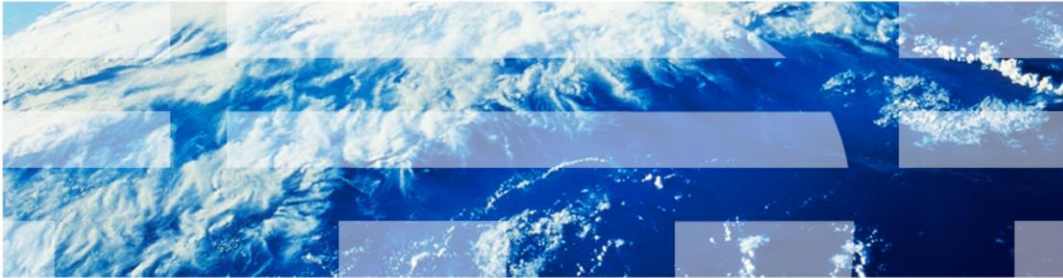


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IBM PureApplication System  
IBM Workload Deployer  
IBM Business Process Manager Pattern V8.0

Scaling



This presentation covers the scaling of the Business Process Manager Pattern V8.0 in IBM PureApplication System and IBM Workload Deployer.

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- Scaling

You will learn about various scaling topics, such as horizontal scaling, vertical scaling and DB2 DASD scaling.

## Horizontal scaling – before deployment

- Horizontal scaling of process center and process server custom nodes only
- Before deployment, specify number of node instances



You can horizontally scale a Business Process Manager process center or process server before deployment by manually increasing or decreasing the number of custom nodes in the pattern, as shown in the pictures.

## Horizontal scaling – After deployment (1 / 2)

- Add or remove node instances after deployment
- In running instance, expand virtual machines section, find the custom node, click **Manage**, and click the Clone icon
  - In pop-up, select **Count** and click OK
- Click the **Delete** icon to stop the virtual machine

The screenshot illustrates the process of horizontally scaling a virtual machine in IBM Business Process Manager. It is divided into three main sections:

- Top Section:** Shows a virtual machine instance named 'aimcpwd021-BPM' with a status of 'PC Custom Node-A'. It has two progress bars (1% and 8%) and buttons for 'Login' and 'Manage'. The 'Manage' button is highlighted with a red box. A pop-up menu is open, showing a 'Clone' icon (a document with a plus sign) also highlighted with a red box.
- Middle Section:** A pop-up window titled 'Number of virtual machines to add during this clone operation'. It contains a 'Count' field with a pull-down menu set to '1' (highlighted with a red box), a 'Password' field, and a 'Verify password' field. At the bottom, there are 'OK' and 'Cancel' buttons, with the 'OK' button highlighted by a red box.
- Bottom Section:** A 'Current status' box showing a sandglass icon and the text 'Clone of virtual machine has started.'

Red arrows indicate the flow from the 'Manage' button to the 'Clone' icon, then to the 'Count' field, and finally to the 'OK' button.

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IBM Business Process Manager Pattern V8.0 Scaling

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The same custom nodes can also be horizontally scaled after deployment. To do so, find the appropriate virtual machine in the running virtual system instance panel, click the Manage link and then click the Clone icon. A pop-up window is displayed where you can add the number of custom node virtual machines required by using the Count pull-down field. Optionally you can provide a password for the new virtual machine. If you don't provide a password, the new virtual machine will use the default of the original virtual machine. If you need to delete the virtual machine to scale back, then use the Delete icon instead of the Clone icon.

The Current status of the newly cloned virtual machine will indicate that the clone has started.

## Horizontal scaling – After deployment (2 / 2)

- History reflects the actions taken for creating and starting the new virtual machine

History		Virtual system is ready
Virtual system is ready		Oct 12, 2012 5:27:27 PM
Clone of virtual machine is complete.		Oct 12, 2012 5:27:27 PM
Executing script package ConfigBPM on virtual machine aimcpwd034-BPM PC Custom Node-A		Oct 12, 2012 4:57:31 PM
Starting virtual machine aimcpwd034-BPM PC Custom Node-A		Oct 12, 2012 4:54:52 PM
Registering virtual system AIMCP_BPM_PC_ConfigBPM_LP		Oct 12, 2012 4:54:12 PM
Transferring virtual images to hypervisors		Oct 12, 2012 4:54:02 PM
Generating model for topology and network		Oct 12, 2012 4:53:47 PM
Processing has started		Oct 12, 2012 4:53:37 PM
Clone of virtual machine has started.		Oct 12, 2012 4:53:35 PM
The virtual system has been deployed		Oct 8, 2012 4:53:52 PM
Executing script package ConfigBPM on virtual machine aimcpwd021-BPM PC Custom Node-A		Oct 8, 2012 3:57:40 PM
Starting virtual machine aimcpwd021-BPM PC Custom Node-A		Oct 8, 2012 3:55:15 PM
Starting virtual machine aimcpwd029-BPM PC DMGR-AIMCP_BP		Oct 8, 2012 3:27:24 PM
Starting virtual machine aimcpwd030-BPM PC IHS-AIMCP_BPM		Oct 8, 2012 3:22:33 PM
Starting virtual machine aimcpwd031-BPM PC Database-AIMC		Oct 8, 2012 3:22:33 PM
Starting virtual machines in virtual system AIMCP_BPM_PC_ConfigBPM_LP.		Oct 8, 2012 3:22:33 PM

The History section of the deployment provides all the relevant messages about the newly cloned virtual machine, as seen in this picture.


## Vertical scaling – PureApplication System (1 of 3)

- Increase or decrease processor and memory per virtual machine
  - Dynamic in PureApplication System
  - Stop / restart of virtual machine required in Workload Deployer



 ipas-lpar-111-001-BPM PS  
 Custom  
 Node-AIMCP\_BPM\_LP\_IBMcopy-8734
 
0%
3%
Login

### General information

Created on:	Sep 6, 2012 12:53:08 PM
From virtual image:	IBM Business Process Manager Advanced 8.0.0.0 RHEL 6 x64 (VMWare)
Part name:	BPM PS Custom Node
Current status:	 Started
Updated on:	Sep 7, 2012 9:35:42 AM
In cloud group:	CloudGroupLarge
Registered as:	0aa1a91e-cd02-4656-978b-a2b0c3bd6df6
Stored on:	CloudGroupLarge storage
In virtual application:	None provided

### IBM products (with license count for isolated usage)

Waiting for initialization to complete

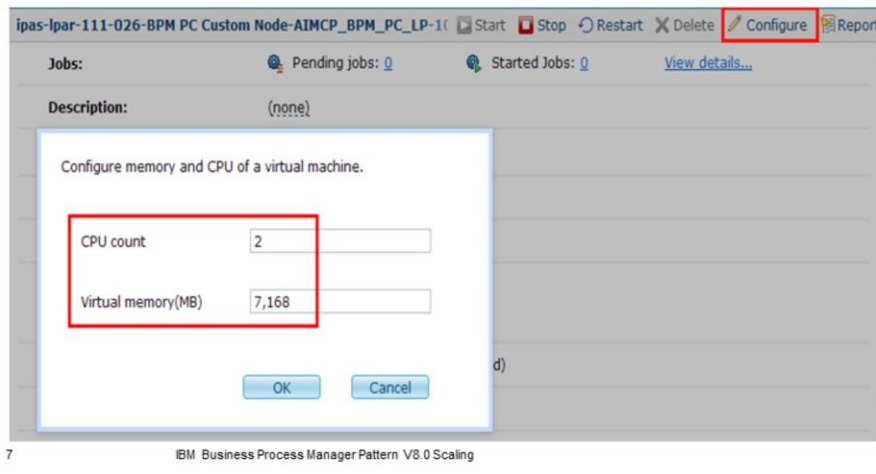
### Hardware and network

Virtual CPU count:	2
Virtual memory (MB):	7168

You can also vertically scale any virtual machine by increasing or decreasing the CPU and memory per virtual machine. The process is different for Workload Deployer and PureApplication System. This slide and the next two slides describe the process for PureApplication System. This slide shows the virtual machine name and the current settings for the CPU count and virtual memory in PureApplication System.

## Vertical scaling – PureApplication System (2 of 3)

- Increase or decrease processor and memory per virtual machine
  - Dynamic in PureApplication System (conditional for memory)
  - From Virtual Machine screen, select **Configure**, and modify processor and memory
  - For a memory change, there are conditions for a dynamic change:
    - If memory is less than 3GB then can be changed to maximum of 3GB
    - If memory is more than 3GB, then can be changed to 16 times current setting
    - In all other cases, virtual machine must be stopped, change made, then restarted




On the previous slide, you located the virtual machine name. Use that name to find the virtual machine in the running virtual system instance panel under the Instances tab. Then click Configure. In the pop-up window, you can modify the CPU count and virtual memory. Then click OK.

Changes to the memory allocation only go into effect immediately, without a virtual machine restart, under the following conditions. If the current memory allocation is less than 3 gigabytes and you change it to a value that is less than or equal to 3 gigabytes, then it will go into effect immediately. Or, if the memory allocation is currently more than 3 gigabytes and you change it to a value that is less than or equal to 16 times the current allocation, then it will go into effect immediately. In all other cases, you must first stop the virtual machine, then make the memory allocation change, and then restart the virtual machine.



## Vertical scaling – PureApplication System (3 of 3)

- Click **Job Queue** to view the job status
- When completed successfully, change can be viewed

 The request to configure the virtual machine ipas-lpar-111-001-BPM PS Custom Node-AIMCP\_BPM\_LP\_IBMcopy-8734 is accepted. You can check the job status in [Job Queue](#) [x] Close

**Started Jobs**



Name  Type

Name	Status	Type	Created On	Updated On	Actions
Virtual Appliance update	 Running	instances	Sep 10, 2012 6:33:07 PM	Sep 10, 2012 6:33:20 PM	

1 - 1 of 1 items

**Started Jobs**

Name  Type

Name	Status	Type	Created On	Updated On	Actions
Virtual Appliance update	 Success	instances	Sep 10, 2012 6:33:07 PM	Sep 10, 2012 6:34:34 PM	

1 - 1 of 1 items

When you change the CPU count or memory allocation, as described on the previous slide, a job is submitted. You can click the Job Queue link provided to go to the Job Queue screen. Initially the job is in Running status and, assuming it completes successfully, will change to Success status when completed. You can then go back to the running virtual system instance panel to verify that the changes have been made correctly.

This completes the process for changing the CPU count or memory allocation for PureApplication System.



## Vertical scaling – Workload Deployer

- Increase or decrease processor and memory per virtual machine
  - Stop virtual machine using the Manage function
  - Edit the processor and memory
  - Start the virtual machine using the Manage function

Part name: BPM PC Custom Node

Current status: **Virtual machine has been stopped**

Updated on: Sep 17, 2012 4:12:23 PM

On hypervisor: 9.3.75.125

In cloud group: Cloud group 1

Registered as: aimcp137-BPM PC Custom Node-BPM

Stored on: datastore1 (2)

In virtual application: None provided

**IBM products (with license count for isolated usage)**

IBM Process Center Adv Hyper Ed on RH Enterprise Lnx Svr for x86 (64 bit) (5725-G76): 100 PVU

**Hardware and network**

Virtual CPU count: 2 [Edit]

CPU shares on host: 2000

CPU shares consumed on host: 0.0

Virtual memory (MB): 4096 [Edit]

Update virtual machine.

Name: aimcp137-BPM PC Custom Node-BPM

Virtual CPU count: 4

Virtual memory (MB): 8192

OK Cancel

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This slide summarizes the process for vertical scaling of CPU count and memory allocation for Workload Deployer. First you need to stop the virtual machine using the **Stop** icon in the **Manage** link for the virtual machine. Once the virtual machine is stopped, the **Edit** link is displayed in the **Hardware and network** section of the running virtual system instance panel, beside both the **Virtual CPU count** and **Virtual memory** fields. Clicking either of those Edit links will display a pop-up window where you can modify the virtual CPU count and the virtual memory. After you make modifications, restart the virtual machine using the **Start** icon in the **Manage** link.

## DB2 disk space scaling – AddDisk script package

- Approximately 8GB of disk space is available for process center or process server databases from the image itself
- By default, a raw disk of 30GB is added for each of the process center and process server databases
- To add more space dynamically, the default raw disk add-on must be in the DB2 part
- The AddDisk script package is included to eliminate the need to manually SSH to the virtual machine in order to mount the disk and add it to the DB2 storage path
- AddDisk script executes only “when I initiate it”

The screenshot displays the IBM Business Process Manager Pattern V8.0 Scaling interface. The top navigation bar includes 'Welcome', 'Instances', 'Patterns', 'Catalog', and 'Reports'. The 'Catalog' tab is active, showing a list of script packages. The 'AddDisk' package is highlighted in blue. A red box highlights the 'AddDisk' package name in the list. A red arrow points from this box to a detailed view of the 'AddDisk' package. This view shows the package name 'AddDisk' and its configuration details:

- Logging directory:** none provided
- Executable:** `adddisk.sh /opt/IBM/BPM/dbPath_$(date -u +%y%m%d%H%M%S)`
- Arguments:** None provided
- Timeout:** 60000000
- Executes:** when I initiate it

Additional annotations in the screenshot include a red box around the 'Default raw disk Add-On' icon in the 'Process center database 8.0.0.0' section, and a red box around the 'AddDisk' icon in the same section. A red arrow points from the 'AddDisk' icon in the 'Process center database' section to the 'AddDisk' package in the 'Script Packages' list.

The DB2 part of the Business Process Manager virtual image provides approximately 8 gigabytes of disk space for the process center or process server databases. Additionally, by default, the raw disk add-on provides an additional 30 gigabytes of disk space to each of the databases. After deployment, if you find this disk space insufficient, you can dynamically scale up the amount of disk space. However note that if, before deployment, you removed the raw disk add-on that is in the DB2 parts of the Business Process Manager patterns by default, you will not be able to scale up the disk space dynamically.

As part of the process to dynamically scale up the disk space, you need to mount a new storage volume on the DB2 virtual machine and add the space to the DB2 storage path. You can do this manually; however the AddDisk script package will do this for you. By default, the AddDisk script package is included in the DB2 parts of the Business Process Manager patterns and is configured to run only when you initiate it.

## DB2 DASD scaling – preparing to use the AddDisk script

- A storage volume must be allocated to the DB2 virtual machine
  - In Workload Deployer,
    - see the VMWare ESX information center for instructions  
[http://pubs.vmware.com/vsphere-4-esxi-installable-vcncenter/index.jsp?topic=/com.vmware.vsphere.bsa.doc\\_40\\_u1/vc\\_admin\\_guide/virtual\\_machine\\_configuration/t\\_add\\_a\\_hard\\_disk\\_to\\_a\\_virtual\\_machine.html](http://pubs.vmware.com/vsphere-4-esxi-installable-vcncenter/index.jsp?topic=/com.vmware.vsphere.bsa.doc_40_u1/vc_admin_guide/virtual_machine_configuration/t_add_a_hard_disk_to_a_virtual_machine.html)
    - stop and restart the DB2 virtual machine
  - In PureApplication System,
    - Create a new storage volume (**System Console > Cloud > Storage Volume**)
    - Assign it to the DB2 virtual machine (**System Console > Cloud > Virtual Machines > select the DB2 virtual machine, and then add the Storage Volume**)
- Mount and add the disk to DB2 storage path using the AddDisk script package
  - Invoke the script package by clicking “Execute Now” under the virtual machine for the DB2 instance (use the root ID)



- Alternative is to log into DB2 virtual machine and manually enter commands

[http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0mx/topic/com.ibm.wbpm.cloud.doc/topics/tbpm\\_priclo\\_addispdbvm.html](http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0mx/topic/com.ibm.wbpm.cloud.doc/topics/tbpm_priclo_addispdbvm.html)

The first step in the process of adding DASD space to either the process center or process server set of databases is to add a storage volume to the affected DB2 virtual machine. The process for adding a storage volume is different between Workload Deployer and PureApplication System.

For Workload Deployer, you must use the VMware VSphere client to add a hard disk to the DB2 virtual machine. This slide provides an information center link to the documentation detailing how to add the hard disk to the virtual machine. Note that the virtual machine must be stopped and restarted for the hard disk addition to become effective.

For PureApplication System on ESX, you can dynamically add the storage volume. First create a new storage volume by navigating to System Console > Cloud > Storage Volume and creating the storage volume. Second, go to the DB2 virtual machine by navigating to System Console > Cloud > Virtual Machines and selecting the DB2 virtual machine. Then select the storage volume you just added in the Storage volumes property in order to assign it to the DB2 virtual machine.

After this step is completed, in either Workload Deployer or PureApplication System, go to the Instances view for the Virtual System instance for Business Process Manager. Select the DB2 virtual machine in the Virtual machines section and find the AddDisk script package. Click the Execute now link and provide the root ID and password. The script will mount the disk and add it to the DB2 storage path for you.

The slide provides an information center link detailing the steps for adding disk space to a DB2 virtual machine.

## AddDisk script log

**Script Packages**

AddDisk ✓ Sep 27, 2012 10:59:39 AM [remote\\_std\\_out.log](#)  
[remote\\_std\\_err.log](#)

[Execute now](#)

```
*** partitioning disk at /dev/sdd
...
*** formatting /dev/sdd1 with ext3 filesystem
...
*** mounting /dev/sdd1 at /opt/IBM/BPM/dbPath_120927145849
*** adding /opt/IBM/BPM/dbPath_120927145849 to database storage
...
connect to BPMDB
...
alter database BPMDB add storage on '/opt/IBM/BPM/dbPath_120927145849'
...
connect reset
...
connect to PDWDB
...
alter database PDWDB add storage on '/opt/IBM/BPM/dbPath_120927145849'
...
connect reset
...
connect to CMNDB
...
alter database CMNDB add storage on '/opt/IBM/BPM/dbPath_120927145849'
...
connect reset
```

Once the AddDisk script completes, click the remote standard out log to see the log from the script package. The slide shows some of the highlights of the log. It first shows some messages related to partitioning the disk, then formatting it and then mounting it. Then there are various messages related to adding the DASD to the DB2 storage path.

## DB2 storage path list and disk sizes

Label	File name	Capacity (GB)
disk1	RHEL62-64.vmdk	12.0
disk2	BPM_Binaries.vmdk	20.0

```

-bash-4.1# df -kh
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1        9.9G  4.6G  4.8G  50% /
tmpfs            1004M  180K 1004M   1% /dev/shm
/dev/sdb1        20G   11G  8.1G  57% /opt/IBM/BPM
/dev/sdc1        5.0G  315M  4.4G   7% /opt/IBM/BPM/dbPath_addon
/dev/sdd1        9.9G  151M  9.2G   2% /opt/IBM/BPM/dbPath_120927145849
-bash-4.1#

```

In the DB2 virtual machine, under the `/opt/IBM/BPM` directory are the DB2 storage directories, all beginning with “dbpath.” The one called “dbpath” correlates to the DASD provided with the virtual image itself. The one called “dbPath\_addon” correlates to the DASD added with the raw disk add-on in the pattern. Then the one suffixed with the date and time stamp is the one added with the AddDisk script package.

The “`df -kh`” command provides some further information about the DASD allocated to the virtual machine, and to the database paths. The file system named `/opt/IBM/BPM` has a size of 20 gigabytes, and correlates to the “disk2” seen in the Disk section of the Business Process Manager virtual image. As you can see in the picture, approximately 8.1 gigabytes of that 20 gigabytes is available to be used by the databases and any other files. The file system named `/opt/IBM/BPM/dbPath_addon` correlates to the disk added with the raw disk add-on before deployment. In this case, 5 gigabytes were added with the add-on, and 4.4 gigabytes remains after overhead is subtracted. The last file system shown correlates to a 10-gigabyte storage volume that was added after deployment; and 9.2 gigabytes remains after overhead is subtracted. Therefore in total, 21.7 gigabytes is available for this virtual machine’s DB2 databases.

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