# XCAT 2 DB2 Setup

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# 1.0 Overview Setup  DB2 on the Management Node

DB2 is supported with the  xCAT 2.4 release or later.
DB2 is a  product of IBM.  To  use it with xCAT,  you will need  access to a licensed version of the product, our document is for the DB2 Enterprise Server Edition (ESE) Version 9.7.  We  support it on AIX and Linux p-series.
 The trial download of DB2 will not work with xCAT, because it does not support multiple client accesses.
Because the setup is rather complex,  if you are going to use DB2 with xCAT, contact the xCAT development team, and we will work with you.

In this scenario, you will install the OS on your service node(s),  setup the DB2 Client and then update the service node with the xCAT software.

Note: xCAT  supports open source databases  MySQL on Linux and AIX, and Postgesql on Linux.  There are setup docs for each of these databases on the xCAT web, and an automated setup script for MySQL (xCAT 2.3.3 or later).

 One reason to migrate from the default SQLite database to DB2 with xCAT is for xCAT hierarchy using Service Nodes. DB2 provides the ability for remote access to the xCAT database on the Management node which is required by Service Nodes. Refer to the xCAT Service Node documentation for more information. Other programs or scenarios within your environment may also benefit from or require DB2. This document contains steps to install DB2, configure the server and client, create a database and populate it with your xCAT data.

Before using this document, you should have a general understanding of DB2. If necessary, review the installation and tutorial sections of the DB2 Product documentation.

There are many DB2 products,  our documents will cover the install and setup of xCAT on DB2 Enterprise Server Edition .   You will have to purchase this production from IBM.    This document will cover the setup of DB2 on SLES 10 SP3  or AIX 6.1, or later releases of those products on p-Series hardware.  This document tested on Service Nodes with diskfull installs.

For more references:  see the  References section.

**Note: with all the DB2 commands run below,  be patient.  Some take several minutes to complete , and some take several seconds to return the prompt,  even after they say they have completed.  Never  kill a command while running.  It can cost you hours of recovery work.  ( Been there, done that).**

## 2.0 Install DB2 on the Management Node

If you already have DB2 installed you can skip to the section  Installation and Setup of  DBD::DB2 Perl modules.
Obtain the DB2 Software appropriate for you OS and hardware.  Save the download for the install of the Client on the Service Nodes later.  Most of these directions come  from the Installing Enterprise DB2  at the Product  Information Center and the *Configuring and Managing BlueGene  DB2 Setup Sections.*  We will be using a Command Line (manual)  installation method, not the Web interface.

All of the following steps must be run logged into the Management Node (xcatmn) as root.
Note: You must also download the DB2® license file `db2ese_o.lic` (part number C14KVEN), which you activate after installing the DB2 server.

1) To uncompress the image, copy the tar file or files to a temporary file system containing at least 2 gigabytes of free space, here we used /db2source. We will use the default install path /opt/ibm/db2/V9.7 (linux) or opt/IBM/db2/V9.7 (IBM) for the database, which also must contain 2 gigabytes of free space.

2) Untar the download package:
```
      cd /db2source
    On Linux:
     zcat  DB2_ESE_97_Linux_ipSeries.tar.gz | tar -xvf-
     or
    On AIX:
     gunzip DB2_ESE_97_AIX.tar.gz
     tar -xvf DB2_ESE_97_AIX.tar
```

3) **If on Linux**, you are going to need to install [IBM XL C/C++ Advanced Edition V9.0 for Linux Runtime Environment Component](#) for the Linux Distro, you are using. Save this download for the install on the Service Nodes later.

   - For our SLES 10 ppc system, we download the following: vacpp.rte.90.sles10.*.update.tar.gz into /db2source/vac9.0.
   - We unzip and untar the software:
     zcat vacpp.rte.90.sles10.*.update.tar.gz | tar -xvf-
   - Apply the updates, this installs the runtime libraries consisting of three RPMs – vacpp.rte, xlsmp.rte,and xlsmp.msg.rte.
     ```
     cd /db2source/vac9.0
     rpm -Uvh *.rpm
     ```

4) Install DB2

   ```
    cd /db2source/ese
    ./db2_install
   ```

   **You will be prompted with the following questions:**

   ```
   Default directory for installation of products - /opt/ibm/db2/
   V9.7
   ```

```
Do you want to choose a different directory to install
[yes/no] ?
```
  **Answer: no**


Specify one of the following keywords to install DB2 products.
```
ESE
CLIENT
RTCL
```

**Answer: ESE**

## 2.1  Installing the DB2 License

The DB2 license file can be found in the db2/license directory on the installation CD or inside the installation directory. Depending on the product you have, the file is named db2ese.lic (Enterprise Server Edition). After installing the license, the system is ready to start the database.  If you loaded a trial copy, you will be able to use it for 90 days without a license.  The license will not be present in the install.

```
To install the license run the following command:

   On Linux: /opt/ibm/db2/V9.7/adm/db2licm -a
      /opt/ibm/db2/V9.7/license/db2ese.lic
   On AIX: /opt/IBM/db2/V9.7/adm/db2licm -a
      /opt/IBM/db2/V9.7/license.db2ese.lic

   DBI1402I License added successfully.
```

## 2.2  Installing Latest Fix Packs

For the latest Fix Packs for all DB2 version,  go to this <u>download site.</u>


# 3.0 Installation and Setup of  DBD::DB2 Perl modules

## 3.1  perl-DBI

DBI (DataBase Interface) module and DBD::DB2 (DataBase Driver) are required on the Management Node for the xCAT code to interface with DB2.

Make sure perl-DBI is installed from the OS.   Check by running:

```
rpm -qa | grep perl-DBI
```

## *3.2  Build and Install   DBD::DB2 code*

The xCAT code uses the Perl DBD interface support for DB2.   The level we have tested with is 1.78.  If you have an older version,  upgrade to 1.78.  Some of the older versions do not support the function needed by xCAT. If you have 1.78 installed you can move on to Setting up the DB2 Server Instance.
For the build and installation of the Perl DBD::DB2 module follow the instructions below.
You can read information about the Perl interface to DB2 at this site.

http://www-01.ibm.com/support/docview.wss?rs=71&uid=swg21297335
or
http://www-01.ibm.com/support/docview.wss?rs=71&uid=swg21297335

You will download  the latest DBD:DB2 source code from CPAN.

Note on AIX: you must install the VAC C/C++ compiler, on Linux gcc compiler

We will then compile and install  it on your machine with the DB2 database you have installed.

```
mkdir ~/DBD
cd ~/DBD
download the current DBD source  into ~/DBD
wget http://www.cpan.org/authors/id/I/IB/IBMTORDB2/DBD-
DB2-1.78.tar.gz
If wget is not available, ftp the file to the directory.
zcat DBD-DB2-1.78.tar.gz | tar -xvf-
cd ~/DBD/DBD-DB2-1.78
```

Build and install  the Perl DBD:

**On Linux:**
```
DB2_HOME=/opt/ibm/db2/V9.7 DB2LIB=/opt/ibm/db2/V9.7/lib32 perl
  Makefile.PL
```

**On AIX:**
```
DB2_HOME=/opt/IBM/db2/V9.7  perl Makefile.PL
```

**For both AIX and Linux:**

```
make  ( on Linux you will get warnings)
make test
make install (if the tests look okay)
```

Note: if you are using perl 5.8.8 on AIX

```
    /usr/bin/perl -> /usr/opt/perl5/bin/perl5.8.8
 The make  may fail, with errors like :

DB2.h", line 18.10: 1506-296 (S) #include file <DBIXS.h> not found.
"dbdimp.h", line 10.10: 1506-296 (S) #include file <dbivport.h> not
found.

Edit the Makefile create by the Makefile.PL:

vi ~/DBD/DBD-DB2-1.78/Makefile

change
INC =  -I"/opt/IBM/db2/V9.7/include"-I"/usr/opt/perl5/lib/site_perl/
5.8.8/aix-thread-multi/auto/DBI" -I"/usr/opt/perl5/lib/5.8.8/aix-
thread-multi/auto/DBI" -I"/usr/opt/perl5/lib/site_perl/5.8.8/aix-
thread-multi/auto/DBI"

to

INC =  -I"/opt/IBM/db2/V9.7/include"-I"/usr/opt/perl5/lib/site_perl/
5.8.2/aix-thread-multi/auto/DBI" -I"/usr/opt/perl5/lib/5.8.2/aix-
thread-multi/auto/DBI" -I"/usr/opt/perl5/lib/site_perl/5.8.2/aix-
thread-multi/auto/DBI"

( Note this is one line it the file)

Rerun :
      make
      make test
      make install
```

# 4.0 Setting up the DB2 Server Instance

On the DB2 Server, the Management Node :This section takes you through the
creation of the the DB2 Server Instance. The Server Instance will be called xcatdb.
For more information on what is an Instance and what part it plays in DB2, read the
following DB2 information.
 All of the following steps must be run logged into the Management Node as root.

1)  Create a xcatdb user id and group for the DB2 instance. The home
    directory for the instance will be in /var/lib/db2.

On AIX:

 mkgroup xcatdb
 mkuser pgrp='xcatdb' home='/var/lib/db2' shell='/bin/ksh' xcatdb

On Linux:

    groupadd xcatdb

    useradd -d /var/lib/db2 -g xcatdb -m -s /bin/bash xcatdb

2) Set the xcatdb password

    passwd xcatdb

    ```
    Note: on AIX you are required to change the password
    when xcatdb first logs in.
    ```

## 3) Add the following entry into /etc/services

Edit the /etc/services file and add the following (suggestion: insert above the references section)

```
#
# xcatd settings : Allow tcp communication for the instance,  make sure port
numbers do not conflict with existing entries.
#
DB2_xcatdb     60000/tcp
DB2_xcatdb_1   60001/tcp
DB2_xcatdb_2   60002/tcp
DB2_xcatdb_END 60003/tcp
db2c_xcatdb    50001/tcp   # Port for server connection
```

## 4) Create the DB2  Server Instance
Note: you will need available  space  in /var/lib/db2 is 465348KB, for this to complete.

To create the xCAT DB2 Server Instance run the following:

on Linux

    /opt/ibm/db2/V9.7/instance/db2icrt **-a server -p** db2c_xcatdb **-s ese -u** xcatdb xcatdb

on AIX

    /opt/IBM/db2/V9.7/instance/db2icrt **-a server -p** db2c_xcatdb **-s ese -u** xcatdb xcatdb

## 5) Modify the DB2 Server Instance

```
cd /opt/ibm/db2/V9.7/instance on Linux
cd /opt/IBM/db2/V9.7/instance  on AIX
./db2iset -g DB2_PARALLEL_IO=*
```

```
./db2iset -g DB2AUTOSTART=yes
./db2iset -g DB2_STRIPED_CONTAINERS=ON

su – xcatdb
> db2set -all
[i] DB2COMM=tcpip
[g] DB2_STRIPED_CONTAINERS=ON
[g] DB2SYSTEM=c76a3l4vp01
[g] DB2INSTDEF=xcatdb
[g] DB2_PARALLEL_IO=*
[g] DB2AUTOSTART=yes
```

6) Set the db2 instance name and db2 home environment variables for root
For AIX as root:
    vi /etc/profile
    add the following line:
     export DB2INSTANCE=xcatdb


For Linux as root:
    cd /etc/profile.d
     vi xcat.sh
      add the following line:
       export DB2INSTANCE=xcatdb

     vi xcat.csh
      add the following line:
       setenv DB2INSTANCE "xcatdb"

Note: either logout and back in or  set the environment variable manually for root:
    export DB2INSTANCE=xcatdb

# 5.0 Start the DB2 Server

To start the server,  you must logon as the xcatd instance id,  create previously.

```
su – xcatdb
xcatdb@c76a3l4vp01:~> db2start
01/27/2010 19:48:08     0   0   SQL1063N  DB2START processing was
   successful.
SQL1063N  DB2START processing was successful.

If you need to stop the database,  use
xcatdb@c76a3l4vp01:~> db2stop
or
xcatdb@c76a3l4vp01:~> db2stop force
```

## 5.1 Increasing processor entitlement

After the database is started, you might want to increase the processor entitlement for DB2.   Check the section "Increasing processor entitlement" for information on customizing you system.


## 5.2 DB2 Useful Commands

Note: path IBM for AIX,  ibm for Linux
    These commands, you run as root:

- Remove an instance:/opt/ibm/db2/V9.7/instance/db2idrop  xcatdb
- If you have problems removing an instance use:
  /opt/ibm /db2/V9.7/instance/db2iset -d xcatdb
- Show all instances:/opt/ibm/db2/V9.7/instance/db2ilist

    These command, you run as xcatdb:

- db2 connect to xcatdb ( connect to database) from Server
- db2 connect to xcatdb user xcatdb  from Client
- db2 drop database  xcatdb ( drop the database)
- db2 list tables
- db2 describe table site
- db2 drop table site
- db2stop
- db2stop force
- db2start
- db2 ( enter interactive admin session)
- db2 -t ( enter interactive admin session where sql must end in ;)
- quit ( quit out of  interactive admin session)


## 6.0 Create the xCAT Database

We will create one database "xcatdb",  it will be store in the "xcatdb" Instance home directory which is /var/lib/db2.

    su – xcatdb


  In your xCAT install  /opt/xcat/share/xcat/tools/createdb.sql,  is a script that you can run to create the xcatdb database.   Run the following:

**db2 -tvf  /opt/xcat/share/xcat/tools/createdb.sql**

Note: be patient, it takes a while.  You may also investigate the default attributes of the database that we chose in this setup scripts and change according to your system needs.

### 6.1  Restart the Instance to Apply the Changes

```
su – xcatdb ( if not already there)
db2 connect reset
db2 force applications all; db2 terminate
db2stop
db2start
exit
```

# 7.0 Migrate xCAT data to DB2

If you are using the db2setup script from xCAT2.4 or later,   this section will automatically be done for you.  See man db2setup.  (TBD)

1. You must backup your xCAT data before populating the DB2  database. There are required default entries that were created in the SQLite database when the xCAT RPMs were installed on the Management Node, and they must be migrated to the new DB2  database.

   mkdir -p ~/xcat-dbback
   dumpxCATdb -p ~/xcat-dbback

   *Note: if you get an error, like "Connection failure: IO::Socket::SSL: connect: Connection refused at....,"   make sure your xcatd daemon is running.*

2. **Creating the /etc/xcat/cfgloc file** tells xcat what database to use.  If the file does not exists, it uses by default SQLite, which  is setup during the xCAT install by default.  The information you put in the files,  corresponds to the information you setup when you configured the database. Create a file called */etc/xcat/cfgloc* and populate it with the following line:

   DB2:xcatdb|xcatdb|ppslab09

   DB2:<databasename>|<instancename>|<instancepassword>

The first variable is the database name xcatdb that was setup. The second variable is the name of the Instance. The password must match the password of your DB2 Instance "xcatdb" userid.

Finally change permissions on the file, so only root can read, to protect the password.

*chmod 0600 /etc/xcat/cfgloc*

3. Stop the xcatd daemon, so no database actions will occur while you are migrating the data to DB2.
   On AIX: stopsrc -s xcatd
   On Linux: *service xcatd stop*

4. Restore your database to DB2. Use bypass mode to run the command because the daemon is no longer running. This can take a while.

   *XCATBYPASS=1 restorexCATdb -p ~/xcat-dbback*

   *Note: If you still have errors that you can not resolve, you can go back to using SQlite, by moving /etc/xcat/cfgloc to /etc/xcat/cfgloc.save and restarting xcatd.*

5. Start the xcatd daemon using the DB2 database.

   On AIX: startsrc -s xcatd
   On Linux: *service xcatd restart*

6. *Test the database*

   *tabdump site*

# 8.0 Setting up the DB2 Client on the Service Nodes.

## 8.1 Install the DB2 Client software on the SN

Follow the instructions in Install DB2 on the Management Node, to install the DB2 code on your Service Node ( SN), up to the point Install DB2 where you actually install DB2. You are only going to install the Client on the SN. Note you probably

do not have to download the DB2 code again,  if you have saved the downloads
from the Server install.

### Install DB2:

```
 cd /db2source/ese
 ./db2_install
```

**You will be prompted with the following questions:**

```
Default directory for installation of products - /opt/ibm/db2/
V9.7

Do you want to choose a different directory to install
[yes/no] ?
```
 **Answer: no**


Specify one of the following keywords to install DB2 products.
```
 ESE
 CLIENT
 RTCL
```

**Answer: CLIENT**


## 8.2   Installation and Setup of  DBD::DB2 Perl modules

As you did on the Management Node (MN),  the Perl DB2 DBD will have to be
installed on all Service nodes.   If your Service Nodes are at the same OS level as
your Management node,  you can mount the directory from the MN to the Service
Node and just run the install.


### For installing the DBD:DB2 DBI from a mount:
  On the MN:

    export ~/DBD  read-only

  On the SN:

     mkdir /mnt2

mount xx.xxx.xxx.xxx:~/DBD   /mnt2

cd  /mnt2/DBD-DB2-1.78

make test  ( if no errors continue with the make install)

make install

unmount or umount /mn2

## For installing the DBD:DB2 DBI from the source code:

Follow the instructions in Installation and Setup of  DBD::DB2 Perl modules.

## *8.3  Creating the Client Instance on the Service Node*

This section takes you through the creation of the  the DB2 Client  Instance on the Service Node.  The Client Instance will be called xcatdb.
 For more information on what is an Instance and what part it plays in DB2,  read the following DB2 information.

 All of the following steps must be run logged into the Service  Node as root.
We will want to create the group and userid with the same gid and uid as was assigned on the Management Node.

1) On the MN,   read  the gid and uid of the xcatdb group and userid.
   cat /etc/passwd | grep xcatdb
   xcatdb:!:212:205::/var/lib/db2:/bin/ksh
   The first number (212) is the uid,  the second (205) is the gid.

2) Create a xcatdb user id and group for the DB2 client instance.  The homedirectory for the instance will be in /var/lib/db2 as on the MN.
   Note: make sure the uid of the userid and group match the uid on the Management Node.  The numbers are from step (1).

   On AIX:

   ```
   mkgroup id=205 xcatdb
   mkuser pgrp='xcatdb' id=212
   home='/var/lib/db2' shell='/bin/ksh'  xcatdb
   ```

   On Linux:

   ```
   groupadd -g 205 xcatdb
   ```

```
useradd -d /var/lib/db2 -g xcatdb -u 212 -m -s
/bin/bash xcatdb
```

3) Set the xcatdb password

passwd xcatdb

```
Note: on AIX you are required to change the password
when xcatdb first logs in.  Recomment you use the same
as was assigned on the MN.
```

**4) Add the following entry into /etc/services on the Service Node**

Edit the /etc/services file and add the following (suggestion: insert above the references section)

# note this must match what is in /etc/services on the Management/DB2 Server. Again make sure matching port is not used on both machines.

db2c_xcatdb    50001/tcp    # Port for DB2 Server Connect

5) Create the DB2 Client Instance
To create the xCAT DB2 Client Instance run the following:

```
On Linux:
```
/opt/ibm/db2/V9.7/instance/db2icrt -s client xcatdb
```
On AIX:
```
/opt/IBM/db2/V9.7/instance/db2icrt -s client xcatdb

## *8.4  Creating the catalog of the DB2 Server Node on the SN*

Now we will setup the Client to access the database using xcatdb instance on the Service Node:

```
su – xcatdb
```

db2 catalog tcpip node mn  remote 9.114.113.203 server db2c_xcatdb
(note: port must match what is in /etc/services)
db2 terminate  ( refreshes cache)

**Note: 9.114.113.203 must be an address or resolvable hostname that the Service Node can access the Management Node.**

## 8.5 Catalog the Server Instance Database

Next we will catalog the xcatdb database on the node that we just defined above (mn). This command looks like :

Here the DATABASENAME is the name of the database (xcatdb) on the server node the MN. The DATABASEALIAS matches the db name, and the SERVERNAME is the node defined above, i.e. mn.

```
 su – xcatdb ( if not already there)
db2 catalog db xcatdb  as xcatdb at node mn
db2 terminate  ( refreshes cache)

For more information: See
http://publib.boulder.ibm.com/infocenter/db2luw/v8/index.jsp?
topic=/com.ibm.db2.udb.doc/core/r0001944.htm
```

## 8.6  Test the Database Connection

```
su – xcatdb (if not already there)



db2 connect to xcatdb user xcatdb
```

You will be prompted for xcatdb's password. After entering it you should see something similar to this:

Database Connection Information Database server = DB2/LINUXPPC64 9.7.1
 SQL authorization ID = XCATDB
 Local database alias = XCATDB

Close the connection with -

```
db2 connect reset
exit
```

## 9.0 Installing xCAT on the Service Node

Now that the DB2 database is setup you can install xCAT on the Service Node.
Use the following references for setting up your Service Nodes:
- Setting up Hierarchy in xCAT
- Setting up an AIX Hierarchical Cluster

## 10.0 Removing xCAT from DB2

To remove the database, first back it up.

*mkdir -p ~/xcat-dbback*
*dumpxCATdb -p ~/xcat-dbback*

1. stop the xcatd daemon

2. Now remove the database.

su – xcatdb

*>db2 drop database xcatdb;*

3. remove /etc/xcat/cfgloc file ( points xCAT to DB2)

4. Install the DB2 database into SQLite

*XCATBYPASS=1 restorexCATdb -p ~/xcat-dbback*

5. start xcatd

## 11.0 Removing DB2 from MN and SN

To remove DB2 from your MN and Service Node after removing xCAT from the
DB, do the following: (note path is IBM for AIX, ibm for Linux)

On the Service Node:

1) Remove the instance:
   /opt/IBM/db2/V9.7/instance/db2idrop xcatdb
2) Check to see if no instance:
   /opt/IBM/db2/V9.7/instance/db2ilist
3) Remove the DB2 ( this takes a while):
   /opt/IBM/db2/V9.7/install/db2_deinstall -a
4) remove instance port from /etc/services

vi /etc/services
delete entry: db2c_xcatdb1    50001/tcp    # Port for server connection
5) remove xcatdb user and xcatdb group
6) remove export DB2INSTANCE=xcatdb1 from /etc/profile on AIX,  or
/etc/profile.d/xcat.sh or xcat.csh on Linux.

On the Management Node
Repeat steps 1 - 6 as above on the MN.


# 12.0 References

- *Configuring and Managing BlueGene  DB2 Setup Sections*
- *MySQL to DB2 migration*
- *Setting up the DB2 Client*
- *DB2 Survival Guide*
- *DBD:DB2 pod*
- *DB2 Deployment Guide*
- *DB2 Perl Database Interface*
- *DBI  mail archives*
- *Perl Progamming with DB2*

# 13.0 Diagnostics

1) "Total Environment Allocation Failure"  when running xCAT command to
the database, such as tabdump.
echo $DB2INSTANCE  should be xcatdb
Usually loss of critical DB2 Env Var settings for the following:
   DB2INSTANCE=xcatdb  ( most important)
   CUR_INSTHOME=/var/lib/db2
   DB2DIR=/opt/ibm/db2/V9.7
   INSTHOME=/var/lib/db2
   See:http://www.perlmonks.org/?node_id=682626

   See: Set the db2 instance name and db2 home environment variables for root



2) Set diagnostics level in database
    You can up the diagnotics level and watch for database errors in the
~/sqllib/db2dump/db2diag.log   and  xcatdb.nfy under the xcatdb instance
home directory on the DB2 Server.

Run the following to increase  the diagnostics level.  Note: this should be set
back to level 3  after diagnosing the problem, because it affects DB
performance.

```
On the MN:
   stop xcatd
   su - xcatdb
   db2 update dbm cfg using diaglevel 4
   db2stop
   db2start
```