

Example xCAT installation on an iDataplex configuration.

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1. Introduction and description of example configuration

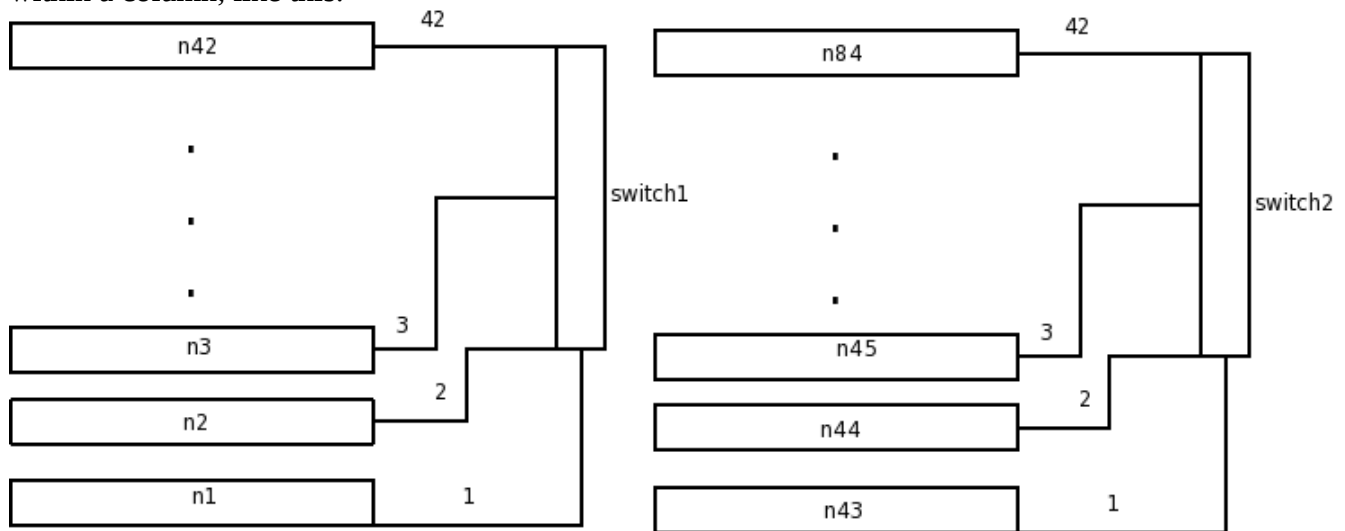
This example configuration is intended as an introduction to xCAT. It will assume the use of IBM e1350 defaults as documented at ftp://ftp.software.ibm.com/eserver/xseries/1350FS_0507.pdf.

This configuration will have a single dx340 management server with 167 other dx340 servers as nodes. The OS deployed will be RH Enterprise Linux 5.1, x86_64 edition. Here is a diagram of the racks:

Rack 1				Rack 2						
A	B	C	D	A	B	C	D			
n42	switch1	n84	switch2	n126	switch3	mgt	switch4			
n41		n83		n125		n167				
n40		n82		n124		n166				
n39		n81		n123		n165				
n38		n80		n122		n164				
n37		n79		n121		n163				
n36		n78		n120		n162				
n35		n77		n119		n161				
n34		n76		n118		n160				
n33		n75		n117		n159				
n32		n74		n116		n158				
n31		n73		n115		n157				
n30		n72		n114		n156				
n29		n71		n113		n155				
n28		n70		n112		n154				
n27		n69		n111		n153				
n26	n68	n110	n152							
n25	n67	n109	n151							
n24	n66	n108	n150							
n23	n65	n107	n149							
n22	n64		n106		n148					
n21	PDU	n63	PDU	n105	PDU	n147	PDU			
n20		n62		n104		n146				
n19		n61		n103		n145				
n18		n60		n102		n144				
n17		n59		n101		n143				
n16		n58		n100		n142				
n15		n57		n99		n141				
n14		n56		n98		n140				
n13		n55		n97		n139				
n12		n54		n96		n138				
n11		n53		n95		n137				
n10		n52		n94		n136				
n9		n51		n93		n135				
n8		n50		n92		n134				
n7		n49		n91		n133				
n6		n48		n90		n132				
n5	n47	n89	n131							
n4	n46	n88	n130							
n3	n45	n87	n129							
n2	n44	n86	n128							
n1	n43	n85	n127							

The management node is known as 'mgt', the nodes are n1-n167, and the domain will be 'cluster'

The network is physically laid out such that port number on a switch is equal to the U position number within a column, like this:



2. Prepare for xCAT installation

xCAT install process will scan and populate certain settings from the running configuration. Having the networks configured ahead of time will aid in correct configuration.

2.1. Install the management server OS

Install RHEL5 Server 5.1 on the management server. It is recommended to ensure that dhcp, bind (not bind-chroot), expect, httpd, nfs-utils, vsftpd, and perl-XML-Parser are installed. If the management server will be on the network and RHN activated, these installs will happen automatically later if not done now.

2.2. Ensure that SELinux is disabled.

`/etc/sysconfig/selinux` should contain `SELINUX=disabled`

If this change had to be made, reboot the system.

2.3. Prevent DHCP client from overwriting DNS configuration

Find the `/etc/sysconfig/network-scripts/ifcfg-*` files relevant to any NICs that are DHCP configured. Put `PEERDNS=no` into them.

2.4. Configure NICS

Configure the cluster facing nics. An example `/etc/sysconfig/network-scripts/ifcfg-eth1`:

```
DEVICE=eth1
ONBOOT=yes
BOOTPROTO=static
IPADDR=172.20.0.1
NETMASK=255.240.0.0
```

2.5. Configure hostname

`/etc/sysconfig/network` should have `HOSTNAME=(desired hostname)`

2.6. Configure dns resolution

/etc/resolv.conf contents in this example:

```
search cluster
nameserver 172.20.0.1
```

2.7. Setup basic hosts file

Ensure a line like the following is in /etc/hosts:

```
172.20.0.1 mgt.cluster mgt
```

2.8. Restart management server

Though it is possible to restart the correct services for all settings except SELinux, the simplest step would be to reboot the management server at this point.

2.9. Configure ethernet switches

xCAT will use the ethernet switches for discovery. In general, this requires that the user in advance set up an ip address and basic snmp functionality. Allowing the snmp version 1 community string “public” read access will allow xCAT to communicate without further customization. It is also recommended that spanning tree be set to portfast or edge-port for faster boot performance. Please see the relevant switch documentation as to how to configure these items.

3. Install xCAT

There are two general scenarios for installation, 3.1a for disconnected operation, 3.1b for live operation. Pick either one, but not both.

3.1a. Prepare to install xCAT from disk or media

If not able to or not wishing to use the live internet repository, choose this option. Go to <http://sourceforge.net/projects/xcat/>, and click the green 'Download xCAT' link. Download core-repo and dep-repo tar.bz2 files

Proceed to extract to a directory:

```
# mkdir -p /install/xcat
# cd /install/xcat
# tar jxvf ~/core-repo-2.0*.tar.bz2
# tar jxvf ~/dep-repo-2.0*.tar.bz2
# xcat-core/mklocalrepo.sh
# xcat-dep/rh5/x86_64/mklocalrepo.sh
```

3.1b. Prepare to install xCAT from live internet hosted repository.

When using the live internet repository, simply make sure the correct repo files are in /etc/yum.repos.d:

```
# cd /etc/yum.repos.d
# wget http://xcat.sourceforge.net/yum/xcat-dep/rh5/x86\_64/xCAT-dep.repo
# wget http://xcat.sourceforge.net/yum/xcat-core/xCAT-core.repo
```

3.2. Install xCAT packages

Use yum to install xCAT and chase all the dependencies for you:

```
# yum install xCAT.x86_64
# ./etc/profile.d/xcat.sh
```

4. Configure xCAT

4.1. Verify site table settings.

The process until now should have produced likely accurate defaults, however, run the following command to use vi to review the site table contents.

```
tabedit site
```

4.2. Load e1350 templates

This configuration will use the provided sample templates as is, to load them:

```
cd /opt/xcat/share/xcat/templates/e1350/  
for i in *csv; do tabrestore $i; done
```

4.3. Declare a dynamic range for discovery.

In this case, we'll designate 172.20.255.1-172.20.255.254 as a dynamic range:

```
chtab net=172.16.0.0 networks.dynamicrange=172.20.255.1-172.20.255.254
```

4.4. Customize template settings

The templates that came with xCAT 2.0 should work as provided for this example. If the situation has a difference (for example U position or IP address scheme difference), a user can either configure it as they would in xCAT 1.x (each node has it's dedicated entry), or modify the group-level definitions to fit the scheme. If interested in an example of template style modification, see Appendix A.

4.5. Declare use of SOL

If not using a terminal server, SOL is recommended, but not required to be configured. To instruct xCAT to configure SOL in installed operating systems on dx340 systems:

```
chtab node=compute nodehm.serialport=1 nodehm.serialspeed=19200 nodehm.serialflow=hard
```

4.6. Add nodes to nodelist

Here use the power of the templates if used to define the nodes quickly:

```
# nodeadd n1-n167 groups=ipmi,idadaplex,42perswitch,compute ,all  
# nodeadd bmc1-bmc167 groups=84bmcperrack  
# nodeadd switch1-switch4 groups=switch
```

At this point, xCAT should be ready to begin managing services.

5. Begin using xCAT to configure system and discover nodes

5.1. Setup hosts file

Ask xCAT to write out a hosts file per the hosts table (skip if writing /etc/hosts by hand):

```
# makehosts switch,idadaplex-bmc,ipmi
```

5.2. Setup DNS

Ensure that /etc/sysconfig/named does not have ROOTDIR set, then:

```
# makedns && service named start
```

5.3. Setup DHCP

```
# makedhcp -n && service dhcpd restart
```

5.4. Configure conserver

```
# makeconservercf && service conserver start
```

5.5. Discover nodes

Walk over to systems, hit power buttons, watch `tail -f /var/log/messages` as nodes discover themselves

5.6. Verify state of nodes

After about 5-10 minutes, nodes should be configured and ready for hardware management:

```
# rpower all stat|xcoll
=====
n1,n10,n100,n101,n102,n103,n104,n105,n106,n107,n108,n109,n11,n110,n111,n112,n113,n114,n115,n
116,n117,n118,n119,n12,n120,n121,n122,n123,n124,n125,n126,n127,n128,n129,n13,n130,n131,n132,
n133,n134,n135,n136,n137,n138,n139,n14,n140,n141,n142,n143,n144,n145,n146,n147,n148,n149,n1
5,n150,n151,n152,n153,n154,n155,n156,n157,n158,n159,n16,n160,n161,n162,n163,n164,n165,n166,
n167,n17,n18,n19,n2,n20,n21,n22,n23,n24,n25,n26,n27,n28,n29,n3,n30,n31,n32,n33,n34,n35,n36,n3
7,n38,n39,n4,n40,n41,n42,n43,n44,n45,n46,n47,n48,n49,n5,n50,n51,n52,n53,n54,n55,n56,n57,n58,n5
9,n6,n60,n61,n62,n63,n64,n65,n66,n67,n68,n69,n7,n70,n71,n72,n73,n74,n75,n76,n77,n78,n79,n8,n80
,n81,n82,n83,n84,n85,n86,n87,n88,n89,n9,n90,n91,n92,n93,n94,n95,n96,n97,n98,n99
=====
on
```

6. Install nodes

6.1. Begin installation

The following command will commence installation to disk on all of the nodes

```
# rinstall -o rhels5.1 all
```

6.2. Monitor installation

It is possible to use the `wcons` command to monitor a sampling of the nodes:

```
# wcons n1,n20,n80,n100
```

Additionally, `nodestat` may be used to check the status of a node as it installs:

```
# nodestat n20,n21
n20: installing man-pages - 2.39-10.el5 (0%)
n21: installing prep
```

After some time, the nodes should be up and ready for general usage

7. Useful Applications of xCAT commands

For any given command, typing `'man command'` should give an in depth document on the workings of that command. Here are some examples of using key commands and command combinations in useful ways.

7.1. Adding groups to a set of nodes

In this configuration, a handy convenience group would be the lower systems in the chassis, the ones able to read temperature and fanspeed. In this case, the odd systems would be on the bottom, so to do this:

```
# nodech '/n.*[13579]$$' groups,=bottom
```

7.2. Listing attributes

We can list discovered and expanded versions of attributes (Actual vpd should appear instead of *) :

```
# nodes n97 nodepos.rack nodepos.u vpd.serial vpd.mtm
n97: nodepos.u: A-13
n97: nodepos.rack: 2
n97: vpd.serial: *****
n97: vpd.mtm: *****
```

7.3. Verifying consistency and version of firmware

Combining the use of in-band and out-of-band utilities with xcoll, it is possible to quickly analyze the level and consistency of firmware across the servers:

```
# rinv n1-n3 mprom|xcoll
=====
n1,n2,n3
=====
BMC Firmware: 1.18
```

The BMC does not have the BIOS version, so to do the same for that, use psh:

```
# psh n1-n3 dmidecode|grep "BIOS Information" -A4|grep Version|xcoll
=====
n1,n2,n3
=====
Version: I1E123A
```

7.4. Reading and interpreting sensor readings

If the configuration is louder than expected (iDataplex chassis should nominally have a fairly modest noise impact), find the nodes with elevated fanspeed:

```
# rvitals bottom fanspeed|sort -k 4|tail -n 3
n3: PSU FAN3: 2160 RPM
n3: PSU FAN4: 2240 RPM
n3: PSU FAN1: 2320 RPM
```

In this example, the fanspeeds are pretty typical. If fan speeds are elevated, there may be a thermal issue. In a dx340 system, if near 10,000 RPM, there is probably either a defective sensor or misprogrammed power supply.

To find the warmest detected temperatures in a configuration:

```
# rvitals bottom temp|grep Domain|sort -t: -k 3|tail -n 3
n3: Domain B Therm 1: 46 C (115 F)
n7: Domain A Therm 1: 47 C (117 F)
n3: Domain A Therm 1: 49 C (120 F)
```

Change tail to head in the above examples to seek the slowest fans/lowest temperatures. Currently, an iDataplex chassis without a planar tray in the top position will report '0 C' for Domain B temperatures.

Appendix A. Template modification example

Templates support powerful expressions for defining a scheme based configuration. This can help for more dynamic configurations or defining a site-standard set of defaults once and applying to multiple clusters. Here we will take two of the default schemes and modify them to support a configuration where n1 is in switch port 2, U position 2, and so on in the first rack. Keep in mind that this is merely an option, not a requirement, and per-node settings are always an option for those that would prefer it. First, extract the current templates for nodepos.rack, nodepos.u, and the ip addresses for nodes and bmcs:

```
# gettab node=idataplex nodepos.rack nodepos.u
nodepos.u: |D+(\d+).*$(sprintf("%c", (65+2*(((S1-1)/42)%2))))((S1-1)%42+1)|
nodepos.rack: |D+(\d+).*$(1+((S1-1)/84))|
# gettab node=42perswitch switch.port switch.switch
switch.switch: |D+(\d+).*$|switch((S1-1)/42+1)|
switch.port: |D+(\d+).*$|((S1-1)%42+1)|
# gettab node=84nodeperrack hosts.ip
|D+(\d+).*$|172.20.(101+((S1-1)/84)).((S1-1)%84+1)|
# gettab node=84bmcperrack hosts.ip
|D+(\d+).*$|172.29.(101+((S1-1)/84)).((S1-1)%84+1)|
```

The left hand side of the values represents how a number is extracted from a node's name, by enclosing it in parentheses. The right hand side can then perform some arithmetic to designate a value. In this case, we are changing the underlined offset to '-0' to reflect the fact that n1 should have the value n2 would have had in the default configuration.

```
# chtab node=idataplex \
nodepos.u='|D+(\d+).*$(sprintf("%c", (65+2*(((S1-0)/42)%2))))((S1-0)%42+1)|\'
nodepos.rack='|D+(\d+).*$(1+((S1-0)/84))| '
# chtab node=42perswitch \
switch.switch='|D+(\d+).*$|switch((S1-0)/42+1)|\' \
switch.port='|D+(\d+).*$|((S1-0)%42+1)| '
# chtab node=84nodeperrack \
hosts.ip='|D+(\d+).*$|172.20.(101+((S1-0)/84)).((S1-0)%84+1)|\'
# chtab node=84bmcperrack \
hosts.ip='|D+(\d+).*$|172.29.(101+((S1-0)/84)).((S1-0)%84+1)|\'
```