

Pegasus Project Working Paper

CIMOM Shutdown

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Introduction

In a typical WBEM environment, once the CIMOM is started, it is expected to be always running and ready to service CIM requests. On occasions, the CIMOM does require to be shutdown. For example, the system administrator needs to backup the CIM repository or upgrade the CIMOM to a new release.

Currently, there is no mechanism in the Pegasus WBEM implementation for shutting down the CIMOM gracefully. The only way to terminate the CIMOM is to kill the CIMOM process (on Unix) or stop the Pegasus service (on Windows). Terminating CIMOM abruptly may cause undesirable consequences if there are CIM operations in progress. Providers that are running may not have a chance to complete the operations in progress and perform the necessary cleanup steps. The CIM clients may not get any responses back from the CIMOM. To ensure a graceful shutdown, a CIMOM shutdown mechanism must be provided in the Pegasus implementation.

This paper is a proposal to add such a mechanism.

Summary of Proposed Changes

The following is a summary of the proposed changes:

1. Add a new command line interface for shutting down CIMOM.
2. Add a new CIMOM Shutdown Service to handle the CIMOM shutdown request.
3. Define configurable shutdown timeout properties.
4. Define provider behavior for provider termination.

These changes will be described in more details below.

Definition of the Proposed Changes

This section defines the proposed changes required to implement the CIMOM shutdown

solution.

CIMOM shutdown Command Line Interface (CLI)

In the Pegasus implementation, the 'cimserver' command is used to start up CIMOM. This command will be enhanced to add a new option for shutting down CIMOM. The following is the proposed command line interface:

Command Syntax:

```
cimserver -s [-t timeout_value] [-f]
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Description:

- s The '-s' (shutdown) option provides a way to shutdown the CIMOM gracefully.

- t timeout_value The '-t' (timeout) option is used to specify the maximum amount of time (in seconds) the user is willing to wait for all the CIM operations to complete before shutting down the CIMOM. If all the CIM operations cannot be completed within this timeout period, CIMOM will not be shutdown.

 If this option is not specified, a configurable default timeout value will be used.

- f The '-f' (force) option is used to indicate that the CIMOM should be shutdown after the specified (or default) timeout period has expired, regardless if there are CIM operations in progress or not. All CIM operations that are still in progress will be terminated/killed.

 This option should only be specified when the user is determined that the CIMOM has to be shutdown.

The usage of the 'timeout' and 'force' options will be described in more details below.

Shutdown Timeout

Under normal operation, CIMOM should be able to be shutdown fairly quickly without problems. There are, however, situations that may prevent CIMOM from shutting down within a reasonable amount of time. For example, a misbehaved provider is hung or is not responding to requests, or a provider is serving a long-running CIM operation.

To handle such situations and to ensure that the CIMOM can be shutdown without having the user wait a long period of time (or indefinitely), two shutdown timeout values will be used. One for determining whether or not to actually proceed with the shutdown, and the other for allowing some time for the actual shutdown to take place.

CIM Operation Completion Timeout

After receiving a shutdown request, the system will wait for a configurable 'CIM operation

completion timeout' period until all the CIM operations are complete before proceeding to shutdown the CIMOM. If after the timeout period has elapsed, and not all the CIM operations have been completed, the shutdown operation will not be continued and the CIMOM will be put back to its original running state.

This mechanism allows any long-running CIM operations to be continued and at the same time, allows the user (who issued the shutdown request) to decide what action to take.

This configurable timeout value can be overridden by specifying the '-t' (timeout) option and a timeout value (in seconds) in the command line.

Provider Shutdown Timeout

The system will proceed to shutdown CIMOM only if one of the following conditions has been met:

1. There are no outstanding CIM operation requests.
2. There are outstanding CIM operation requests, and a 'force' option was specified by the user.

Part of the CIMOM shutdown process is to shutdown all the providers. To allow some time for the providers to shutdown gracefully, the system will wait for a 'provider shutdown timeout' period before actually shutting down the CIMOM. This 'provider shutdown timeout' property is internal to CIMOM. It cannot be changed by the user issuing the shutdown command. However, it is a configurable property that can be changed depending on the need.

Force Shutdown

As described earlier, after the user issues a shutdown request, the system waits for a configurable (or user-specified) timeout period for all the CIM operations to complete. If the CIM operations cannot be completed within that timeout period, CIMOM will not be shutdown.

There are, however, situations in which the CIMOM must be shutdown. The '-f' (force) option is provided to force a shutdown, allowing the user to shutdown CIMOM regardless if there are outstanding CIM requests. If the 'force' option is specified, any CIM operations that are in progress will be killed and CIMOM will be shutdown.

Provider Termination

The provider termination mechanism is the terminate() method in the Provider API. The providers must implement this method. Each of the active provider's terminate() method will be called by the CIMOM Shutdown Service as part of the CIMOM shutdown process. To ensure a graceful shutdown, once the provider's terminate() method is called, the provider must perform the necessary steps to prepare for a shutdown.

The following defines the proposed behavior of a provider for the terminate() method.

- When the provider's terminate() method is called, if the provider is not servicing any requests and there are no pending requests, it should simply perform any necessary cleanup steps and

return to the caller.

- If there are CIM operation requests pending, the provider must cancel those operations and throw a CIM Exception (TBD) back to the initiating clients to indicate that the requests cannot be carried out due to CIMOM shutdown. It should then perform any necessary cleanup steps and return to the caller.
- If there are CIM operations in progress, the provider must determine either to complete or abort the CIM operations. Regardless of the decision, the provider must send a response back to the initiating clients. If it chooses to abort the CIM operations, it must throw a CIM Exception (TBD) back to the initiating clients to indicate that the operation cannot be completed due to CIMOM shutdown. It should then perform any necessary cleanup steps and return to the caller.

As described earlier, the CIMOM Shutdown Service allows a configurable ‘provider shutdown timeout’ period before actually unloading the providers and shutting down the CIMOM. If the provider cannot complete the CIM operations and respond to the terminate() method within that time, it should expect to be unloaded. The end result is that the CIM clients may not get a response back. Providers should take that into consideration.

Client Request and Response

While CIMOM is shutting down, a client connection request will result in a connection error. For clients who have already established a connection to CIMOM, new CIM requests will be rejected and responded with a CIM error (TBD) indicating that the CIMOM is shutting down.

When a client receives a response containing a CIM error indicating that the CIMOM is shutting down, it should close the connection and reconnect to CIMOM at a later time.

CIMOM Shutdown Service

When a user issues the shutdown request using the ‘cimserver -s’ command, the shutdown request will be sent to the CIMOM. A new service, called the CIMOM Shutdown Service, will be implemented within the CIMOM. This service will be responsible for processing the shutdown request.

The CIMOM Shutdown Service handles the shutdown request as follows:

- Disable new incoming client connections, return a CIM error (TBD) to the client requesting a new connection to indicate that the CIMOM is shutting down.
- Disable new incoming CIM requests, return a CIM error (TBD) to the client to indicate that the CIMOM is shutting down.
- Check to see if there are any outstanding CIM requests being processed by CIMOM.
- If no outstanding CIM requests, proceed to shutdown CIMOM:
 - Terminate providers: For each loaded provider, call the provider's terminate()

method.

- Respond to the shutdown command client that CIMOM has been terminated.
- If there are outstanding CIM requests, wait periodically for all the CIM requests to complete or until timeout expires.
- If there are no more outstanding CIM requests, proceed to shutdown CIMOM and respond to the shutdown command client.
- If timeout period has expired:
 - If the 'force' option is not specified:
 - Resume CIMOM by enabling incoming client connections and CIM requests
 - Return message to inform the shutdown command client that the CIMOM cannot be shutdown due to timeout.
 - If the 'force' option is specified, proceed to shutdown CIMOM.

The following diagram shows the processing flow of a shutdown request by the CIMOM Shutdown Service:

