Pegasus Enhancement Proposal (PEP)

PEP #: 065

Title: benchmarkTest Utility

Version: 1.0

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Authors: Denise Eckstein, Hewlett-Packard

Status: Accepted

Version History:

Version	Date	Author	Change Description
1.0	15 May 2003	Denise Eckstein	Initial Submission

Abstract: This PEP proposes adding a simple benchmark Test utility to OpenPegsus.

Definition of the Problem

By supporting a common, industry standard interface for monitoring and accessing management data, WBEM offers a significant number of benefits to instrumentation developers, management application developers and system administrators.

However, with the introduction of any interface layer comes an additional cost. This cost needs to be considered as part of a decision to use the WBEM interface to expose and access management data. The benchmarkTest utility has been developed as a tool to help developers characterize the performance impact of moving to WBEM.

In addition, this tool could help the OpenPegasus Community monitor performance changes during the development lifecycle.

Proposed Solution

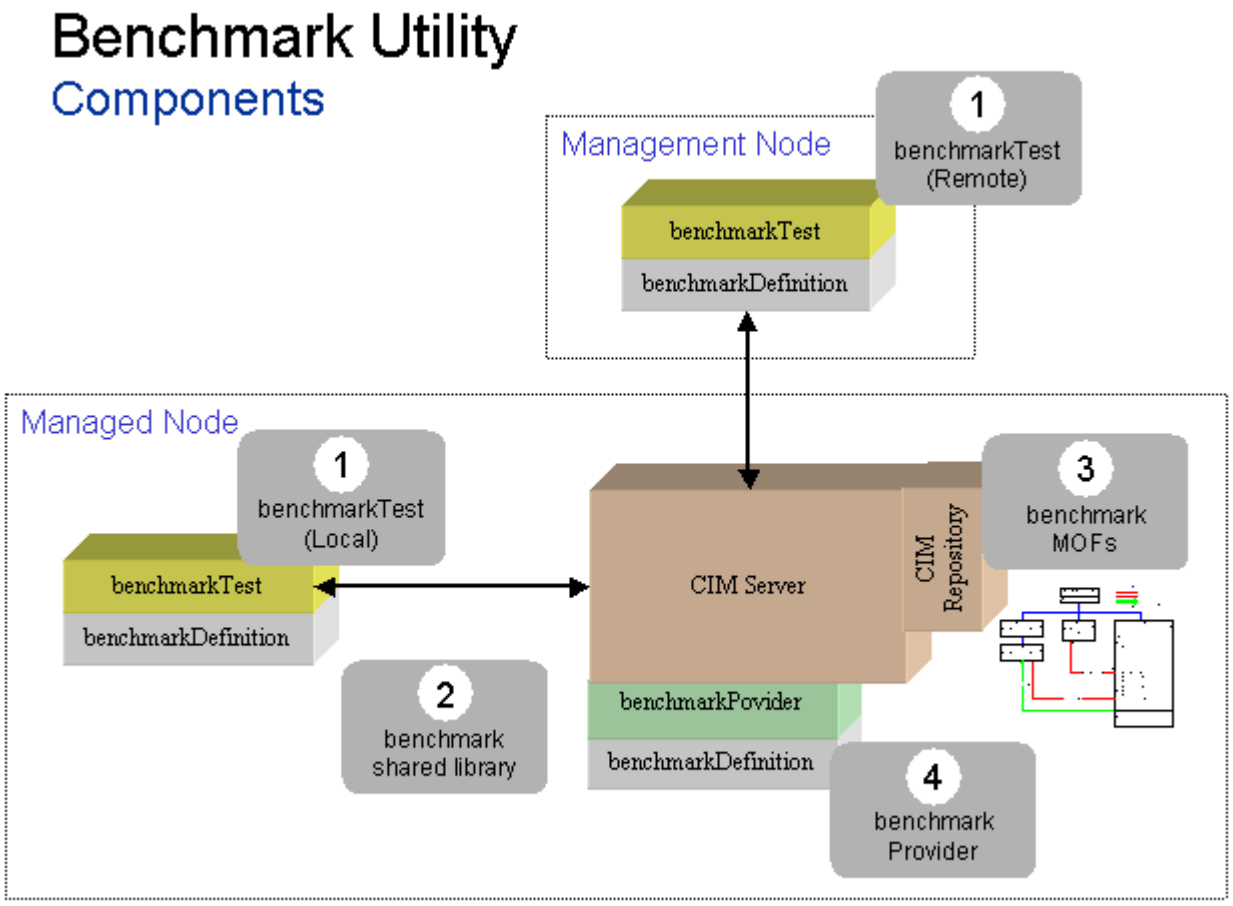
Note 1: The code segments and output shown in this PEP, although representative of the final submission, are still subject to change.

Note 2: A base set of tests are proposed in this PEP. As part of this PEP, we are proposing that the addition of new test cases and configurations to this utility be handled using the Bugzilla process.

Solution Description

The WBEM benchmarkTest utility consists of five components:

- **benchmarkTest:** the benchmarkTest CIM Client application
- **libbenchmarkProviderModule:** the benchmarkTest CIM Provider
- **libbenchmarkDefinition:** a shared library containing common definitions and functions
- **benchmarkProvider.mof:** the benchmarkTest class definitions
- **benchmarkProviderR.mof:** the benchmarkTest provider registration MOF



The **benchmarkTest Client** is a CIM Client that (1) issues a canned set of requests against the benchmarkTest Provider, (2) monitors the Elapse Time between requests and responses, and (3) generates a simple report describing the results.

The **benchmarkTest Provider** is a CIM Instance Provider that generates a response of a requested size.

Class Definitions

The benchmarkTest Provider uses the class name to determine the amount of data to return in the response. The benchmark Provider will “support” classes that use the following format for class name:

BenchmarkClassPxxxx**S**yyyy**I**zzzz

The benchmarkTest Provider uses the values of xxxx, yyyy, and zzzz in the class name string (i.e., BenchmarkClassPxxxxSyyyyIzzzz) to determine the number of non-key Properties (xxxx), the Size (yyyy) of each non-key Property, and the number of Instances (zzzz) to return in the response. E.g., calling enumerateInstances with the class name benchmarkClassP0050S0100I0010 will return a response with 10 instances; each instance will have 50 properties and each property will return a string with 100 characters.

The following figure shows class definitions for the benchmarkClassP0001S1000I0010, benchmarkClassP0010S0010I0010 and benchmarkClassP0010S0100I0010. The class definitions for the benchmark classes are defined in benchmarkProvider.mof.

```
class benchmarkClassP0001S1000I0010
{
        [key] Uint32 Identifier;
        string Property0001;
};

class benchmarkClassP0010S0010I0010
{
        [key] Uint32 Identifier;
        string Property0001;
        string Property0002;
        string Property0003;
        string Property0004;
        string Property0005;
        string Property0006;
        string Property0007;
        string Property0008;
        string Property0009;
        string Property0010;
};

class benchmarkClassP0010S0100I0010
{
        [key] Uint32 Identifier;
        string Property0001;
        string Property0002;
        string Property0003;
        string Property0004;
        string Property0005;
        string Property0006;
        string Property0007;
        string Property0008;
        string Property0009;
        string Property0010;
};
```

Note 1: The benchmarkTest Provider will never return more instances or properties than allowed by an operation. E.g., calling getInstance with the class name benchmarkClassP0050S0100I0010 will return a response with a single instance; this instance will have 50 non-key properties of size 100.

Note 2: All benchmarkTest classes MUST contain a single key property named Identifier.

```
[key] Uint32 Identifier;
```

Provider

The benchmarkTest Provider is a CIM Instance Provider that generates a response of a requested size. As an example, the following figure contains the implementation of enumerateInstances.

```
void benchmarkProvider::enumerateInstances(
        const OperationContext & context,
        const CIMObjectPath & classReference,
        const Boolean includeQualifiers,
        const Boolean includeClassOrigin,
        const CIMPropertyList & propertyList,
        InstanceResponseHandler & handler)
{
    CIMInstance _instance;
    Uint32 numberOfProperties;
    Uint32 sizeOfPropertyValue;
    Uint32 numberOfInstances;

    CIMName className = classReference.getClassName();
    test.getConfiguration(className, numberOfProperties,
                  sizeOfPropertyValue, numberOfInstances);

    // begin processing the request
    handler.processing();

    for (Uint32 i = 1; i <= numberOfInstances; i++)
    {
       _instance = _buildInstance(className,
                        numberOfProperties,
                        sizeOfPropertyValue , CIMValue(i));
       handler.deliver(_instance);
    }

    // complete processing the request
    handler.complete();
}
```

Client

The benchmarkTest Client is a CIM Client that (1) issues a canned set of requests against the benchmarkTest Provider, (2) monitors the Elapse Time between requests and the responses, and (3) generates a simple report describing the results.

benchmarkTest [-h *hostname*] [-p *portnumber*] [-t *timeout*] [-u *username*] [-w *password*] [-s] [-i *iterations*]

Test Definition

The benchmarkTest Client implements 5 different tests. With the exception of test 2, each test is designed to run a specified number of iterations. The default number of iterations is 10. This value can be changed using the [-i *iterations*] parameter on the benchmarkTest command line.

- **Test 1 – Connect / Disconnect:**

  This test simply connects to the CIM Server and then immediately disconnects.

  The following figure shows the output generated for Test 1. This output shows that the test was run 10 times with a Total Elapse Time of 0.004 seconds. The Average Elapse Time is computed by dividing the Total Elapse Time by the number of iterations (e.g., 10).

```
1: Benchmark Test #1: Connect/Disconnect Test
10 requests processed in 0.004 Seconds (Average Elapse Time =
0.0004)
```

- **Test 2 – Provider Load:**

  This test times the “first invocation” of the provider. It includes the overhead associated with the load and initialization of the provider library.

  The benchmarkTest client uses a getInstance request on the class benchmarkClassP0001S0010I0001 for this operation. The following output shows the time required to perform this operation was 0.032 seconds.

```
2: Benchmark Test #2: Load Provider Test on class
benchmarkClassP0001S0010I0001
Connect time = 0
Unload Module time = 1.773
First getInstance request processed in 0.032 Seconds
```

Note 1: The output of this test also includes the time (i.e., Unload Module Time) required to “disable” and “enable” the Provider. The Unload Module Time will vary depending on whether or not the Provider was already loaded.

Note 2: If the Elapse Time between the request and the response is small (i.e., < .001 second), a “Connect time” of “0” will be displayed.

- **Test 3 – getInstance:**

  This test calls getInstance on a specified class.

  The following figure shows the Test 3 code segment used to invoke getInstance.

```
    stopwatchTime.reset();

    CIMObjectPath reference =
        benchmarkTestCommand::_buildObjectPath(className,
CIMValue(99));

    for (Uint32 i = 0; i < _iterations; i++)
    {
        CIMInstance cimInstance = client.getInstance(NAMESPACE,
reference);
        CIMObjectPath instanceRef = cimInstance.getPath();
        if ( !(instanceRef.getClassName().equal(className)))
        {
            outPrintWriter << "Returned ClassName = "
                           <<
instanceRef.getClassName().getString() << endl;
            outPrintWriter << "Expected ClassName = "
                           << className.getString() << endl;
            errorExit(errPrintWriter, "getInstance failed");
        }
    }

    double elapsedTime = stopwatchTime.getElapsed();
```

  The following figure shows the output generated for Test 3. This output shows that the test was run 10 times on class benchmarkClassP0001S0010I0001 with a Total Elapse Time of 0.147 seconds.

```
3: Benchmark Test #3: getInstance Test on
benchmarkClassP0001S0010I0001
Connect time = 0
Number of Non-Key Properties Returned  = 1
Size of Each Non-Key Property Returned  = 10
Number of Instances Returned = 1
10 requests processed in 0.147 Seconds (Average Elapse Time =
0.0147)
```

- **Test 4 – enumerateInstanceNames:**

  This test calls enumerateInstanceNames on a specified class.

  The following figure shows the output generated for Test 4. This output shows that the test was run 10 times on class benchmarkClassP0001S0010I0001 with a Total Elapse Time of 0.153 seconds.

```
4: Benchmark Test #4: enumerateInstanceNames Test on class
benchmarkClassP0001S0010I0001
Connect time = 0
Number of Non-Key Properties Returned  = 0
Number of Instances Returned = 1
10 requests processed in 0.153 Seconds (Average Elapse Time =
0.0153)
```

  Note 1: The enumerateInstanceNames operation returns '0' non-key properties.

- **Test 5 – enumerateInstances:**

  This test calls enumerateInstances on a specified class.

  The following figure shows the output generated for Test 5. This output shows that the test was run 10 times on class benchmarkClassP0001S0010I0001 with a Total Elapse Time of 0.153 seconds.

```
5: Benchmark Test #5: enumerateInstances Test on class
benchmarkClassP0001S0010I0001
Connect time = 0
Number of Non-Key Properties Returned  = 1
Size of Each Non-Key Property Returned  = 10
Number of Instances Returned = 1
10 requests processed in 0.153 Seconds (Average Elapse Time =
0.0153)
```

Class Definitions

In the benchmarkTest, tests 3, 4 and 5 are repeated for the following classes. A total of 83 tests are run during a single invocation of benchmarkTest.

Note: This PEP proposes that the addition of new test cases and configurations to this utility be handled using the Bugzilla process.

Class Name	P	S	I

benchmarkClassP0001S0010I0001	1	10	1
benchmarkClassP0001S0100I0001	1	100	1
benchmarkClassP0001S1000I0001	1	1000	1
benchmarkClassP0010S0010I0001	10	10	1
benchmarkClassP0010S0100I0001	10	100	1
benchmarkClassP0010S1000I0001	10	1000	1
benchmarkClassP0050S0010I0001	50	10	1
benchmarkClassP0050S0100I0001	50	100	1
benchmarkClassP0050S1000I0001	50	1000	1
benchmarkClassP0001S0010I0010	1	10	10
benchmarkClassP0001S0100I0010	1	100	10
benchmarkClassP0001S1000I0010	1	1000	10
benchmarkClassP0010S0010I0010	10	10	10
benchmarkClassP0010S0100I0010	10	100	10
benchmarkClassP0010S1000I0010	10	1000	10
benchmarkClassP0050S0010I0010	50	10	10
benchmarkClassP0050S0100I0010	50	100	10
benchmarkClassP0050S1000I0010	50	1000	10
benchmarkClassP0001S0010I0100	1	10	100
benchmarkClassP0001S0100I0100	1	100	10
benchmarkClassP0001S1000I0100	1	1000	100
benchmarkClassP0010S0010I0100	10	10	100
benchmarkClassP0010S0100I0100	10	100	100
benchmarkClassP0010S1000I0100	10	1000	100
benchmarkClassP0050S0010I0100	50	10	100
benchmarkClassP0050S0100I0100	50	100	100
benchmarkClassP0050S1000I0100	50	1000	100

Connection Types

HP WBEM Services supports multiple CIM-XML connection types between a CIM Client and the CIM Server.

The following table describes the supported communication protocols between a remote CIM Client and CIM Server.

From Component	To Component	Encoding	Communication Protocol	Port	Comments
CIM Client	CIM Server	CIM-XML	HTTP	5988	
CIM Client	CIM Server	CIM-XML	HTTPS	5989	

Local connection types are defined in the following table.

From Component	To Component	Encoding	Communication Protocol	Port	Comments
CIM Client	CIM Server	CIM-XML	connectLocal		Protocol will vary depending on platform.
CIM Client	CIM Server	CIM-XML	HTTP	5988	
CIM Client	CIM Server	CIM-XML	HTTPS	5989	

The benchmarkTest utility supports command line parameters that allow the connection type to be specified.

Synopsis

benchmarkTest [-h *hostname*] [-p *portnumber*] [-t *timeout*] [-u *username*] [-w *password*] [-s] [-i *iterations*]

Description

By default, the benchmark tests are executed on the local host, using a connectLocal. By default, benchmarkTest waits 20000 milliseconds (20 seconds) on sending a request, then times out if a response hasn't been received. The -h option allows the user to specify a remote host. The **-p** option allows the user to specify a different port number. The **-t** option allows the user to specify, in milliseconds, a different timeout value for the request. The **-u** and **-w** options allow the user to specify a username and password to use for authentication of the user. The **-s** option enables the SSL protocol between benchmarkTest and the CIM Server.

Options

benchmarkTest recognizes the following options:

-h *hostname*
: Use the specified host. A CIM Server must be running on the specified host. If this option is not specified, benchmarkTest will connect to the local host and authenticate itself.

-p *portnumber*
: Use the specified port number. The port number must be the port number on which the CIM Server is running on the specified host. If port 5989 is specified, the SSL protocol is used.

-t *timeout*
: Wait the specified number of milliseconds on sending a request, before timing out if no response has been received. The timeout value must be an integer value greater than 0.

-u *username*
: Authorize the operation using the specified username. If username is not specified, the current logged in user will be used for authentication.

-w *password*
: Authorize the operation using the specified password. If the password is not specified and the remote host requests authentication, the user will be prompted for a password.

-s
: Enable the use of the SSL protocol between benchmarkTest and the CIM

server. If **–s** is specified and a port is not, port 5989 will be assumed.

-i *iterations*

Run each test the specified number of iterations. The default value for iterations is 10.

Return Value

When an error occurs, an explanatory error message is written to stderr and an appropriate value is returned.

The following return values are returned:

0 Success

1 Error

Schedule

Action	Planned	Actual	Comment
PEP Submitted	15 May 2003	15 May 2003	
PEP Reviewed	23 May 2003		
PEP Approved	31 May 2003	06 June 2003 Ballot 14	
Code Committed	30 June 2003		