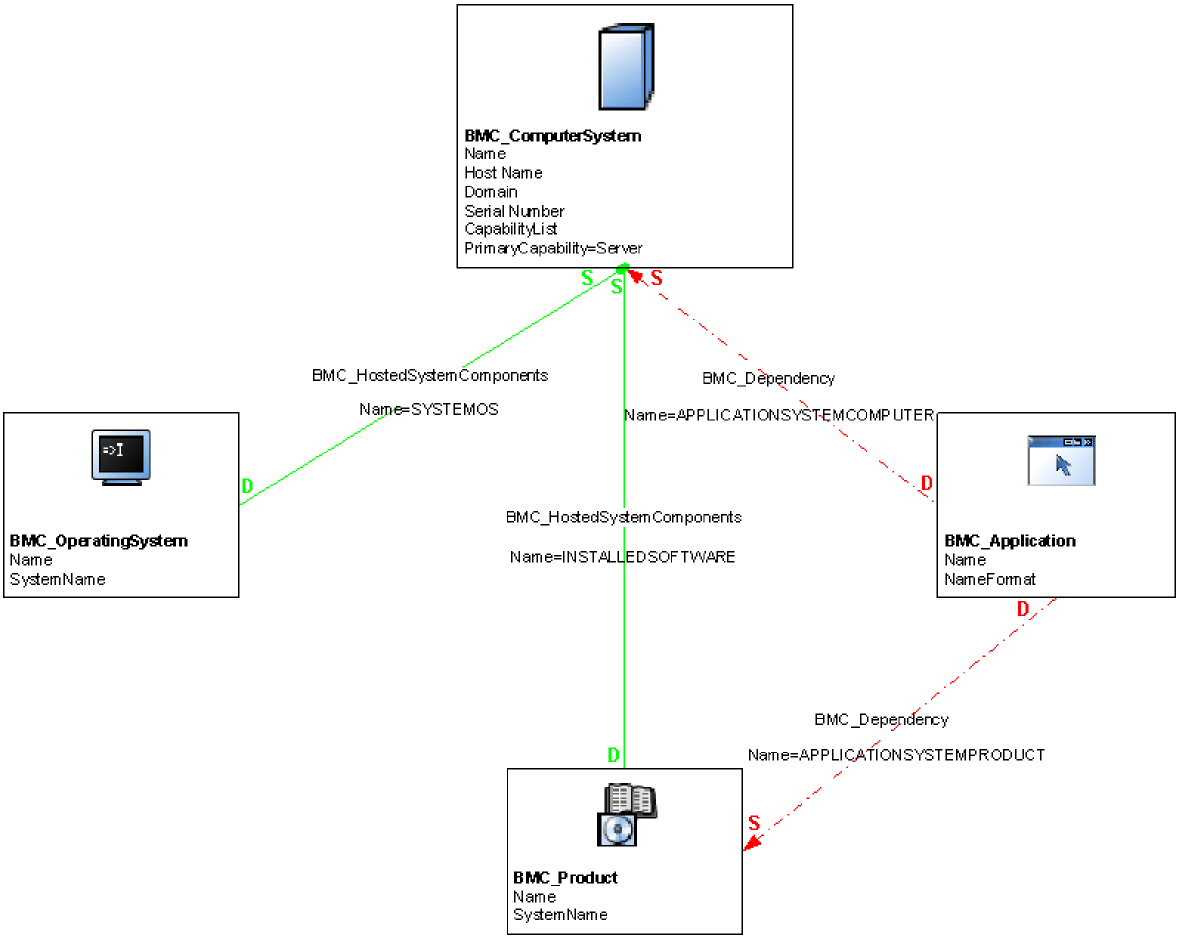
An application infrastructure cannot have any direct relationship to computers. Only applications and software servers have relationships to computers.

This model can also be applied to an application or set of applications that support or collaborate to provide a particular business function. For example, an Oracle® application infrastructure supports two applications, TimeCard and HR personal data, both stored in the BMC_Application class. The two classes relate to each other through the BMC_Dependency relationship, meaning that both the TimeCard and HR personal data applications are dependent on the supporting Oracle application infrastructure. To decompose the system into its functional components, relate an instance of this class to its component BMC_SoftwareServer instance with the BMC_Dependency class.

## Applications running on computer systems

To model applications to run on computer systems (physical or virtual), relate an instance of the `BMC_Application` class to a hosting physical or virtual `BMC_ComputerSystem` instance. Figure 2-4 illustrates this model.

**Figure 2-4: Illustrative model of applications running on computer systems**



# Relationships for applications

The relationships for modeling applications are described in Table 2-2.

**Table 2-2: Relationships for modeling applications**

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Application infrastructure hosting the application. | `BMC_Dependency` | DEPLOYEDAPPLICATION |
| System hosting the application (mandatory). | `BMC_Dependency` | APPLICATIONSYSTEMCOMPUTER |

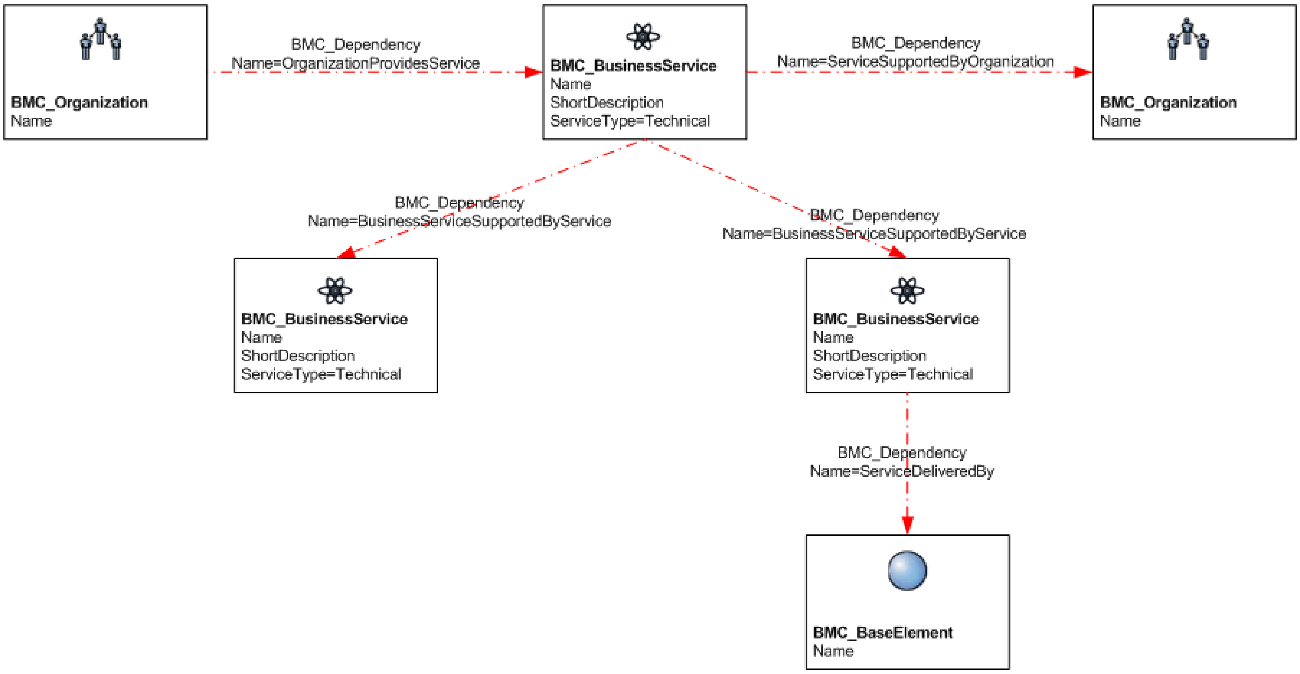
Table 2-2: Relationships for modeling applications (Continued)

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Operating system running the application (optional). | BMC_Dependency | APPLICATIONSYSTEMOS |
| Product representing the installed software of which this application is an instance (optional). | BMC_Dependency | APPLICATIONSYSTEMPRODUCT |

# Business applications and services

To model the business aspect of applications, use the BMC_BusinessService class. Business applications support a particular business function (such as payroll or trading) and are, generally, made up of a set of applications, servers, and databases that collaborate to provide a particular service.

Figure 2-5: Illustrative model of business services



***NOTE***

In this model, the BMC_BaseElement Name is typically an application or database.

Chapter

# 3 Software server modeling

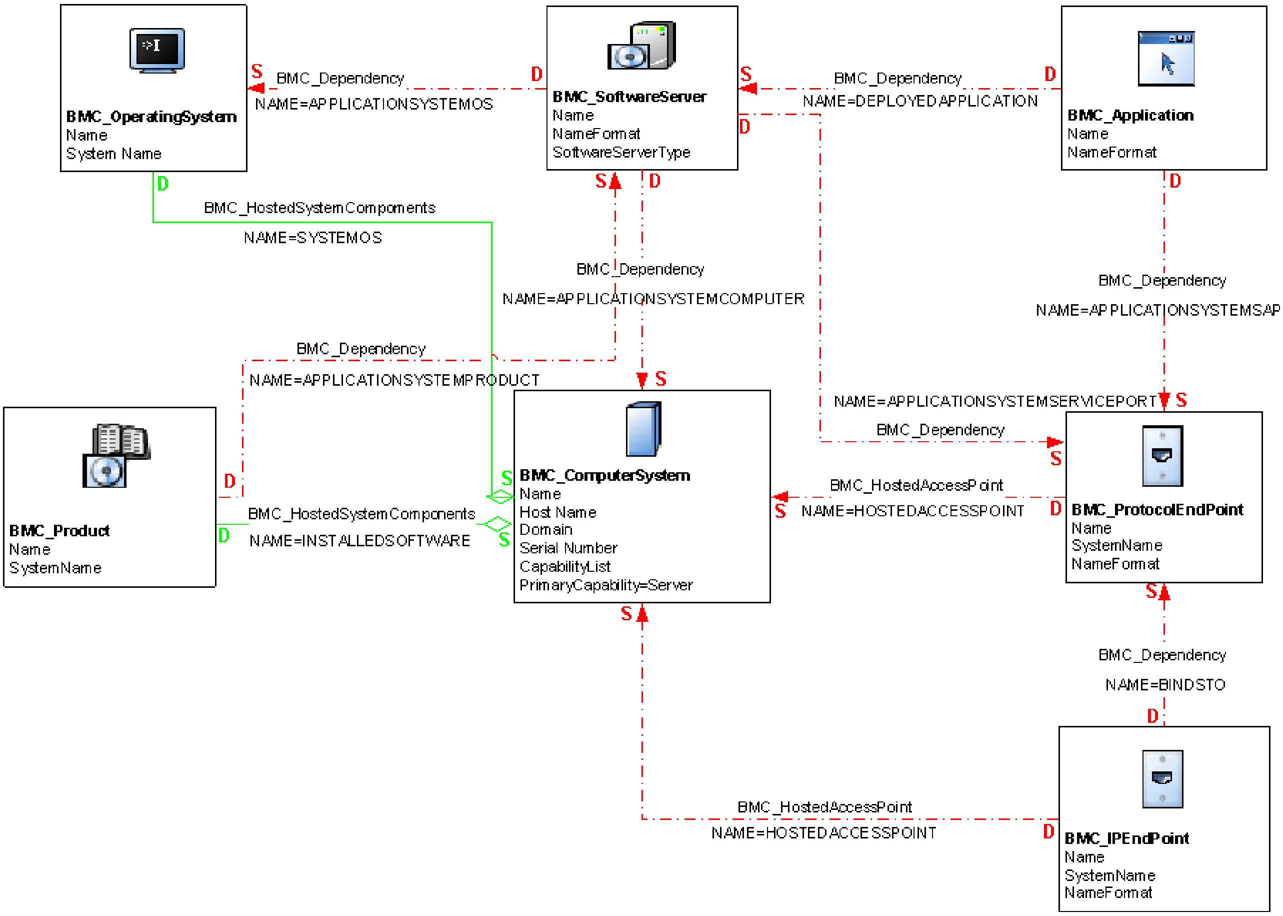
This section describes how to model software servers, such as database servers, web servers, DNS servers, mainframe servers, and directory servers.

The following topics are provided:

# Software server characteristics

A software server is a system that provides services to client applications and other servers, runs on top of a physical or virtual system, and is modeled using the BMC_SoftwareServer class. Figure 3-1 illustrates a software server model.

**Figure 3-1: Illustrative model of software servers**



# Logical identity of BMC_SoftwareServer

The BMC_SoftwareServer class stores information about a server that provides a single service to client applications or other systems. Database servers, web servers, DNS servers, mainframe servers, and directory servers can be represented by this class.

Table 3-1 details the key attributes used in the BMC_SoftwareServer class. When modeling software servers, you identify the unique server type by specifying its name in the SoftwareServerType attribute.

For example, for database servers, set the SoftwareServerType attribute to DatabaseServer.

Table 3-1: Key attributes for BMC_SoftwareServer

| Attribute | Usage |
|---|---|
| Name | Identifies the name of the software server. |
| NameFormat | Sets the heuristic used to generate the Name value. Set this attribute to name the installation directory of the server. |
| SoftwareServerType | Specifies the type of software server (for example, DatabaseServer). |

## Additional attributes for BMC_SoftwareServer

Table 3-2 describes additional attributes for BMC_SoftwareServer.

Table 3-2: Additional attributes for BMC_SoftwareServer

| Attribute | Description |
|---|---|
| ShortDescription | A caption of the software server. |
| TokenId | The unique identifier populated by BMC Discovery products and used by the Reconciliation Engine (of BMC Atrium CMDB) to identify instances. |

## Relationships for software servers

Table 3-3 describes the relationships for software servers.

Table 3-3: Relationships for software servers

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Computer system hosting the software server (mandatory). | BMC_Dependency | APPLICATIONSYSTEMCOMPUTER |
| Communication endpoint (one relationship per endpoint) that the software server is listening on. | BMC_Dependency | APPLICATIONSYSTEMSERVICEENDPOINT |
| Operating system running the application. This dependency is actually on the OS that is running the server (as opposed to the computer). | BMC_Dependency | APPLICATIONSYSTEMOS |
| Installed software of which this software server is an instance (optional). | BMC_Dependency | APPLICATIONSYSTEMPRODUCT |

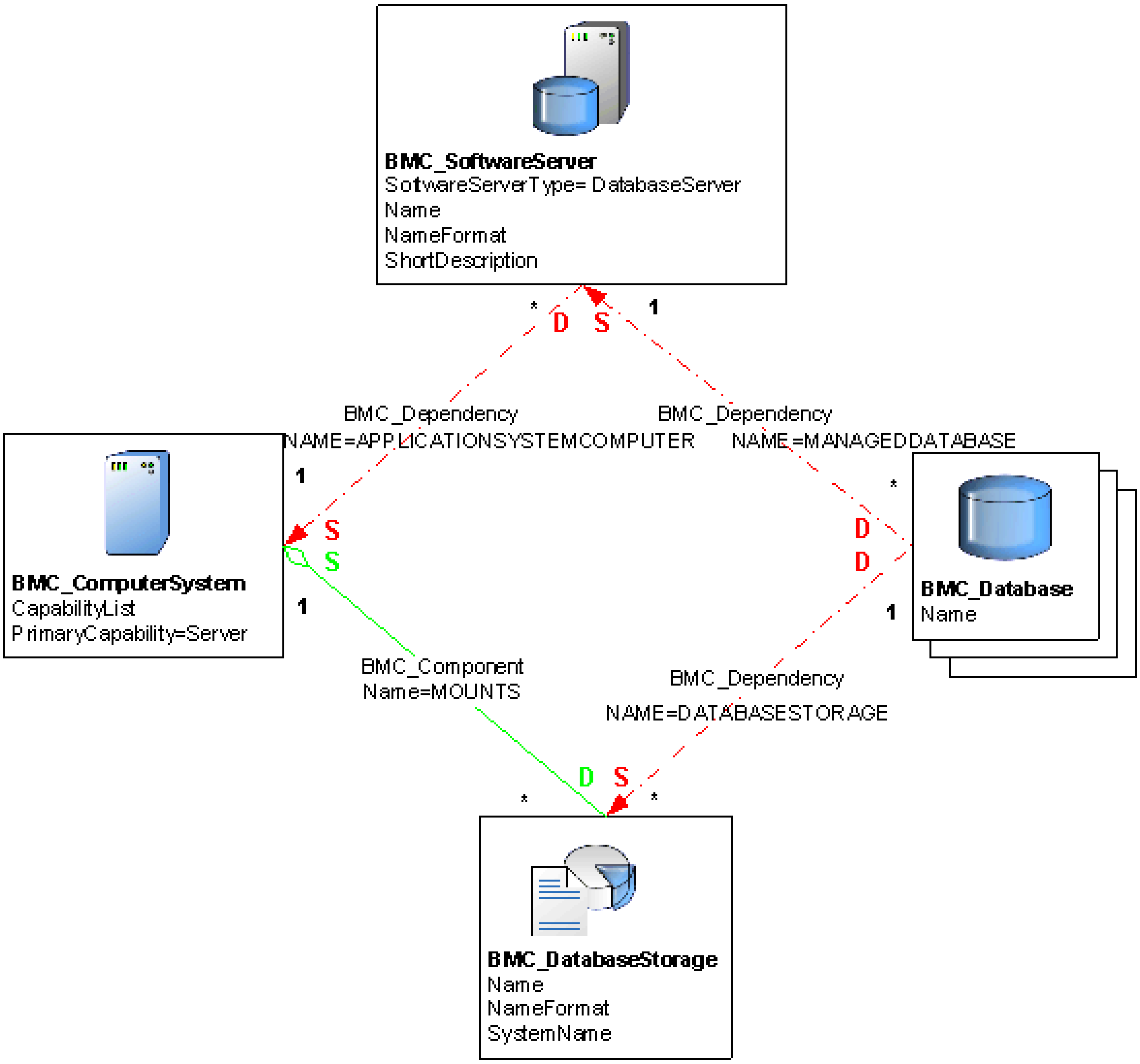
# Database server modeling

A database server is a form of software server that, like all software servers, must be uniquely named in the context of the CDM. A database server is modeled as an instance of the BMC_SoftwareServer class (derived from the BMC_ApplicationSystem class) and is identified by its Name attribute.

The key attribute for this class is SoftwareServerType, which must be set to DatabaseServer.

Figure 3-2 illustrates how to model a database server.

**Figure 3-2: Illustrative model of a database server environment**



# Database modeling

A database is a collection of interrelated data that is treated as a unit and that is organized into one or more schemas. Databases are dependent on software servers and, therefore, are dependent on database servers.

## Logical identity of BMC_DataBase

A database is modeled as an instance of the BMC_DataBase class (derived from the BMC_LogicalEntity class) and is identified by its Name attribute.

Table 3-4 describes the description and syntax for the Name and NameFormat attributes used in the BMC_DataBase class.

**Table 3-4: Key attributes for BMC_DataBase**

| Attribute | Usage |
|---|---|
| Name | Identifies the database. |
| NameFormat | As multiple valid naming conventions can be used in specific contexts, the NameFormat attribute must be set with a value indicating the heuristic used to generate the Name value. For example, in some cases, a computer system will be identified by an external DNS Name (a name configured in a DNS Server). In other cases, a static IP Address will be used. In any case, the values for NameFormat should be:<br>■ HostName.IP: The name must be a valid IP Address, decimal bytes delimited with dots ('.')<br>■ HostName.DNS: The name must a fully qualified host name, a host name and a domain name delimited with dots (the domain name can also consist of multiple components delimited with dots). |

The BMC_DataBase class defines the properties that are common across database models and vendor implementations for the database entity that is represented by the unit of interrelated data. Create an instance of this class for each managed database. You can use this class to specify the software that belongs to the database, perform system-wide database management operations (such as stopping all the databases that were created by the system for maintenance purposes), or view runtime statistics for the database.

To represent database storage areas, use the BMC_DataBaseStorage class. The key to a BMC_DataBase instance in an enterprise environment is its Name attribute. For more information about database storage, see “Database storage entity modeling” on page 58.

## Additional attributes for BMC_DataBase

Although databases are primarily defined by the Name attribute, Table 3-5 provide additional information about an instance of BMC_DataBase:

Table 3-5: Additional information for BMC_DataBase

| Attribute | Description |
|---|---|
| ShortDescription | A short description of the database. |
| TokenId | A unique identifier populated by BMC Discovery products and used by the Reconciliation Engine (of BMC Atrium CMDB) to identify instances. |

# Oracle Listener modeling

The Oracle Listener manages network communications for one or more database instances. An Oracle Listener is modeled as an instance of the BMC_SoftwareServer class (derived from BMC_ApplicationSystem) and is identified by both its Name attribute (set to Oracle Listener) and SoftwareServerType attribute (set to Other).

Table 3-6 details the attributes used to model Oracle Listeners.

Table 3-6: Attributes used to model Oracle Listeners

| Attribute | Usage |
|---|---|
| Name | Identifies the Oracle Listener. |
| NameFormat | Defines the heuristic used to generate the Name  value. |
| SoftwareServerType | Defines the type of server. This value must be set to Other. |
| ShortDescription | A caption of the database. |
| TokenId | Specifies the unique identifier populated by BMC Discovery products and used by the Reconciliation Engine to identify instances. |

# Relationships for database servers and databases

The BMC_Dependency class is a generic association used to establish dependency relationships between instances in the BMC Atrium CMDB. This association allows you to establish dependency relationships between endpoints, including the roles of the endpoints.

Table 3-7 describes the relationships for database servers and databases.

**Table 3-7: Relationships for database servers and databases**

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Computer system (source) and database server (destination) | BMC_Dependency | APPLICATIONSYSTEMCOMPUTER |
| Computer system (source) and Oracle Listener (destination) | BMC_Dependency | APPLICATIONSYSTEMCOMPUTER |
| Oracle Listener (source) and database server (destination) | BMC_Dependency | DEPENDENCY |
| Installed software of which this software server is an instance (optional). | BMC_Dependency | APPLICATIONSYSTEMPRODUCT |
| Database server (source) and database (destination) | BMC_Dependency | MANAGEDDATABASE |
| Computer system (source) and the file system (destination) | BMC_HostedSystemComponents | HOSTEDSYSTEMCOMPONENT |
| Database storage (source) and database (destination) | BMC_Component | DATABASEDATASTORAGE |

# Database storage entity modeling

Database storage entities are an extension of file system CIs in a database environment and are modeled using the BMC_DataBaseStorage class.

## Logical identity of BMC_DataBaseStorage

The BMC_DataBaseStorage class stores information about a collection of logical storage areas that hold and retain data. You model a database storage CI as an instance of the BMC_DataBaseStorage class (derived from the BMC_FileSystem class) and identify the instance by its Name and SystemName attributes. The BMC_DataBaseStorage class extends a file system CI and uses its inherited associations to represent the internal structure of the database.

Table 3-8 details the attributes used to model database storage CIs.

**Table 3-8: Key attributes for model database storage CIs**

| Attribute | Usage |
|---|---|
| Name | Identifies the storage area (tablespace) name. |
| NameFormat | Specifies the heuristic used to generate the Name value. Set it with the storage name used to generate the Name value. |
| SystemName | Specifies the name of the parent BMC_Database CI. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the operating system. |

## Additional attributes for BMC_DataBaseStorage

Table 3-9 describes attributes that provide additional information about an instance of BMC_DataBaseStorage.

**Table 3-9: Additional information for BMC_DataBaseStorage**

| Attribute | Description |
|---|---|
| IsSystemArea | The owner of the storage area. |
| ShortDescription | A caption of the database. |
| TokenId | A unique identifier populated by BMC Discovery products and used by the Reconciliation Engine to identify instances |

# Chapter 4 Storage entity modeling

This section details how to model storage entities and their relationship to the computer systems that will utilize the services provided.

The following topics are provided:

# Characteristics of storage entities and devices

Storage entities and devices that you want to model in your environment might include tape drives, disk drives, virtual disks, network-attached storage (NAS), and pool of storage subsystems.

# Modeling a tape drive

A tape drive is modeled as an instance of `BMC_TapeDrive` (derived from `BMC_Media`).

## Logical identity of BMC_TapeDrive

Table 5-1 describes key attributes of a tape drive.

**Table 4-1: Key attributes of a tape drive**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the instance. The unique name is not necessarily human-readable. |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value. |
| `SystemName` | Specifies the name of the system in which the component resides. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the tape drive. |

## Additional attributes for BMC_TapeDrive

Table 5-2 describes additional attributes of a tape drive.

**Table 4-2: Additional attributes of a tape drive**

| Attribute | Description |
|---|---|
| `Description` | The description of the instance. |
| `ManufacturerName` | The name of the vendor. |
| `MediaType`<br>(not inherited) | The type of media. Its value is always Removable Media. |
| `Model` | The tape drive model. |
| `ShortDescription` | A caption of the instance. |

## Tape drive instance

Table 5-3 illustrates an example instance.

Table 4-3: Example of a tape drive instance

| Attribute | Value |
|---|---|
| Description | 003590.B1A.IBM.13.000000044832.0080 |
| ManufacturerName | IBM |
| MediaType | Removable Media |
| Model | 3590-1 |
| Name | 003590.B1A.IBM.13.000000044832.0080 |
| NameFormat | Mainframe |
| ShortDescription | 003590.B1A.IBM.13.000000044832.0080 |
| SystemName | 003590.B1A.IBM.13.000000044832 |

# Modeling a DASD

A direct access storage device (DASD) is modeled as an instance of BMC_DiskDrive (derived from BMC_Media).

## Logical identity of BMC_DiskDrive

Table 5-4 describes key attributes of a DASD.

Table 4-4: Key attributes of DASD

| Attribute | Usage |
|---|---|
| Name | Identifies the instance of the disk drive. Use this attribute to specify the unique name of the instance; not necessarily human-readable. |
| NameFormat | Specifies the heuristic used to generate the Name value. |
| SystemName | Specifies the name of the system in which the component resides. This attribute is automatically populated from the related CI when a weak relationship is created between the computer system and the tape drive. |

## Additional attributes for BMC_DiskDrive

Table 5-5 describes additional attributes of a DASD.

Table 4-5: Additional attributes of DASD

| Attribute | Description |
|---|---|
| Description | The description of the instance. |
| ManufacturerName | The name of the mainframe vendor. |
| MediaType<br>(inherited from BMC_Media) | The type of media. Its value is always Fixed Hard Disk. |

Table 4-5: Additional attributes of DASD (Continued)

| Attribute | Description |
|---|---|
| Model | The DASD model. |
| SerialNumber | The manufacturer-allocated number used to identify the instance. |
| ShortDescription | A caption of the instance. |

## DASD instance

Table 5-6 illustrates an example of an DASD instance.

Table 4-6: Attributes of a DASD instance

| Attribute | Value |
|---|---|
| Name | 002105.000.IBM.13.000000025559.0B46 |
| NameFormat | Mainframe |
| SystemName | 002105.000.IBM.13.000000025559 |
| Description | 002105.000.IBM.13.000000025559.0B46 |
| ManufacturerName | IBM |
| MediaType | Fixed Hard Disk |
| Model | 3390 |
| SerialNumber | ADR071 |
| ShortDescription | ADR071 |

# Modeling a Virtual disk

A virtual disk refers to storage allocated to a virtual machine for use by the operating system. The file system is laid on the provided virtual disk. Virtual disks are created from a physical hard drive or allocated from NAS/SAN infrastructure. A virtual disk is modeled as an instance of BMC_LogicalDisk.

## Logical identity of BMC_LogicalDisk (virtual disk)

Table 4-7 describes key attributes of a virtual disk.

**Table 4-7: Key attributes of a virtual disk**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the logical disk with respect to the virtual machine to which the disk is allocated. The following list provides examples of the values that the Name attribute might contain, depending on the operating system:<br>■ Windows—the name of the drive, for example, E:\<br>■ UNIX—the access path, for example, '/dev/...' |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value. When this attribute is set to 'OS Device Name', the Name attribute is populated with a uniquely identifiable device name. |
| `SystemName` | Name of the computer system to which the logical device belongs. |

## Additional attributes of BMC_LogicalDisk

Table 4-8 describes additional attributes of a virtual disk.

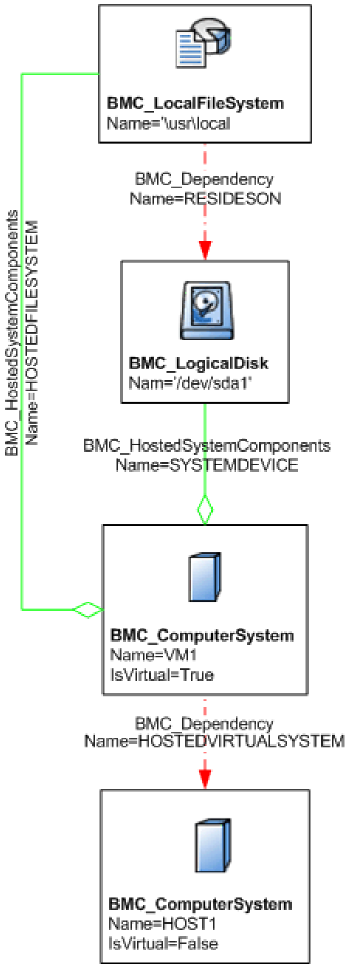
**Table 4-8: Additional attributes of a virtual disk**

| Attribute | Description |
|---|---|
| `BlockSize` | Size of the blocks (in bytes) that form the given storage extent. If the block size is variable, make sure that you specify the maximum block size in bytes. If the block size is unknown, specify a value of 1. |
| `NumberOfBlocks` | Total number of logical contiguous blocks that form the given storage extent. You can calculate the total size of the storage extent by multiplying the BlockSize by the value of the NumberOfBlocks attribute. If the BlockSize is 1, this property is the total size of the Extent. |
| `AvailableCapacity` | Indicates the total amount of free space (in bytes) that is available on the given storage extent. If the free space is unknown, specify a value of 0. |
| `ConnectionType` | The storage protocol used to communicate with the storage controller, for example, SCSI, iSCSI, FCoE, and Infiniband. |

## Modeling virtual disk allocated to a virtual machine

Model the virtual disk allocated to a virtual machine (VM) using the BMC_LogicalDisk class and create an association to the virtual machine using the SYSTEMDEVICE relationship. Figure 4-1 on page 64 illustrates a simple scenario where a virtual disk is allocated to a VM and a file system is installed on it.

**Figure 4-1: Modeling virtual disk allocated to virtual machine**



# Modeling logical disk allocated to a virtual machine from a resource pool

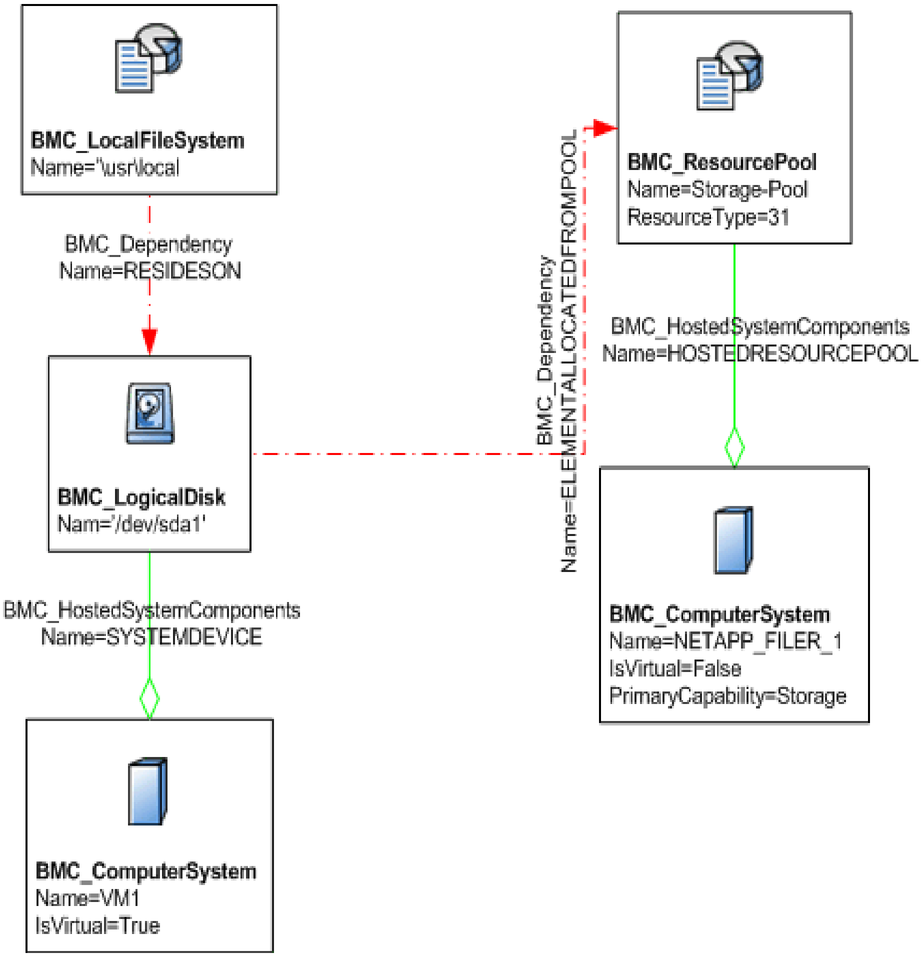
You can model storage resources that are allocated from the storage resource pool using the BMC_ResourcePool class. This class has attributes to store the capacity and utilization properties of the storage resources. The resource pool should be related to the storage system that hosts it using HOSTEDRESOURCEPOOL relationship.

You might have one or more virtual disks in your environment that are created from a storage system and are allocated to virtual machines. You model such virtual disks by using the BMC_LogicalDisk class. You can associate this class to the hosted virtual machine by using the SYSTEMDEVICE relationship. You will also need to associate the logical disk to the resource pool where it comes from by using the ELEMENTALLOCATEDFROMPOOL relationship.

You should model the file system laid by the virtual computer system on the logical disk by using the BMC_LocalFileSystem class. You associate this class to the logical disk by using the RESIDESON relationship. Associate the BMC_ComputerSystem class by using the HOSTEDFILESYSTEM relationship.

Figure 4-2 illustrates an example of a logical disk that is allocated from a resource pool and is hosted on a storage system.

**Figure 4-2: Modeling a logical disk**



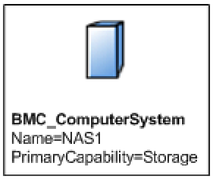
# Modeling a NAS device

This section describes how to model simple and complex NAS devices.

## Modeling a simple NAS device

To model a NAS device in a simple scenario, represent the NAS device using the BMC_ComputerSystem class. Set the PrimaryCapability attribute of the class to Storage. Figure 4-3 on page 66 illustrates how to model a simple NAS device.

**Figure 4-3: Modeling NAS device—simple**



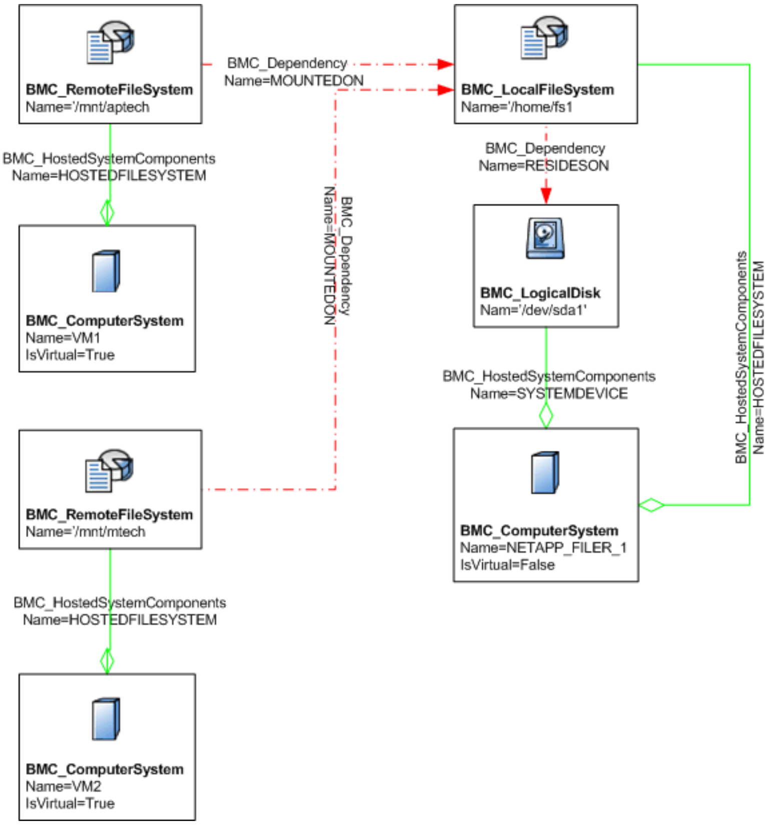
## Modeling a remote mounted file system

When a virtual machine mounts a file system from a network-attached storage (NAS) device, model the file system by using the BMC_RemoteFileSystem class.

You model the file system on the NAS device by using the BMC_LocalFileSystem class. You relate the remote file system to the local file system by using the MOUNTEDON relationship. Associate the remote file system with the computer system by using the HOSTEDFILESYSTEM relationship.

You can model various logical storage components in the NAS device by using the BMC_LogicalDisk class and the BMC_ResourcePool class. Figure 4-4 on page 66 illustrates an example where a virtual machine accesses a NAS device and uses the NAS to mount a file system from it.

**Figure 4-4:** Modeling a remote mounted file system



# Modeling raw storage

A raw storage volume might be directly mapped to a physical or virtual machine, provided a storage volume manager is present, from the host computer over the network, from SAN infrastructure, or a physical machine.

The virtualization platform, in order to access such volumes over the network, uses protocols such as iSCSI or Fiber Channel. Raw storage volume is modeled as an instance of `BMC_storageVolume`.

## Logical identity of BMC_StorageVolume (raw storage volume)

Table 4-9 describes key attributes of a raw storage volume.

**Table 4-9: Key attributes of a raw storage volume**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the storage volume allocated to a virtual machine. A unique device identifier that is returned from the storage system is populated in this attribute. |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value. |
| `SystemName` | Name of the computer system on which the storage volume is hosted. |

## Additional attributes of BMC_StorageVolume

Table 4-10 describes additional attributes of a raw storage volume.

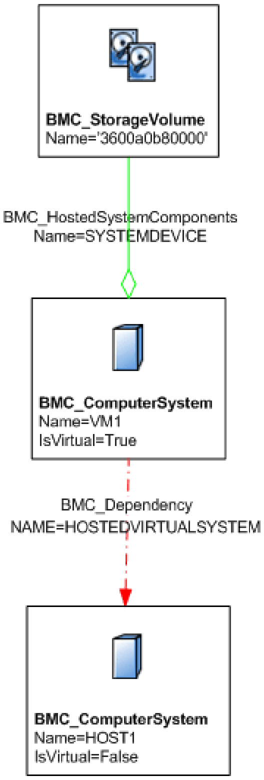
**Table 4-10: Additional attributes of a virtual disk**

| Attribute | Description |
|---|---|
| `LUNID` | A logical unit number (LUN) is the identifier of a device, which is being addressed by the SCSI protocol or similar protocols, such as Fiber Channel and iSCSI. |
| `BlockSize` | Size of the blocks (in bytes) that form the given storage extent. If the block size is variable, make sure that you specify the maximum block size in bytes. If the block size is unknown, specify a value of 1. |
| `NumberOfBlocks` | Total number of logical contiguous blocks that form the given storage extent. You can calculate the total size of the storage extent by multiplying BlockSize by the value of the NumberOfBlocks attribute. If the BlockSize is 1, this property is the total size of the Extent. |
| `AvailableCapacity` | Indicates the total amount of free space (in bytes) that is available on the given storage extent. If the free space is unknown, specify a value of 0. |
| `ConnectionType` | The storage protocol used to communicate with the storage controller, for example, SCSI, iSCSI, FCoE, and Infiniband. |

## Modeling storage volume allocated to a virtual machine

You can model storage volume allocations to virtual machines using the BMC_StorageVolume class and associate it to the containing computer using the SYSTEMDEVICE relationship. Figure 4-5 on page 68 illustrates a simple scenario where a storage volume is used in a virtual machine.

**Figure 4-5: Modeling storage volume allocated to virtual machine**



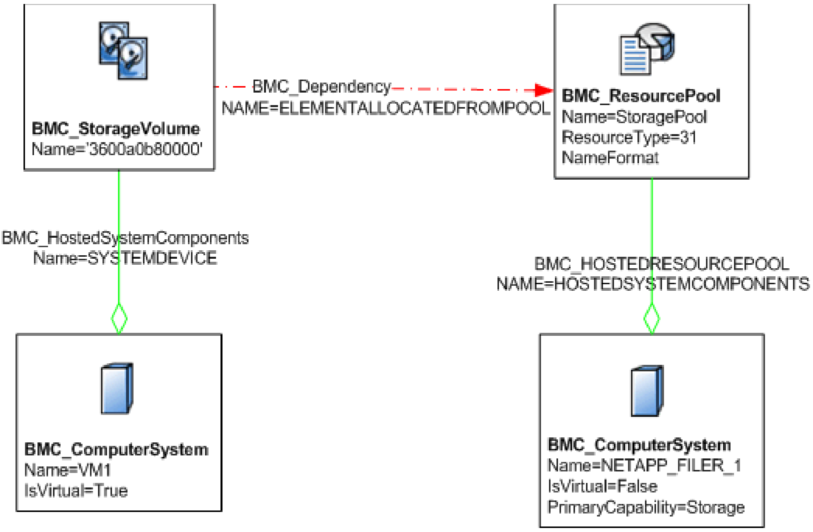
## Modeling storage volume allocated to a virtual machine from a resource pool

Model virtual machine, storage resource pool, and the storage system, as described in Modeling logical disk allocated to a virtual machine from a resource pool (page 64).

You should model the raw device that is mapped directly to a virtual machine by using the BMC_StorageVolume class. You associate this class to the resource pool by using the ELEMENTALLOCATEDFROM relationship and the BMC_ComputerSystem class that represents the virtual system by using the SYSTEMDEVICE relationship.

Figure 4-6 on page 69 illustrates an example of allocating a storage volume to a virtual machine from a storage system.

Figure 4-6: Modeling a raw storage volume



## Relationships for storage systems

Table 4-11 describes the relationships used for storage systems. Use the value listed in the table to specify the name for a relationship between any two storage classes.

Table 4-11: Relationships for storage systems

| Relationship | Relationship class | Value of Name attribute |
|---|---|---|
| Storage subsystem and an operating system | BMC_Dependency | STORAGESUBSYSTEMOS |
| Storage subsystem and a DASD | BMC_HostedSystemComponents | STORAGESUBSYSTEMDASD |
| Storage subsystem and a tape drive | BMC_HostedSystemComponents | STORAGESUBSYSTEMTAPE |
| File system hosted on a physical or virtual machine | BMC_HostedSystemComponents | HOSTEDFILESYSTEM |
| A logical disk allocated to a virtual machine | BMC_HostedSystemComponents | SYSTEMDEVICE |
| A file system residing on a logical disk | BMC_Dependency | RESIDESON |
| A storage volume allocated to a virtual machine | BMC_HostedSystemComponents | SYSTEMDEVICE |
| Relationship between a remote mounted file system such as NFS and the file system where it actually resides. | BMC_Dependency | MOUNTEDON |

Chapter

# 5 Network topology modeling

This section details how to model network topology, including components on a subnet, network interfaces, and LAN and WAN networks.

The following topics are provided:

# Network topology characteristics

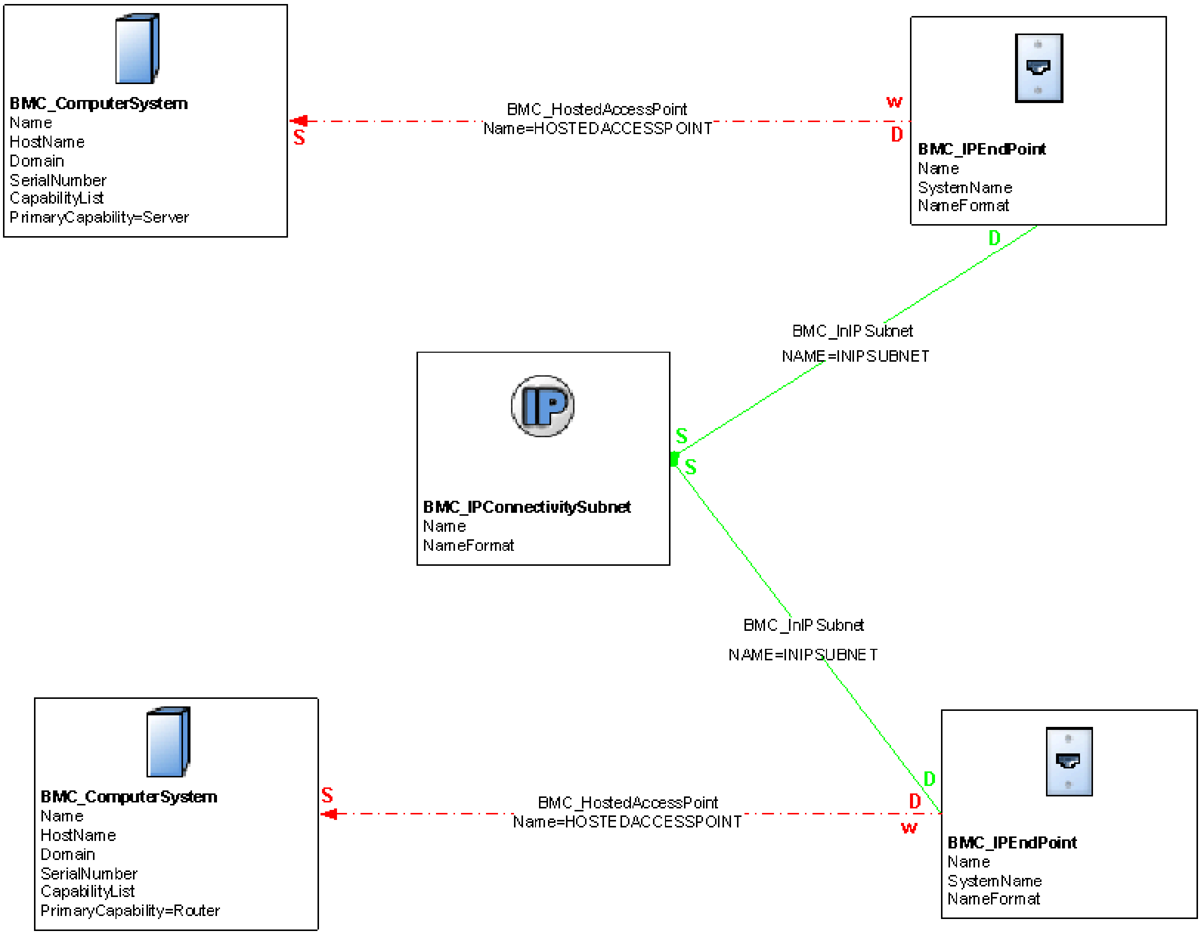
Topologies are based on the BMC_ConnectivityCollection class, which are collections of BMC_ProtocolEndpoint (communication points from which data may be sent or received) of the same type and which can communicate with each other. Logical groupings of these connectivity collections enable users to define the scope of LAN and WAN networks.

# L3 topology and IP connectivity modeling

A BMC_IPConnectivitySubnet instance represents a group of related BMC_IPEndpoint instances that can communicate with each other as members of a subnet and describes the characteristics of the subnet.

Figure 6-1 illustrates a server and a router that belong to the same subnet.

**Figure 5-1: Illustrative model of components on a subnet**



## Logical identity of BMC_IPConnectivitySubnet

Table 6-1 describes key attributes of BMC_IPConnectivitySubnet.

**Table 5-1: Key attributes for BMC_IPConnectivitySubnet**

| Attribute | Usage |
|---|---|
| Name | Identifies the IP address of the entire subnet, formatted according to the appropriate convention as defined in the AddressType attribute. When AddressType is 1 (IPV4), the Name must be built by concatenating the SubnetNumber and SubnetMask separated by a /. |
| NameFormat | Specify the heuristic used to generate the Name value, which must be set to IP. |

## Additional attributes for BMC_IPConnectivitySubnet

Table 6-2 describes attributes that provide additional information about BMC_IPConnectivitySubnet.

**Table 5-2: Additional attributes for BMC_IPConnectivitySubnet**

| Attribute | Description |
|---|---|
| AddressType | An enumeration that describes the format of the Name and SubnetNumber properties in IPConnectivitySubnet:<br>■ 0—Unknown<br>■ 1—IPv4<br>■ 2—IPv6 |
| PrefixLength | A prefix length for IPv6 addresses in the IP subnet (AddressType property is 2). |
| SubnetMask | The mask for the starting address of the IPv6 IP subnet (AddressType is 1). |
| SubnetNumber | The IP address of the entire subnet; must be equal to the Name attribute. |

## Relationships for components on a subnet

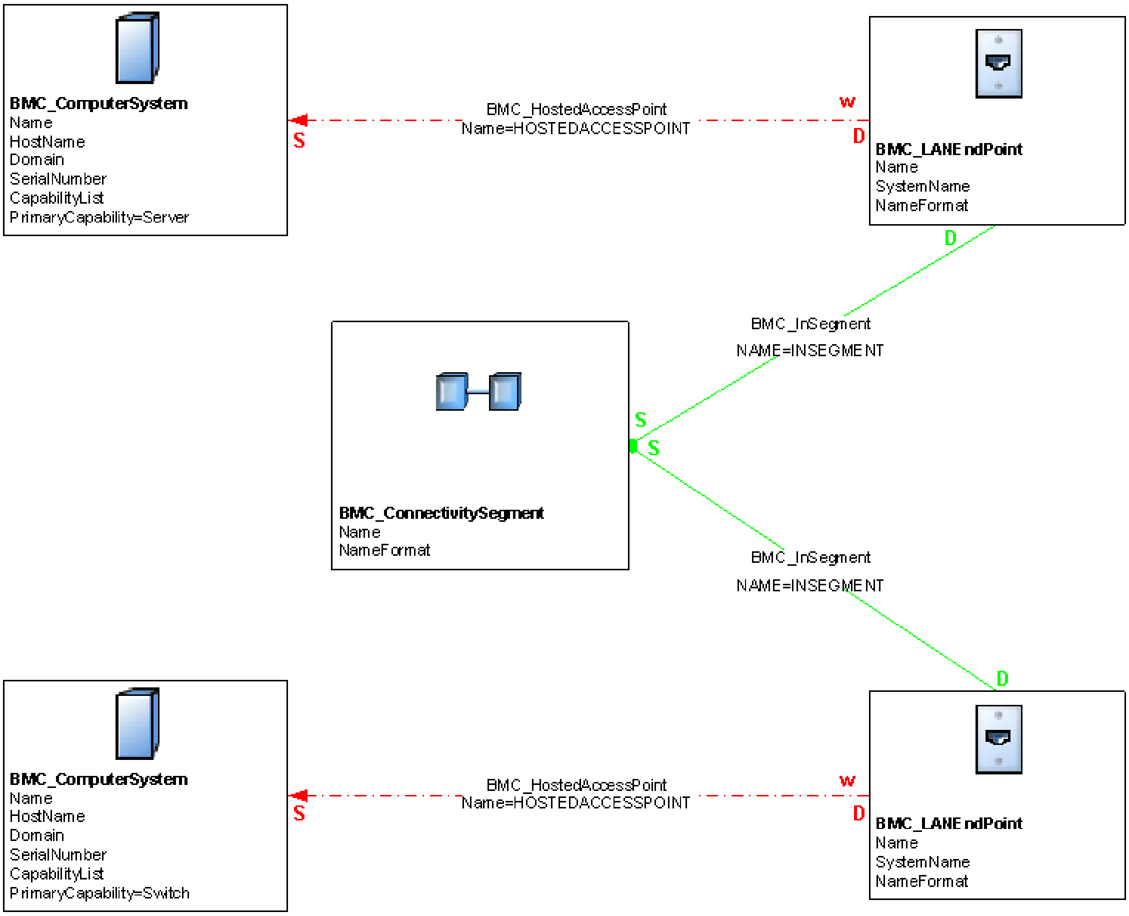
BMC_IPEndpoint instances are associated to the BMC_IPConnectivitySubnet to which they belong through the BMC_InIPSubnet relationship.

# L2 topology and physical connectivity modeling

A BMC_ConnectivitySegment instance represents a group of related instances of BMC_LANEndpoint of a particular type (such as Ethernet, token ring, or fiber channel) that can intercommunicate without the assistance of bridging or routing services. They are sometimes referred to as members of the same collision domain. The class describes the characteristics of the group, or segment.

Figure 6-2 illustrates a server and a switch, with the server having one NIC directly connected to a network interface of the switch.

**Figure 5-2: Illustrative model of a network interface**



## Logical identity of BMC_ConnectivitySegment

Table 6-3 describes key attributes of `BMC_ConnectivitySegment`.

**Table 5-3: Key attributes of BMC_ConnectivitySegment**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the connectivity segment, which uses the following information and generates a hash code as resulting value:<br>■ The list of physical addresses that belong to the segment.<br>■ The name of the LAN instance to which the segment belongs. |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value, which must be set to OID. |

## Additional attributes for BMC_ConnectivitySegment

Table 6-4 describes attributes that provide additional information about BMC_ConnectivitySegment.

**Table 5-4: Additional attributes for BMC_ConnectivitySegment**

| Attribute | Description |
|---|---|
| ConnectivityType | An enumeration that describes the type of technology used:<br>■ 0—Unknown<br>■ 1—Other<br>■ 2—Ethernet<br>■ 3—Token Ring<br>■ 4—FDDI<br>■ 5—Fiber Channel |
| Count | The current number of endpoints connected to this segment. When this value equals 2 it indicates a direct connection between the two network ports interconnected by means of the segment. |

## Relationships for network interfaces

Instances of BMC_LANEndpoint are associated to the BMC_ConnectivitySegment to which they belong through the BMC_InSegment relationship.

# Network topology and LAN and WAN network modeling

LAN and WAN networks do not have a well-known identifier, such as an IP address or mask for an IP subnet. These networks are characterized by the list of machines that can intercommunicate at the physical level without crossing the boundaries of gateways. This description includes the infrastructure network devices (switches, hubs) that enable these machines to communicate. In the CDM, LANs and WANs are captured by entities that aggregate that list of IP subnets.

Figure 6-3 illustrates a LAN that aggregates IP subnets.

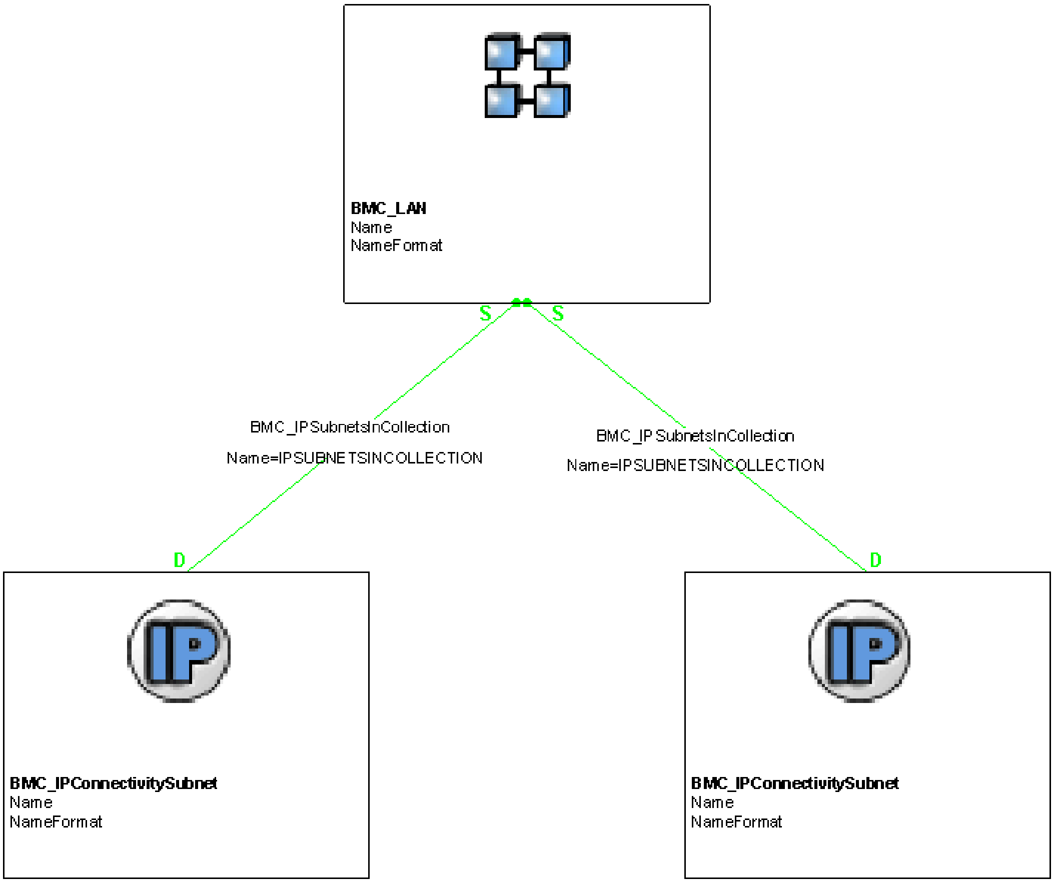

BMC_LAN
Name
NameFormat
S
S
BMC_IPSubnetsInCollection
Name=IPSUBNETSINCOLLECTION
BMC_IPSubnetsInCollection
Name=IPSUBNETSINCOLLECTION
D
D
BMC_IPConnectivitySubnet
Name
NameFormat
BMC_IPConnectivitySubnet
Name
NameFormat

**Figure 5-3: Illustrative model of a LAN**

Figure 6-4 illustrates an example of a WAN that aggregates IP subnets.

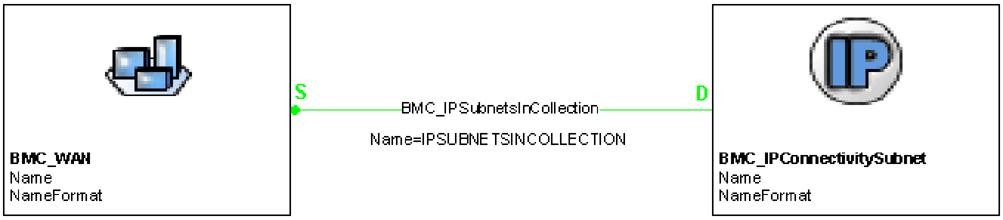


**Figure 5-4: Illustrative model of a WAN**

## Logical identity of BMC_LAN

You can model a virtual LAN by using the BMC_LAN class and setting its IsVirtual attribute to True. Table 6-5 describes key attributes of `BMC_LAN`.

**Table 5-5: Key attributes of BMC_LAN**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the LAN, computed from the list of IP subnets that make up the LAN. The name for the LAN is the lexicographically lower value of the names of IP subnets. |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value, which must be set to OID. |

## Logical identity of BMC_WAN

Table 6-6 describes key attributes of a `BMC_WAN`.

**Table 5-6: Key attributes of BMC_WAN**

| Attribute | Usage |
|---|---|
| `Name` | Identifies the WAN, computed from the list of IP subnets that make up the WAN. The name for the WAN is the lexicographically lower value of the names of IP subnets. |
| `NameFormat` | Specifies the heuristic used to generate the `Name` value, which must be set to OID. |
| `WANType` | Specifies the enumeration that describes the type of technology used:<br>■ 0—Unknown<br>■ 1—Other<br>■ 2—ATM<br>■ 3—Frame relay |

Appendix

# A Summary of changes to the Common Data Model

This section lists all the change to the Common Data Model in the 7.6.00 release.

The following topics are provided:

- Changes to the BMC Atrium CMDB 7.5.00 Common Data Model (page 80)
- Changes to the BMC Atrium CMDB 7.6.00 Common Data Model (page 81)
- Changes to the BMC Atrium CMDB 7.6.03 Common Data Model (page 82)
- Changes to the BMC Atrium CMDB 7.6.04 Common Data Model (page 83)

# Changes to the BMC Atrium CMDB 7.5.00 Common Data Model

The following CI classes were added to the CDM in BMC Atrium CMDB 7.5.00:

**Table A-1: New CI classes in BMC Atrium CMDB 7.5.00**

| CI class | Description |
|---|---|
| BMC_Offering | stores information about service offerings that are part of a high-level service |
| BMC_ServiceLevelTarget | stores information about Service Level Targets (SLTs) |
| BMC_Contract | acts as a container object made up of line items that establish a specific agreement between a provider and a customer |
| BMC_ContractLine | stores contract line items that establish specific agreements between the provider and the customer |
| BMC_Transaction | specifies a single transaction initiated by an end user or system |
| BMC_ResourcePool | serves as a logical entity (with associated controls) provided by the host system to allocate and assign resources |
| BMC_ResourceAllocationSettingData | represents settings that specifically relate to an allocated resource that is outside the scope of the CIM class (which is typically used to represent the resource itself) |
| BMC_VirtualSystemSettingData | defines the virtual aspects of a virtual system through a set of virtualization-specific properties |
| BMC_Settings | represents additional attributes of a given CI that are not part of the CI type definition |

The following relationship classes were added to the CDM in BMC Atrium CMDB 7.5.00:

**Table A-2: New relationship classes in BMC Atrium CMDB 7.5.00**

| Relationship class | Description |
|---|---|
| BMC_Impact | represents a generic association used to establish impact relationships between objects |
| BMC_SettingsOf | represents the association between ManagedElements and applicable setting data |
| BMC_ServiceRealizedByOffering | defines the relationship between the business service and the offering |
| BMC_OfferingMeasuredBy | defines the relationship between the offering and the Service Level Target |
| BMC_ContractComponent | defines the relationship between the contract and the contract line item |

The BMC_VirtualSystem class was removed. The VirtualSystemType attribute from the removed class was added to BMC_ComputerSystem. The TotalMemory attribute was deleted. Your virtual system information should be stored in BMC_ComputerSystem.

# Changes to the BMC Atrium CMDB 7.6.00 Common Data Model

The following classes and attributes have been added in BMC Atrium CMDB 7.6.00.

**Table A-3: New classes and attributes in BMC Atrium CMDB 7.6.00**

| New Class | Existing class | New attributes |
|---|---|---|
| BMC_Geneology | Not applicable | No attributes |
| Not applicable | BMC_VirtualSystemSettingData | ActualDecommissionDate,<br>ActualProvisionDate,<br>ProposedDecommissionDate |

## Attributes that have been moved

In BMC Atrium CMDB 7.6.00, the isVirtual attribute was moved from the BMC_ComputerSystem class to the BMC_System and BMC_SystemComponent classes. This move expands the virtualization scope beyond computer systems, enabling you to model potential future virtualizable entities, such as applications. Because BMC_ComputerSystem is a subclass of the BMC_System class, the isVirtual attribute is still available in the BMC_ComputerSystem class.

## Attributes that have been hidden

The Dimensions attribute in the BMC_ComputerSystem class is hidden in the Console view but can be seen in the Class Manager.

# Changes to the BMC Atrium CMDB 7.6.03 Common Data Model

The following classes and attributes have been added in BMC Atrium CMDB 7.6.03.

**Table A-4: New classes and attributes in BMC Atrium CMDB 7.6.03**

| New class | Existing class | New attributes |
|---|---|---|
| BMC_MFCouplingFacility | Not applicable | CFRMName, CFRMSiteName, NodeDescriptor, Storage |
| BMC_StorageSubsystem | Not applicable | No attributes added |
| Not applicable | BMC_BaseElement | ADDMIntegrationId, MarketVersion, NormalizationStatus, ReconciliationMergeStatus |
| Not applicable | BMC_ComputerSystem | IsUnqualified |
| Not applicable | BMC_IPEndpoint | IsUnqualified |
| Not applicable | BMC_ApplicationSystem | MFJobName, MFServerId |
| Not applicable | BMC_BaseRelationship | ImpactSourceId, ImpactDestinationId, NormalizationStatus, ReconciliationMergeStatus |
| Not applicable | BMC_HostesAccessPoint | IsUnqualified |
| BMC_MFCouplingFacility | Not applicable | CFRMName, CFRMSiteName, NodeDescriptor, Storage |

## Classes that have been deprecated

The `BMC_Impact` relationship class is deprecated and is mapped to the `BMC_BaseRelationship` class. The `HasImpact` attribute of the `BMC_BaseRelationship` class is set to "Yes" and the `Name` attribute is set to "ImpactOnly".

# Changes to the BMC Atrium CMDB 7.6.04 Common Data Model

The following classes and attributes are added in BMC Atrium CMDB 7.6.04.

**Table A-5: New classes and attributes in BMC Atrium CMDB 7.6.04(Sheet 1 of 2)**

| New class | Existing class | New attributes |
|---|---|---|
| Not applicable | BMC_BaseElement | ReconciliationIdType, LastUpdatedDatasetId |
| Not applicable | BMC_BaseRelationship | ReconciliationIdType, LastUpdatedDatasetId |
| Not applicable | BMC_Offering | IsLocked, WarrantyLevel |
| Not applicable | BMC_ServiceLevelTarget | SLTClassification |
| Not applicable | BMC_Document | DocumentPurpose, ExecutionDate, TerminationDate |
| Not applicable | BMC_BusinessService | ServiceLifeCycle |
| Not applicable | BMC_ContractLine | Quantity, PerPricePeriod, PriceAmount, PriceUOM, ServiceRequestId |
| Not applicable | BMC_FileSystem | FileSystemSize, AvailableSpace, FileSystemType, BlockSize |
| Not applicable | BMC_Collection | IsVirtual |
| Not applicable | BMC_ResourcePool | HighWaterMark, LowWaterMark, MaxConsumableResource, MinConsumableResource |
| BMC_ServiceOffering | Not applicable | IsDefault |
| BMC_RequestableOffering | Not applicable | IsAddOn, DeliveryRO |
| BMC_ServiceOfferingInstance | | ActualDecommissionDate, ProposedDecommissionDate, ProvisionDate |
| BMC_Option | | ChoiceSelectionMode, FulfillmentDetails, OptionType |
| BMC_OptionChoice | | Sequence, IsDefault |
| BMC_FinancialElement | | PerTimePeriod, UOM |
| BMC_Cost | | CostAmount, CostDeliveredFlag |

**Table A-5: New classes and attributes in BMC Atrium CMDB 7.6.04(Sheet 2 of 2)**

| New class | Existing class | New attributes |
|---|---|---|
| BMC_Price | | IsLocked,<br>MaximumQuantity,<br>MinimumQuantity,<br>PriceAmount,<br>PriceLifeCycle,<br>PriceQuantity |
| BMC_StorageExtent | Not applicable | BlockSize, NumberOfBlocks, AvailableCapacity, ConnectionType |
| BMC_LogicalDisk | Not applicable | No attributes added |
| BMC_StorageVolume | Not applicable | LUNID |
| BMC_Tag | Not applicable | IsCategory, CategoryName |
| Not applicable | BMC_Offering | IsLocked, WarrantyLevel |

## Classes and attributes that are deprecated

The OfferingType attribute of the BMC_Offering class is deprecated. Use the BMC_ServiceOffering or the BMC_RequestableOffering derived classes instead of the BMC_Offering class to store OfferingType information for a service.

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