Linux for SQL Server DBAs Series

Linux Primer for SQL Server DBAs

March 2018

SentryOne
Global Partner Network

VISCOSITY NORTH AMERICA

SentryOne®

Charles Kim

Founder and President of Viscosity

ORACLE ACE Director

vmware vEXPERT

@racdba

ORACLE Platinum Partner

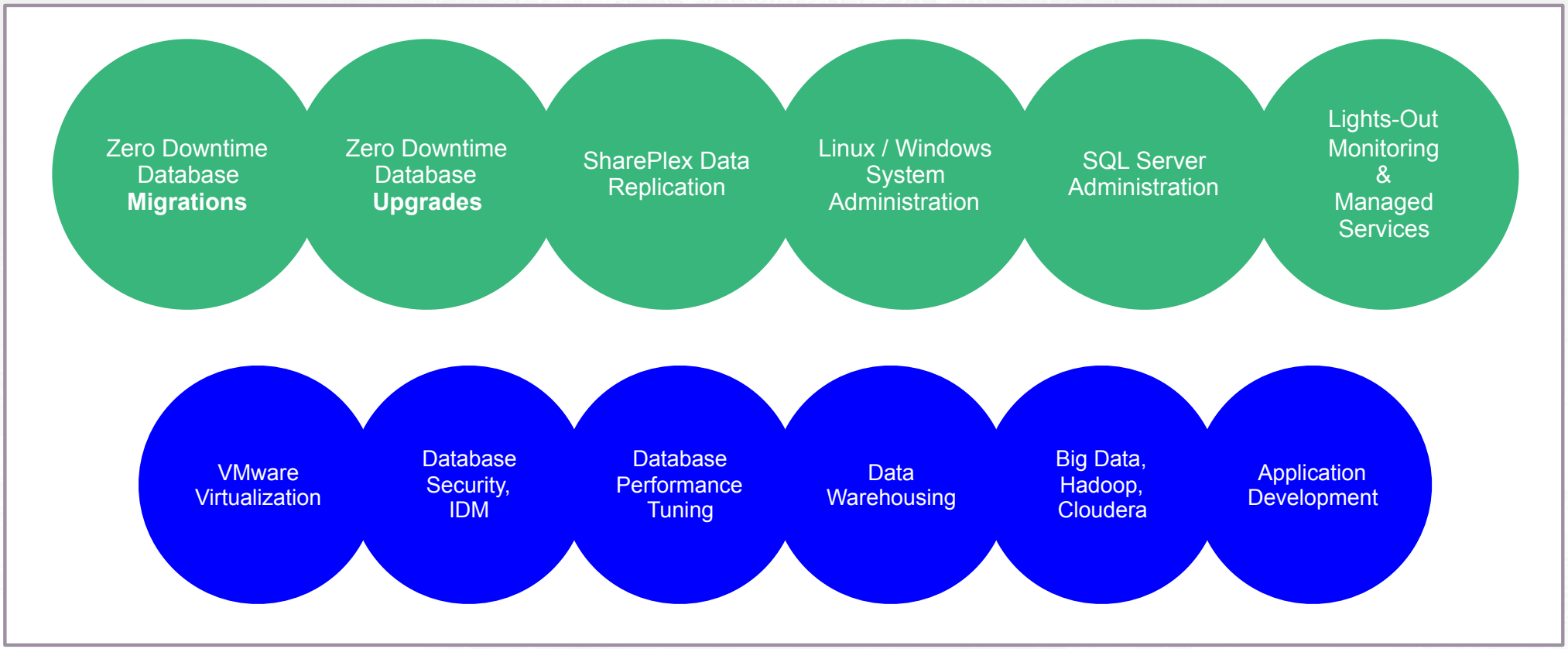
- Oracle ACE Director 2009 - 2018
- VMware vExpert 2013 – 2018
- On and off **SQL Server** Admin since 1999
- Over 27 years of Oracle Expertise: **Mission Critical Databases,** RAC, Data Guard, ASM, RMAN, **Shareplex/GoldenGate**
- Specialize in "**Complex Data Replication & Integration"** with Shareplex & GG
- President - IOUG Cloud Special Interest Group (SIG)
- Blog Sites: http://DBAExpert.com/blog
- **LinkedIn**: https://www.linkedin.com/in/chkim/
- Oracle Exadata Certified Implementation Specialist, (2014, 2016)
- Oracle Certified RAC Expert

redhat. CERTIFIED

ORACLE Certified Professional

vmware certified PROFESSIONAL

Viscosity North America



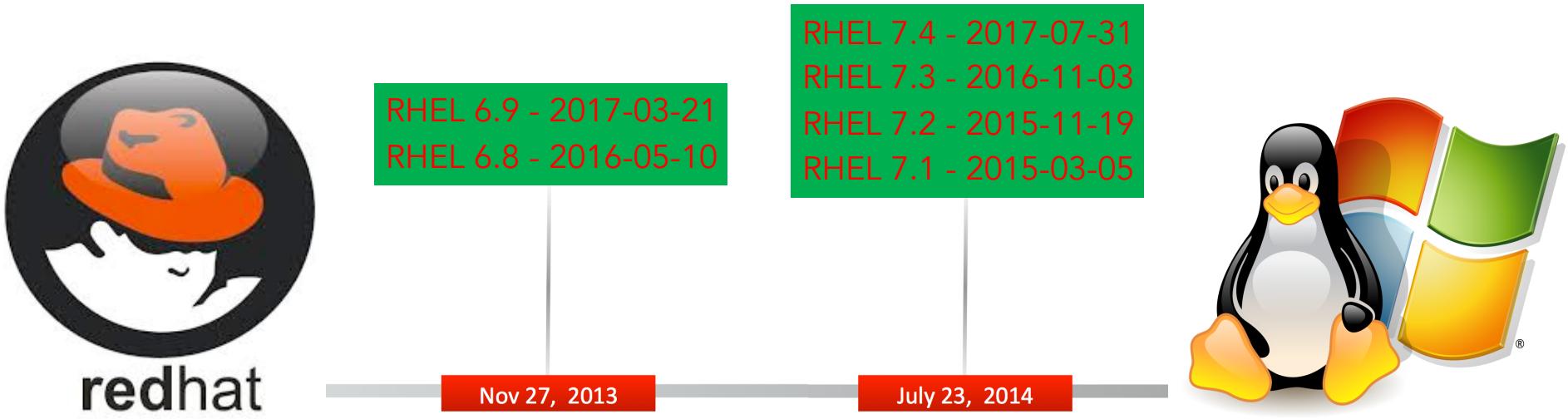
Agenda

- State of the penguin
- Installation and Configuration of SQL Server on Linux
  - * Setup a Local Yum Repository
  - * Overview of mssql user account and directory structure
  - * Installation of mssql-tools
  - * Enabling SQL Server Agent
- Logging into the Linux System with ssh
  - * ssh key generation
  - * ssh passwordless login
- Look into systemctl
- Firewall management
- Top 10 commands for DBAs
- Regular Expressions
- Shell Scripting 101
- Demo - Time Permitting!

State of the Penguin

Red Hat Linux Release Updates

Releases from the past year



Installation Guide

Installation Guide For SQL Server

https://docs.microsoft.com/en-us/sql/linux/sql-server-linux-setup

Supported OS in order of popularity:

RHEL: 7.3 & 7.4

Ubuntu: 16.04

SUSE: v12 SP2

Containerization

Docker: >1.8

Most Popular Operating Systems

Easy as 1-2-3 Installation

Red Hat	Ubuntu	SUSE (SLES)
sudo curl -o /etc/yum.repos.d/mssql-server.repo https://packages.microsoft.com/config/rhel/7/mssql-server-2017.repo	wget -qO- https://packages.microsoft.com/keys/microsoft.asc | sudo apt-key add - sudo add-apt-repository "$(wget -qO- https://packages.microsoft.com/config/ubuntu/16.04/mssql-server-2017.list)"	sudo zypper addrepo -fc https://packages.microsoft.com/config/sles/12/mssql-server-2017.repo sudo zypper --gpg-auto-import-keys refresh
sudo yum update mssql-server	sudo apt-get update	sudo zypper update mssql-server
sudo yum install -y mssql-server	sudo apt-get install -y mssql-server	sudo zypper install -y mssql-server
sudo /opt/mssql/bin/mssql-conf setup	sudo /opt/mssql/bin/mssql-conf setup	sudo /opt/mssql/bin/mssql-conf setup

System Requirements

Memory	2GB
File System	EXT4 XFS • No BTRFS Support • Locate only the **/var/opt/mssql** directories on the NFS mount. Other files, such as the SQL Server system binaries, are not supported.
Minimum Disk Space	6GB
CPU	2 Cores, 2GHz, 64 bit Only
NFS	4.2+ • Need Sparse File Creation • Needs Fallocate Support • 'nolock' on client when mounting remote share

1. Download the Repo File

Download the repo file	**[ckim@sql100 .ssh]$ sudo curl -o /etc/yum.repos.d/mssql-server.repo https://packages.microsoft.com/config/rhel/7/mssql-server-2017.repo** [sudo] password for ckim: % Total % Received % Xferd Average Speed Time Time Time Current Dload Upload Total Spent Left Speed 100 232 100 232 0 0 387 0 --:--:-- --:--:-- --:--:-- 387
	Look for step-by-step installation with complete screen shots for SUSE and Ubuntu on http://DBAExpert.com/blog.

2. Install SQL Server on Red Hat EL

Install SQL Server

```
[ckim@sql100 .ssh]$ sudo yum install -y mssql-server
Loaded plugins: langpacks, product-id, search-disabled-repos, subscription-manager
This system is not registered with an entitlement server. You can use subscription-manager
to register.
packages-microsoft-com-mssql-server-2017                          | 2.9 kB  00:00:00
packages-microsoft-com-mssql-server-2017/primary_db               | 9.1 kB  00:00:00
Resolving Dependencies
--> Running transaction check
---> Package mssql-server.x86_64 0:14.0.3022.28-2 will be installed
--> Finished Dependency Resolution

Dependencies Resolved
================================================================================
 Package        Arch     Version          Repository                       Size
================================================================================
Installing:
mssql-server   x86_64   14.0.3022.28-2   packages-microsoft-com-mssql-server-2017   167 M

Transaction Summary
================================================================================
Install  1 Package

Total download size: 167 M
Installed size: 167 M
Downloading packages:
warning: /var/cache/yum/x86_64/7Server/packages-microsoft-com-mssql-server-2017/packages/
mssql-server-14.0.3022.28-2.x86_64.rpm: Header V4 RSA/SHA256 Signature, key ID be1229cf:
NOKEY
Public key for mssql-server-14.0.3022.28-2.x86_64.rpm is not installed
```

3. Configure SQL Server on Red Hat EL

Configuration

```
[ckim@sql100 ~]$ sudo /opt/mssql/bin/mssql-conf setup
Choose an edition of SQL Server:
  1) Evaluation (free, no production use rights, 180-day limit)
  2) Developer (free, no production use rights)
  3) Express (free)
  4) Web (PAID)
  5) Standard (PAID)
  6) Enterprise (PAID)
  7) Enterprise Core (PAID)
  8) I bought a license through a retail sales channel and have a product key to enter.


Details about editions can be found at
https://go.microsoft.com/fwlink/?LinkId=852748&clcid=0x409

Use of PAID editions of this software requires separate licensing through a
Microsoft Volume Licensing program.
By choosing a PAID edition, you are verifying that you have the appropriate
number of licenses in place to install and run this software.

Enter your edition(1-8): 2
The license terms for this product can be found in
/usr/share/doc/mssql-server or downloaded from:
https://go.microsoft.com/fwlink/?LinkId=855862&clcid=0x409

The privacy statement can be viewed at:
https://go.microsoft.com/fwlink/?LinkId=853010&clcid=0x409
```

Status of SQL Server Configuration

```
[ckim@sql100 ~]$ systemctl status mssql-server
● mssql-server.service - Microsoft SQL Server Database Engine
   Loaded: loaded (/usr/lib/systemd/system/mssql-server.service; enabled; vendor preset: disabled)
   Active: active (running) since Sat 2018-03-17 23:11:25 CDT; 9min ago
     Docs: https://docs.microsoft.com/en-us/sql/linux
 Main PID: 2946 (sqlservr)
   CGroup: /system.slice/mssql-server.service
           ├─2946 /opt/mssql/bin/sqlservr
           └─2992 /opt/mssql/bin/sqlservr


Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.31 Server      S...].
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.31 Server      S...].
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.33 Server      D...4.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.34 spid19s     S...d.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.47 spid11s     S...'.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.58 spid11s     T...).
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.59 spid22s     T...e.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.59 spid22s     T...e.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.59 spid22s     S...d.
Mar 17 23:11:28 sql100 sqlservr[2946]: 2018-03-17 23:11:28.61 spid6s      R...d.
Hint: Some lines were ellipsized, use -l to show in full.

[ckim@sql100 ~]$ systemctl status mssql-server -l
```

* Full listing

SQL Server Files – mssql binaries

Listing of mssql binaries:

```
sql100:/opt/mssql/bin
 > ls -ltr
total 23548
-rwxrwxr-x. 1 root root     1294 Feb 16 16:20 mssql-conf
-rwxr-xr-x. 1 root root   934136 Feb 16 16:20 sqlservr
-rwxr-xr-x. 1 root root 23140824 Feb 16 16:20 paldumper
-rwxr-xr-x. 1 root root     1886 Feb 16 16:20 handle-crash.sh
-rwxr-xr-x. 1 root root     1615 Feb 16 16:20 generate-sql-dump.sh
-rwxr-xr-x. 1 root root    16302 Feb 16 16:20 crash-support-functions.sh
-rwxr-xr-x. 1 root root      409 Feb 16 16:20 compress-dump.sh
```

file command: Display the type of file

```
 > file sqlservr
sqlservr: ELF 64-bit LSB shared object, x86-64, version 1 (SYSV), dynamically linked (uses shared libs), for
GNU/Linux 2.6.32, BuildID[sha1]=2e700676cb898bd5ce16eb3833a8bc7254e38054, stripped

 > file generate-sql-dump.sh
generate-sql-dump.sh: Bourne-Again shell script, ASCII text executable
```

SQL Server Files – Look inside binaries with strings

strings command: Display text strings within a binary file

```
sql100:/opt/mssql/bin
 > strings sqlservr |more
/lib64/ld-linux-x86-64.so.2
libpthread.so.0
_ITM_deregisterTMCloneTable
_Jv_RegisterClasses
_ITM_registerTMCloneTable
sem_close
pthread_cond_init
pthread_rwlock_trywrlock
pthread_yield
pthread_self
pthread_rwlock_wrlock
__libc_current_sigrtmin
pthread_sigmask
pthread_exit
sem_timedwait
pthread_rwlock_unlock
fsync
__errno_location
```

SQL Server User/Group and Running Processes

Look for MS User and Group

```
 > cat /etc/passwd |grep mssql
mssql:x:991:986::/var/opt/mssql:/bin/bash

sql100:/opt/mssql/bin
 > cat /etc/group |grep mssql
mssql:x:986:
```

Look for running processes

```
sql100:/opt/mssql/bin
 > ps -ef |grep -i mssql |grep -v grep
mssql      1206      1  0 15:35 ?        00:00:10 /opt/mssql/bin/sqlservr
mssql      1687   1206  1 15:35 ?        00:02:41 /opt/mssql/bin/sqlservr

 > ps -fu mssql
UID         PID   PPID  C STIME TTY          TIME CMD
mssql      1206      1  0 15:35 ?        00:00:10 /opt/mssql/bin/sqlservr
mssql      1687   1206  1 15:35 ?        00:02:43 /opt/mssql/bin/sqlservr
```

SQL Server – Review Database File Locations

Look at the database files in the DATA Directory

```
sql100:/var/opt/mssql/data
 > ls -ltr
total 54720
-rw-r-----. 1 mssql mssql  8388608 Mar 18 19:37 model.mdf
-rw-r-----. 1 mssql mssql  8388608 Mar 18 19:37 modellog.ldf
-rw-r-----. 1 mssql mssql  8388608 Mar 18 19:37 tempdb.mdf
-rw-r-----. 1 mssql mssql  8388608 Mar 18 19:37 templog.ldf
-rw-r-----. 1 mssql mssql   786432 Mar 18 19:37 msdblog.ldf
-rw-r-----. 1 mssql mssql 15400960 Mar 18 19:37 msdbdata.mdf
-rw-r-----. 1 mssql mssql  4194304 Mar 18 20:00 master.mdf
-rw-r-----. 1 mssql mssql  2097152 Mar 18 20:05 mastlog.ldf
```

Setup Local Yum Repository

Easy as 1-2-3

Mount the ISO as loop device (Only if RHEL did not do this for you automatically):

```
mkdir /mnt/RHEL.DVD /mnt/rhel6.5.iso
scp rhel-server-6.5-x86_64-dvd.iso root@duppy:/mnt/rhel6.5.iso
mount -o loop -t iso9660 /mnt/rhel6.5.iso/rhel-server-6.5-x86_64-dvd.iso /mnt/RHEL.DVD
```

```
$ pwd
/run/media/ckim/RHEL-7.4 Server.x86_64
```

```
$ cat .discinfo
1499751070.690815
Red Hat Enterprise Linux 7.4
x86_64
1
```

Setup Local Yum Repository

Create a file in the /etc/yum.repos.d:

[root@sql100 ~]# cat /etc/yum.repos.d/viscosity.repo

```
[viscosity]
mediaid=1499751070.690815
name=Local Viscosity Repo
baseurl="file:///run/media/ckim/RHEL-7.4 Server.x86_64"
enabled=1
gpgcheck=no
```

Needs a double quote because of the space

```
[root@sql100 ~]# yum repolist
Loaded plugins: langpacks, product-id, search-disabled-repos, subscription-manager
This system is not registered with an entitlement server. You can use subscription-manager to register.
Repository packages-microsoft-com-prod is listed more than once in the configuration
repo id                                                repo name                                                status
packages-microsoft-com-mssql-server-2017               packages-microsoft-com-mssql-server-2017                    21
packages-microsoft-com-prod                            packages-microsoft-com-prod                                113
viscosity                                              Local Viscosity Repo                                     4,986
repolist: 5,120
```

Add prod.repo (Prior to installing mssql-tools)

```
$ sudo curl -o /etc/yum.repos.d/msprod.repo https://packages.microsoft.com/config/rhel/7/prod.repo
[sudo] password for ckim:
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   193  100   193    0     0    587      0 --:--:-- --:--:-- --:--:--   588
```

Install mssql-tools

$ sudo curl -o /etc/yum.repos.d/msprod.repo https://packages.microsoft.com/config/rhel/7/prod.repo

$ sudo yum install mssql-tools unixODBC-devel  Setup a Yum Repository from the RHEL ISO Image

```
Loaded plugins: langpacks, product-id, search-disabled-repos, subscription-manager
This system is not registered with an entitlement server. You can use subscription-manager to register.
Repository packages-microsoft-com-prod is listed more than once in the configuration
Resolving Dependencies
--> Running transaction check
---> Package mssql-tools.x86_64 0:17.0.1.1-1 will be installed
--> Processing Dependency: msodbcsql17 < 17.1.0.0 for package: mssql-tools-17.0.1.1-1.x86_64
--> Processing Dependency: msodbcsql17 >= 17.0.0.1 for package: mssql-tools-17.0.1.1-1.x86_64
---> Package unixODBC-devel.x86_64 0:2.3.1-11.el7 will be installed
--> Processing Dependency: unixODBC(x86-64) = 2.3.1-11.el7 for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libesoobS.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libmimerS.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libnn.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbccr.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbcdrvcfg1S.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbcdrvcfg2S.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbcminiS.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbcnnS.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
--> Processing Dependency: libodbctxtS.so.2()(64bit) for package: unixODBC-devel-2.3.1-11.el7.x86_64
```

Connect to the localhost using sqlcmd

Add binaries to PATH

```
echo 'export PATH="$PATH:/opt/mssql-tools/bin"' >> ~/.bash_profile
echo 'export PATH="$PATH:/opt/mssql-tools/bin"' >> ~/.bashrc
source ~/.bashrc
source .bash_profile
```

Sourcing a file is different than executing a file

Alternative way:
. ./.bash_profile

dot space dot slash .bash_profile

Connect to the localhost using sqlcmd

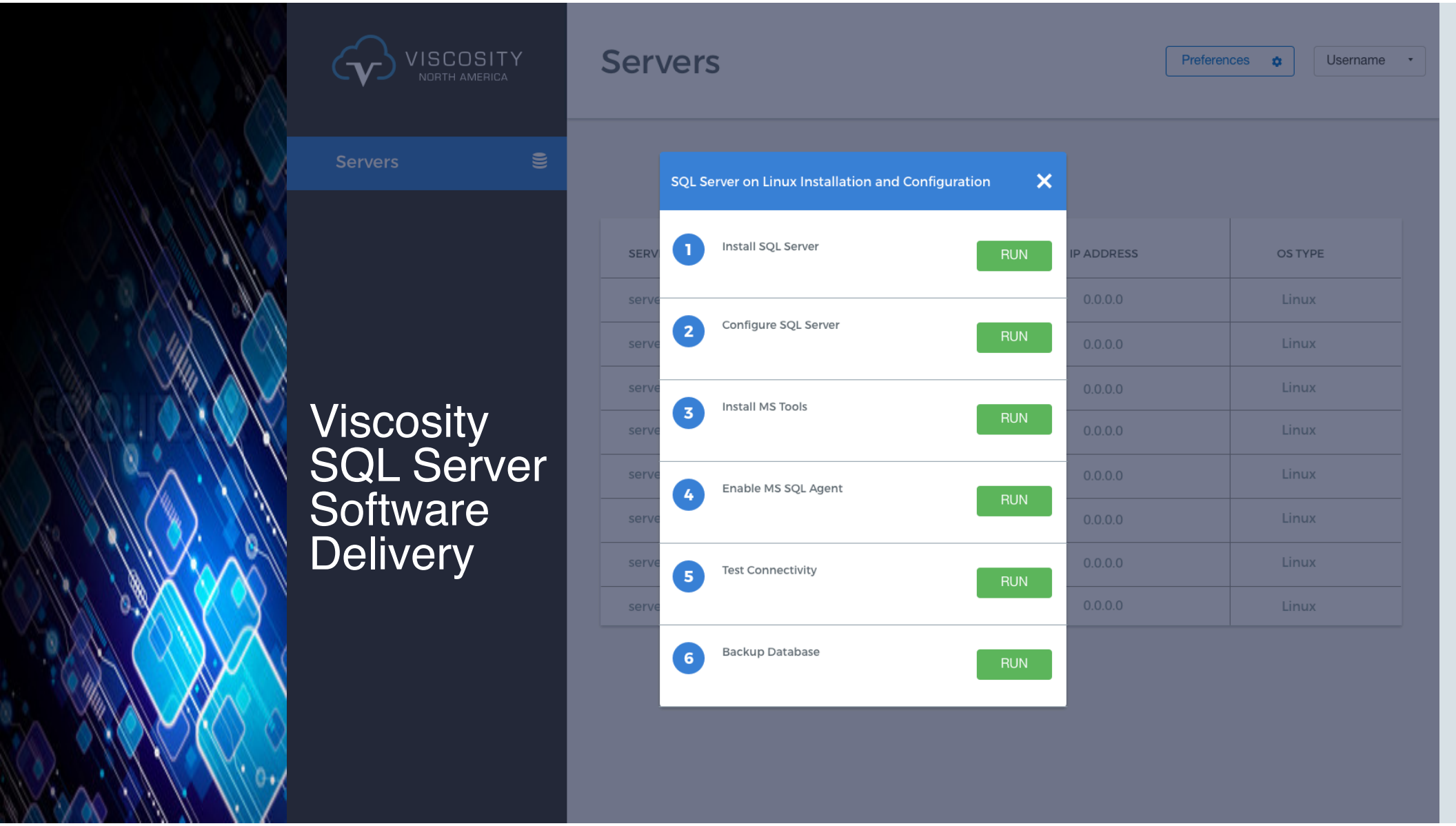
```
sqlcmd -S localhost -U SA -P 'Oracle123'
1> select @@VERSION
2> go
```

```
Microsoft SQL Server 2017 (RTM-CU4) (KB4056498) - 14.0.3022.28 (X64)
Feb  9 2018 19:39:09
Copyright (C) 2017 Microsoft Corporation
Developer Edition (64-bit) on Linux (Red Hat Enterprise Linux Server 7.4 (Maipo))
```

Enable SQL Server Agent

Install/Enable the SQL Server Agent:
For Versions 2017 CU4 and above, Enable the SQL Server Agent
For Versions 2017 CU3 and Below, Install the SQL Server Agent

```
 > sudo /opt/mssql/bin/mssql-conf set sqlagent.enabled true
[sudo] password for ckim:
SQL Server needs to be restarted in order to apply this setting. Please run
'systemctl restart mssql-server.service'.
sql100:/home/ckim
 > systemctl restart mssql-server.service
==== AUTHENTICATING FOR org.freedesktop.systemd1.manage-units ===
Authentication is required to manage system services or units.
Authenticating as: C (ckim)
Password:
==== AUTHENTICATION COMPLETE ===
> systemctl status mssql-server.service
● mssql-server.service - Microsoft SQL Server Database Engine
   Loaded: loaded (/usr/lib/systemd/system/mssql-server.service; enabled; vendor preset: disabled)
   Active: active (running) since Sun 2018-03-18 19:37:26 CDT; 12s ago
     Docs: https://docs.microsoft.com/en-us/sql/linux
 Main PID: 10275 (sqlservr)
   CGroup: /system.slice/mssql-server.service
```


VISCOSITY
NORTH AMERICA
Servers
Servers
Preferences
Username
SQL Server on Linux Installation and Configuration
1
Install SQL Server
RUN
2
Configure SQL Server
RUN
3
Install MS Tools
RUN
4
Enable MS SQL Agent
RUN
5
Test Connectivity
RUN
6
Backup Database
RUN
IP ADDRESS
OS TYPE
0.0.0.0
Linux
Viscosity
SQL Server
Software
Delivery

Logging on to the Linux System

Local Admin Terminal	console
ssh Tools	Most popular: PuTTY
	Terminal on GUI Linux and Mac
	WSL (Bash on Windows) Cygwin Win32 OpenSSH
GUI	Desktop Manager, VNCServer (equivalent to Windows RDP)

Note:

- Do not run production database servers in runlevel 5 (graphical.target)
- Run production environments in runlevel 3 (multi-user.target)

```
[ckim@sql100 log]$ systemctl get-default
graphical.target
```

Custom Prompt on Linux

How to Change / Setup bash custom prompt (PS1)	
	`export HO=`hostname` export NEWHO=$(echo $HO |awk -F. {'print $1'}) export PS1='$NEWHO:$PWD  > '`
Change Directory to where the mssql binaries reside Look at the custom prompt	`sql100:/root > > cd /opt/mssql sql100:/opt/mssql  > cd bin` **`sql100:/opt/mssql/bin`**

systemctl options

status	systemctl status mssql-server
enable	systemctl enable mssql-server
disable	systemctl disable mssql-server
stop	systemctl stop mssql-server
start	systemctl start mssql-server
restart	systemctl restart mssql-server

systemctl stop mssql-server

sql100:/opt/mssql/bin
> systemctl stop mssql-server

> systemctl status mssql-server
● mssql-server.service - Microsoft SQL Server Database Engine
Loaded: loaded (/usr/lib/systemd/system/mssql-server.service; enabled; vendor preset: disabled)
Active: inactive (dead) since Mon 2018-03-19 07:53:56 CDT; 6s ago
Docs: https://docs.microsoft.com/en-us/sql/linux
Process: 10275 ExecStart=/opt/mssql/bin/sqlservr (code=exited, status=0/SUCCESS)
Main PID: 10275 (code=exited, status=0/SUCCESS)

Mar 18 19:37:35 sql100 sqlservr[10275]: 2018-03-18 19:37:35.15 spid51 Using 'xpsqlbot.dll' version '2017.140.3022' to execute...quired.
Mar 18 19:37:35 sql100 sqlservr[10275]: 2018-03-18 19:37:35.23 spid51 Attempting to load library 'xpstar.dll' into memory. Th...quired.
Mar 18 19:37:35 sql100 sqlservr[10275]: 2018-03-18 19:37:35.27 spid51 Using 'xpstar.dll' version '2017.140.3022' to execute e...quired.
Mar 18 19:42:57 sql100 sqlservr[10275]: 2018-03-18 19:42:57.94 spid55 Using 'dbghelp.dll' version '4.0.5'
Mar 19 07:53:53 sql100 systemd[1]: Stopping Microsoft SQL Server Database Engine...
Mar 19 07:53:53 sql100 sqlservr[10275]: 2018-03-19 07:53:53.21 spid7s Always On: The availability replica manager is going of...quired.
Mar 19 07:53:53 sql100 sqlservr[10275]: 2018-03-19 07:53:53.22 spid7s SQL Server is terminating in response to a 'stop' reque...quired.

Firewall Management

Open Port 1433	**ckim@sql100 ~]$ sudo firewall-cmd --zone=public --add-port=1433/tcp --permanent success**
Open Port 22	[ckim@sql100 ~]$ sudo firewall-cmd --zone=public --add-port=22/tcp --permanent success
Reload	[ckim@sql100 ~]$ sudo firewall-cmd --reload success
List Ports	[ckim@sql100 ~]$ sudo firewall-cmd --zone=public --list-ports 1433/tcp 22/tcp
Remove Port 22	[ckim@sql100 ~]$ firewall-cmd --remove-port=22/tcp success [ckim@sql100 ~]$ firewall-cmd --runtime-to-permanent success [ckim@sql100 ~]$ sudo firewall-cmd --reload Success
Start/Stop/Restart	[ckim@sql100 log]$ systemctl stop firewalld [ckim@sql100 log]$ systemctl start firewalld [ckim@sql100 log]$ systemctl restart firewalld

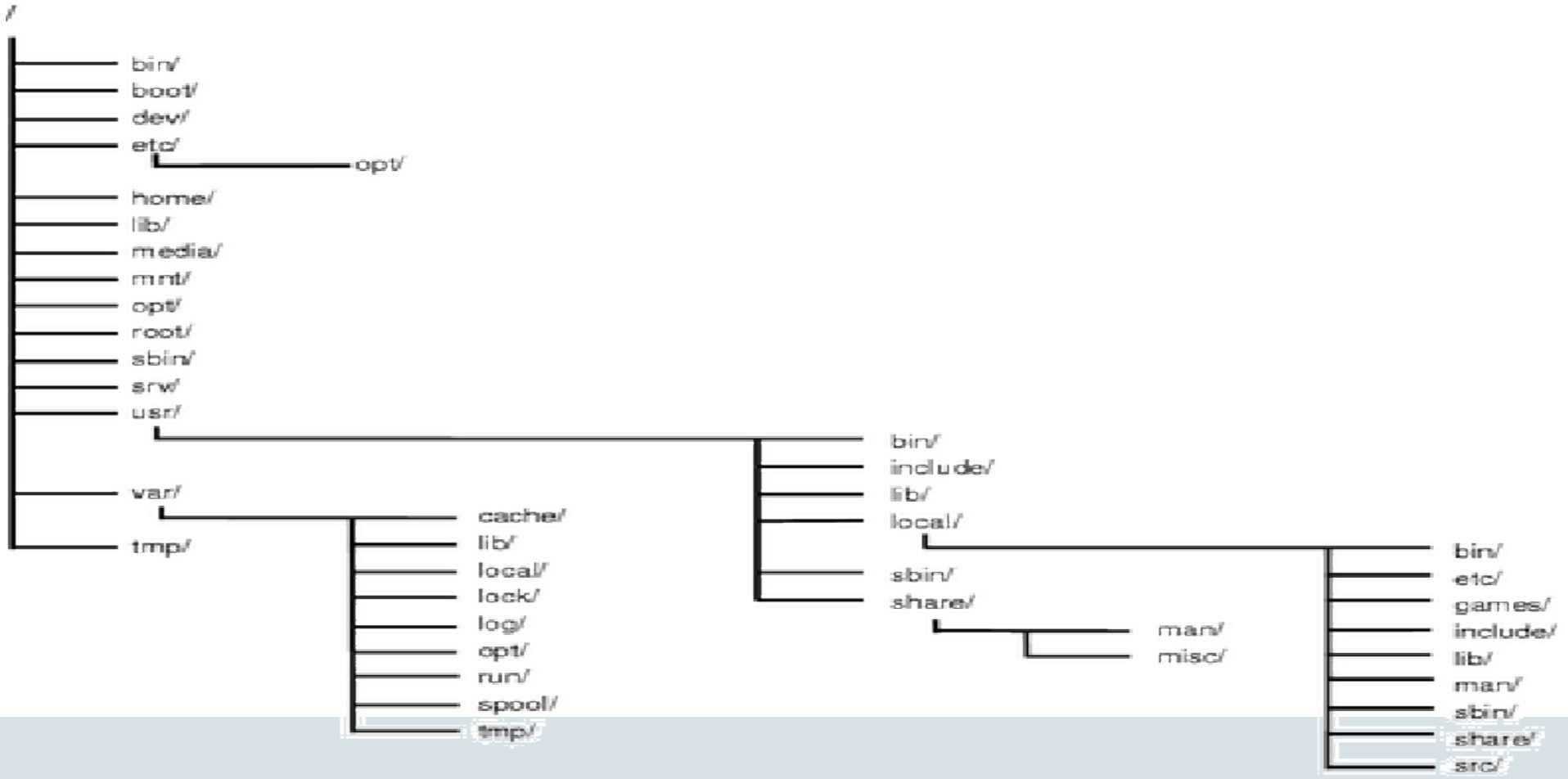
XFS

Default File System for RHEL 7

- EXT4 file system is more popular
- XFS allows users to have 500 TB for the file system size, which is ten times more than what you would get with EXT4.

- Drawback is that it only allows for 16 TB maximum file size.
- XFS is supported when using RHEL 7 or later.

Filesystem Hierarchy Standard (FHS)
The Filesystem Tree



Linux 101 – Top 10 Commands for DBAs

man	In a nutshell, man pages will provide **basic description of the command and a complete list of parameters and their meanings**
cat	Short for conCATonate and provides contents of a text file
yum or apt	Yum for Red Hat Distros and apt for Ubuntu/Debian distros to download and install software from vendor repositories. • They are package managers to install and upgrade. • Handles dependency trees
top	sudo
find	grep
df	vi
more	
Others: ps, tar screen	

Linux 101 – Navigating Around

cd $HOME cd ~	Change directory to the home directory
cd -	Change back to your last directory you were at
cd ~mssql	Change your directory to the home directory of the mssql user
cd ..	Move one directory up from where you are now
cd ../../	Move two directory up from where you are now
export LOGDIR=/var/opt/mssql/log cd $LOGDIR	Change directory to the MS SQL log directory for troubleshooting

Linux 101

Shells	More popular: bash, ksh Less popular: csh, sh
Execute Scripts	bash ./backup.sh ksh ./backup.sh With Execute permissions ($ chmod 755 filename) ./backup.sh
.	Current Directory
$PWD	Current Working Directory echo $PWD $ pwd
clear	Clear the screen, control + l (as in larry)
mkdir	Create Directory
rmdir	Remove Directory
rm	Delete file and subdirs; Never Read Mail Real Fast (rm –rf /)

Linux 101 – Comparison to Windows

C:\	/
C:\windows	/bin, /sbin
C:\users\[username]	/home/[username]
System Logs	/var/log
clear	Clear the screen, control + l (as in larry)
mkdir	Create Directory
rmdir	Remove Directory
type	cat
ipconfig	ifconfig ifconfig –a
edit	vi
dir, dir/w	ls –l, ls
del	rm
copy	cp

Linux 101 – cron scheduler

Edit Scheduler	crontab –e
List	crontab –l
Backup the schedule	crontab –l >crontab.[username].[$DATETIME]
Example	SH=/apps/ms/general/sh # -- RMAN Backups to Disk 0 0 * * 0 $SH/backup.ksh -d TEST01 -l 0 >/tmp/backup.cron.L0.log 2>&1 0 0 * * 1-6 $SH/backup.ksh -d TEST01 -l 1 >/tmp/backup.cron.L1.log 2>&1 # ---------- # Check disk usage - Runs every 20 mins. Alert if free space falls below 10% AND below 5,000 MB. # ---------- 0,10,20,30,40,50 * * * * $SH/diskfree.ksh 10 5000 > /tmp/diskfree.log 2>&1
	# -- Check for Stale statistics **@weekly** $SH/stale_stats.ksh >/tmp/stale_stats.log 2>&1 # -- Clean up uncleared events **@daily** /bin/rm /tmp/*.alert.[1-5] >/tmp/daily.rm.log 2>&1

uptime and w utilities

uptime	Load Average
	• displays current time and up-time
	• displays the average number of processes in run-queue over the past 1 minute, 5 minutes, and 15 minutes
	•
	`$ uptime`
	`02:00:58 up 2 min,  2 users,  load average: 0.83, 0.40, 0.16`

w	Show who is logged on and what they are doing
	
	`$ w`
	`02:02:33 up 3 min,  2 users,  load average: 0.17, 0.29, 0.14`
	`USER     TTY      FROM              LOGIN@   IDLE   JCPU   PCPU WHAT`
	`ckim     :0       :0                02:00   ?xdm?  39.79s  0.14s /`
	`usr/libexec/gn`
	`ckim     pts/0    :0                02:00    1.00s  0.03s  0.00s w`

top

```
top - 20:48:01 up 17:43,  3 users,  load average: 0.01, 0.03, 0.05
Tasks: 276 total,   3 running, 273 sleeping,   0 stopped,   0 zombie
%Cpu0  :  1.3 us,  1.0 sy,  0.0 ni, 97.3 id,  0.0 wa,  0.0 hi,  0.3 si,  0.0 st
%Cpu1  :  1.3 us,  1.0 sy,  0.0 ni, 97.7 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  2825512 total,    82828 free,  1744768 used,   997916 buff/cache
KiB Swap:  2097148 total,  2094816 free,     2332 used.   834936 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
22650 mssql     20   0 3254704 761732   7708 S   1.3 27.0   1:59.60 /opt/mssql/bin/sqlservr
 2291 ckim      20   0 2120340 120924  28664 S   1.0  4.3   1:22.80 /usr/bin/gnome-shell
 1492 root      20   0  327368  19680   5248 S   0.7  0.7   0:27.06 /usr/bin/X :0 -background none -noreset -audit 4 -verbose -auth /run/+
 2859 ckim      20   0  724900  25420  12608 S   0.7  0.9   0:16.30 /usr/libexec/gnome-terminal-server
  498 root      20   0       0      0      0 S   0.3  0.0   0:13.69 [xfsaild/dm-0]
  796 root      20   0    6472    624    512 S   0.3  0.0   0:02.52 /sbin/rngd -f
 2530 ckim      20   0  390852  16092   6736 S   0.3  0.6   0:50.24 /usr/bin/vmtoolsd -n vmusr
25158 ckim      20   0  157872   2372   1540 R   0.3  0.1   0:00.13 top
    1 root      20   0  195080   6632   2508 S   0.0  0.2   0:09.52 /usr/lib/systemd/systemd --switched-root --system --deserialize 21
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.07 [kthreadd]
    3 root      20   0       0      0      0 S   0.0  0.0   0:00.25 [ksoftirqd/0]
    5 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 [kworker/0:0H]
    7 root      rt   0       0      0      0 S   0.0  0.0   0:01.22 [migration/0]
    8 root      20   0       0      0      0 S   0.0  0.0   0:00.00 [rcu_bh]
    9 root      20   0       0      0      0 R   0.0  0.0   0:06.17 [rcu_sched]
   10 root      rt   0       0      0      0 S   0.0  0.0   0:00.26 [watchdog/0]
   11 root      rt   0       0      0      0 S   0.0  0.0   0:00.28 [watchdog/1]
   12 root      rt   0       0      0      0 S   0.0  0.0   0:01.17 [migration/1]
   13 root      20   0       0      0      0 S   0.0  0.0   0:00.26 [ksoftirqd/1]
   15 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 [kworker/1:0H]
   17 root      20   0       0      0      0 S   0.0  0.0   0:00.00 [kdevtmpfs]
   18 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 [netns]
   19 root      20   0       0      0      0 S   0.0  0.0   0:00.06 [khungtaskd]
   20 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 [writeback]
   21 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 [kintegrityd]
```

1 – list by thread
C – command path

free

Display amount of free and used memory in the system

```
$ free -m
              total        used        free      shared  buff/cache   available
Mem:           2759        1703          80           7         974         815
Swap:          2047           2        2045
```

diskfree - report file system disk space usage

```
 > df -m
Filesystem           1M-blocks  Used Available Use% Mounted on
/dev/mapper/rhel-root     41948  4336     37613  11% /
devtmpfs                   1365     0      1365   0% /dev
tmpfs                      1380     0      1380   0% /dev/shm
tmpfs                      1380    10      1371   1% /run
tmpfs                      1380     0      1380   0% /sys/fs/cgroup
/dev/sda1                  1014   179       836  18% /boot
/dev/mapper/rhel-home     20478    39     20440   1% /home
tmpfs                       276     1       276   1% /run/user/42
tmpfs                       276     1       276   1% /run/user/1000
/dev/sr0                   3871  3871         0 100% /run/media/ckim/RHEL-7.4 Server.x86_64
```

```
 > df -h
Filesystem           Size  Used Avail Use% Mounted on
/dev/mapper/rhel-root   41G  4.3G   37G  11% /
devtmpfs               1.4G     0  1.4G   0% /dev
tmpfs                  1.4G     0  1.4G   0% /dev/shm
tmpfs                  1.4G  9.2M  1.4G   1% /run
tmpfs                  1.4G     0  1.4G   0% /sys/fs/cgroup
/dev/sda1             1014M  179M  836M  18% /boot
/dev/mapper/rhel-home   20G   39M   20G   1% /home
tmpfs                  276M  4.0K  276M   1% /run/user/42
tmpfs                  276M   24K  276M   1% /run/user/1000
/dev/sr0               3.8G  3.8G     0 100% /run/media/ckim/RHEL-7.4 Server.x86_64
tmpfs                  276M     0  276M   0% /run/user/0
```

sudo

Superuser do

- Execute any commands as a privileged user
- Login as another user

```
[ckim@sql100 ~]$ sudo su -


We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:


    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.


[sudo] password for ckim:
```

sudo configuration File & sudo Incident Logs

Sudo Config File:	# vi /etc/sudoers
Review Sudo Incident Logs	On Red Hat based linux systems: /var/log/secure Debian based systems like ubuntu : /var/log/auth.log

```
Mar 17 23:06:49 sql100 sshd[1210]: Server listening on 0.0.0.0 port 22.
Mar 17 23:06:49 sql100 sshd[1210]: Server listening on :: port 22.
Mar 17 23:06:51 sql100 gdm-launch-environment]: pam_unix(gdm-launch-environment:session): session opened for user gdm by (uid=0)
Mar 17 23:06:57 sql100 polkitd[806]: Registered Authentication Agent for unix-session:c1 (system bus name :1.31 [/usr/bin/gnome-shell], obje
ct path /org/freedesktop/PolicyKit1/AuthenticationAgent, locale en_US.UTF-8)
Mar 17 23:10:35 sql100 gdm-password]: pam_unix(gdm-password:session): session opened for user ckim by (uid=0)
Mar 17 23:10:38 sql100 polkitd[806]: Unregistered Authentication Agent for unix-session:c1 (system bus name :1.31, object path /org/freedesk
top/PolicyKit1/AuthenticationAgent, locale en_US.UTF-8) (disconnected from bus)
Mar 17 23:10:40 sql100 polkitd[806]: Registered Authentication Agent for unix-session:2 (system bus name :1.58 [/usr/bin/gnome-shell], objec
t path /org/freedesktop/PolicyKit1/AuthenticationAgent, locale en_US.UTF-8)
Mar 17 23:10:59 sql100 sudo:    ckim : TTY=pts/0 ; PWD=/home/ckim ; USER=root ; COMMAND=/opt/mssql/bin/mssql-conf setup
Mar 17 23:10:59 sql100 sudo:    ckim : TTY=pts/0 ; PWD=/home/ckim ; USER=root ; COMMAND=/opt/mssql/lib/mssql-conf/checkinstall.sh
Mar 17 23:11:11 sql100 sudo:    ckim : TTY=pts/0 ; PWD=/var/opt/mssql ; USER=mssql ; COMMAND=/bin/bash -c /opt/mssql/bin/sqlservr --setup --
reset-sa-password
Mar 17 23:11:25 sql100 sudo:    ckim : TTY=pts/0 ; PWD=/home/ckim ; USER=root ; COMMAND=/bin/systemctl start mssql-server
Mar 17 23:11:25 sql100 polkitd[806]: Registered Authentication Agent for unix-process:2940:28420 (system bus name :1.104 [/usr/bin/pkttyagen
t --notify-fd 5 --fallback], object path /org/freedesktop/PolicyKit1/AuthenticationAgent, locale en_US.UTF-8)
Mar 17 23:11:25 sql100 polkitd[806]: Unregistered Authentication Agent for unix-process:2940:28420 (system bus name :1.104, object path /org
/freedesktop/PolicyKit1/AuthenticationAgent, locale en_US.UTF-8) (disconnected from bus)
Mar 17 23:11:25 sql100 sudo:    ckim : TTY=pts/0 ; PWD=/home/ckim ; USER=root ; COMMAND=/bin/systemctl enable mssql-server
Mar 17 23:11:25 sql100 polkitd[806]: Registered Authentication Agent for unix-process:2953:28432 (system bus name :1.105 [/usr/bin/pkttyagen
--More--
```

ssh

	Generate Key

```
[ckim@sql100 ~]$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ckim/.ssh/id_rsa):
Created directory '/home/ckim/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ckim/.ssh/id_rsa.
Your public key has been saved in /home/ckim/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:zxd2sSb7f/0g13D4zmfEcHgMJuGBiAeaxa4dL5vz2Cs ckim@sql100
The key's randomart image is:
+---[RSA 2048]----+
|     .oo . .o.   |
|     +o o ....o  |
|    o. .    .o.+ |
|      o       o++|
|     o oS   + *=.|
|    . o .o . * =o|
|       +  o + o.+|
|      Eo   . + +=|
|      .++.    .oO|
+----[SHA256]-----+
```

ssh Passwordless Login

	Establish User Equivalence

Local Server Files	`[ckim@sql100 .ssh]$ pwd`
	`/home/ckim/.ssh`
	`[ckim@sql100 .ssh]$ ls -l`
	`total 8`
	`-rw-------. 1 ckim ckim 1679 Mar 17 19:19 id_rsa`
	`-rw-r--r--. 1 ckim ckim  393 Mar 17 19:19 id_rsa.pub`
	
	`[ckim@sql100 .ssh]$ cat id_rsa.pub`
	`ssh-rsa`
	`AAAAB3NzaC1yc2EAAAADAQABAAABAQCxnJinFtSM33BESmdCEMQM3uK99Rwu3Oc7AMZHrX5IjBUizp`
	`SAMRJGy8tnSsxGVzJyiAC/RsMcc2RHKKHX69pmpq7/QiCAl8qLju0k1K9aLH+iJGXMlbMn/`
	`4V+7EY6KFrBEXD/`
	`SvUszxZFV0nvgl9pcZ8ynJd73H4GmJTqfliQGIb4ys+TPDnIQvyZ115qbbMGjTNM8fCBeSWM0BzEgU`
	`bfECTbo2lIFHv/SDPpprsNhwBXl3s/`
	`k22K5iQgagjhjKfueC82OICpxp4FgLt+1B5RYgpANAKdCZFxBqAmJwQBgiaZ6dVk4Ua6DGdgwbKWlu`
	`Y4FW1E48VH0ebEjW+/zo1T ckim@sql100`

Remote Server Configuration	`$HOME/.ssh/authorized_keys` • Paste the contents of id_rsa.pub • If the file does not exist, create a file • Change the permissions to be chmod 640

Some Common Regular Expressions

^	Beginning of the line
$	End of the line
[ ]	Range of characters
.	To match any character
*	To match one or occurrences of a character

Regular Expressions Examples

Find comments in a file	grep '^#" filename
Find blank lines in a file	grep '^$' $filename
List file that start with letter A to D (notice that this is not a long listing)	$ ls | grep ^[A-D]
Listing of only files (exclude directories)	ls -l | grep ^-
Listing of only directories	ls -l | grep ^d
Listing of filenames that end with ments (i.e. looking for documents)	ls -l | grep ments$
Listing of all files that start with d and end with the word pdf at the end. -i for ignore case	ls | grep -i ^d.*pdf$

It is a shell game

sh	Shell (Bourne SHell) POSIX Compliant
ksh	Korn Shell (popular with old timers)
bash	Bourne Again SHell (most popular) • Every script should being with "#!/bin/bash" • Called a *shebang*, and tells the parent shell which interpreter should be used to execute the script.
`csh`	C shell

$ cat hello.bash

```
#!/usr/bin/bash

# This is a comment!
echo Hello World!      # This is a comment, too!
```

Shell Script 101 – Hello World

`$ chmod u+x hello.bash`
 	
Or
 	
`chmod 755 hello.bash`
	Make the shell script executable
	
	`[ckim@sql100 ~]$ ls -l hello.bash`
	`-rw-rw-r--. 1 ckim ckim 97 Mar 19 20:31 hello.bash`
	
	`[ckim@sql100 ~]$ chmod u+x hello.bash`
	
	`[ckim@sql100 ~]$ ls -l hello.bash`
	`-rwxrw-r--. 1 ckim ckim 97 Mar 19 20:31 hello.bash`
	
	`-[user][group][world]`
	`-[ rwx][ rwx ][ rwx ]`

Execute hello.bash	`$ ./hello.bash` `Hello World!`

Shell Script 101 – chmod

r-	w-	x-
r The file can be read	The file can be modified	The file can be executed.
- The file cannot be read	The file cannot be modified.	The file cannot be executed.
The directory's contents cannot be shown.	The directory's contents cannot be modified.	The directory cannot be accessed with **cd**.

Shell Script 101 – SQL Server Startup / Shutdown / Status

Simple Script to manage SQL Server

```
$ cat sqlserver_state.bash
#!/usr/bin/bash

export STATE=$1
echo State: $STATE

sudo systemctl $STATE mssql-server
```

```
[ckim@sql100 ~]$ ./sqlserver_state.bash status
State: status
● mssql-server.service - Microsoft SQL Server Database Engine
   Loaded: loaded (/usr/lib/systemd/system/mssql-server.service; enabled; vendor preset: disabled)
   Active: active (running) since Mon 2018-03-19 16:56:54 CDT; 4h 11min ago
     Docs: https://docs.microsoft.com/en-us/sql/linux
 Main PID: 22640 (sqlservr)
   CGroup: /system.slice/mssql-server.service
           ├─22640 /opt/mssql/bin/sqlservr
           └─22650 /opt/mssql/bin/sqlservr

Mar 19 16:57:36 sql100 sqlservr[22640]: 2018-03-19 16:57:36.39 spid9s      The tempdb database has 1 data file(s).
Mar 19 16:57:36 sql100 sqlservr[22640]: 2018-03-19 16:57:36.41 spid17s     The Service Broker endpoint is in disabled or stopped state.
Mar 19 16:57:36 sql100 sqlservr[22640]: 2018-03-19 16:57:36.41 spid17s     The Database Mirroring endpoint is in disabled or stopped state.
Mar 19 16:57:36 sql100 sqlservr[22640]: 2018-03-19 16:57:36.49 spid17s     Service Broker manager has started.
Mar 19 16:57:36 sql100 sqlservr[22640]: 2018-03-19 16:57:36.73 spid6s      Recovery is complete. This is an informational message ...quired.
Mar 19 16:57:41 sql100 sqlservr[22640]: 2018-03-19 16:57:41.39 spid51      Attempting to load library 'xpsqlbot.dll' into memory. ...quired.
Mar 19 16:57:41 sql100 sqlservr[22640]: 2018-03-19 16:57:41.40 spid51      Using 'xpsqlbot.dll' version '2017.140.3022' to execute...quired.
Mar 19 16:57:41 sql100 sqlservr[22640]: 2018-03-19 16:57:41.54 spid51      Attempting to load library 'xpstar.dll' into memory. Th...quired.
Mar 19 16:57:41 sql100 sqlservr[22640]: 2018-03-19 16:57:41.58 spid51      Using 'xpstar.dll' version '2017.140.3022' to execute e...quired.
Mar 19 20:11:48 sql100 sqlservr[22640]: 2018-03-19 20:11:48.92 spid53      Using 'dbghelp.dll' version '4.0.5'
Hint: Some lines were ellipsized, use -l to show in full.
```

Linux 101 – Shell Scripting: Standard Input

Simple Shell script with standard input (STDIN) to sqlcmd

```
 echo "select @@VERSION
GO
exit" |sqlcmd -S localhost -U SA -P 'Oracle123'
```

```
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------------------------------------------------------------------------
------------
Microsoft SQL Server 2017 (RTM-CU4) (KB4056498) - 14.0.3022.28 (X64)
Feb  9 2018 19:39:09
Copyright (C) 2017 Microsoft Corporation
Developer Edition (64-bit) on Linux (Red Hat Enterprise Linux Server 7.4
(Maipo))


(1 rows affected)
```

Linux 101 – Shell Scripting: Here Document

Simple Shell script with a here document (heredoc) to look at databases	> cat databases.sh sqlcmd -S localhost -U SA -P 'Oracle123' <<EOF :setvar SQLCMDMAXVARTYPEWIDTH 30 :setvar SQLCMDMAXFIXEDTYPEWIDTH 30 EXEC sp_databases GO exit EOF
Output	> ./databases.sh DATABASE_NAME DATABASE_SIZE REMARKS ------------------------------ ------------ ------------------------------ master 6144 NULL model 16384 NULL msdb 14144 NULL tempdb 16384 NULL

Shell Script 101 – More Examples

```
$ cat databases.sh
IP=$(ifconfig |grep -i inet |head -1 |awk {'print $2'})
echo IP of the server is: $IP
echo

sqlcmd -S ${IP} -U SA -P 'Oracle123' <<EOF
:setvar SQLCMDMAXVARTYPEWIDTH 30
:setvar SQLCMDMAXFIXEDTYPEWIDTH 30

EXEC sp_databases
GO
exit
EOF
```

```
$ ./databases.sh
IP of the server is: 192.168.21.138
DATABASE_NAME                  DATABASE_SIZE REMARKS
------------------------------ ------------- ------------------------------
master                                  6144 NULL
model                                  16384 NULL
msdb                                   15808 NULL
tempdb                                 16384 NULL
```

Shell Script 101 – Hello World

`$ chmod u+x hello.bash`
 	
Or
 	
`chmod 755 hello.bash`
	Make the shell script executable
	
	`[ckim@sql100 ~]$ ls -l hello.bash`
	`-rw-rw-r--. 1 ckim ckim 97 Mar 19 20:31 hello.bash`
	
	`[ckim@sql100 ~]$ chmod u+x hello.bash`
	
	`[ckim@sql100 ~]$ ls -l hello.bash`
	`-rwxrw-r--. 1 ckim ckim 97 Mar 19 20:31 hello.bash`
	
	`-[user][group][world]`
	`-[ rwx][ rwx ][ rwx ]`

ksh	Korn Shell (popular with old timers)
Execute hello.bash	`$ ./hello.bash` `Hello World!`

Advanced Examples

Arsenal for troubleshooting

Find Tips That Will Save You Time

Removing files older than 14 Days	**find . -type f -mtime +14 -exec rm -f {} \;**
Finding the top 5 largest files	find . -ls | sort -nrk 7 | head -5 • n = numeric sort • r = reverse • K = key #7 (column #7)
Find files larger than 100MB	find . -size +100000k
Delete audit records that's older than 30 days	find $DIRECTORY -name "*.aud" -mtime +30 -exec rm {} \;
Delete files in /tmp that's older than 30 days	find /tmp -group dba -type f -mtime +5 -exec rm -f {} \; find /tmp/dba -group dba -type f -mtime +5 -exec rm -f {} \;
Delete filenames with .trc extension more than 5 days old.	find $TRACE_DIR -name '*.trc' -type f -mtime +5 -exec rm {} \;

More Commands to Locate Large Files

Display top 5 largest files in a current directory	**ls -alS | head -5**
Largest space-consuming directories (Does not include sub-directories)	du -Sm . | sort -nr | head -5
report the sum of space consumed by a directory and its subdirectories	du . | sort -nr | head -5
export DB_SIZE=$(find . -newer $RMAN_BACKUP_MARKER_FILE -name '*.DB' |xargs du -sk |awk '{SUM += $1} END {print SUM/1024}') export ARCH_SIZE=$(find . -newer $RMAN_BACKUP_MARKER_FILE -name '*.A' |xargs du -sk |awk '{SUM += $1} END {print SUM/1024}') echo "DB Backup Size is: $DB_SIZE" echo "Archive Backup Size is: $ARCH_SIZE		
List files in a directory greater than 300M	ls -l | awk '{if ($5 >314572800) print $0}' |sort +4

tar & scp One-Liners to remember

Examples are relevant on SQL Server too

Tar and un-tar on the same machine Make a clone of ASM Oracle Home to DB Oracle Home	**cd /u01/app/oracle/product/11.1.0/asm tar cvf - * | (cd /u01/app/oracle/product/11.1.0/db; tar xvfp -)**
Tar and un-tar to a remote server Push the ASM Home Directory from Server#1 to the DB Home on Server #2	tar cvf - DIR_NAME |ssh REMOTE_HOST "cd DIR_NAME; tar xvf – "
Create compressed tarfile	tar –cvzf orahome.tar /u01/app/oracle/product/11.2/db Or for non GNU tar: tar -cvf - /u01/app/oracle/product/11.2/db | gzip>orahome.tar.gz
scp pull of the dgmenu directory	scp -rp oracle@rac5501:/home/oracle/work/dgmenu
scp push the dgmenu directory	scp -rp dgmenu oracle@rac5502:/home/oracle/work

Rotate Logs with Linux logrotate

Other use cases:

1. **Apache httpd.log, access_log, error_log**
- **JVM logs, etc.**

```
#!/bin/ksh
/usr/sbin/logrotate -f -s /apps/general/config/listener_HOSTNAME.status /apps/general/config/
listener_HOSTNAME.conf
```

This logrotate config file looks like this:

```
LISTENER_HOSTNAME.conf
{
weekly
copytruncate
rotate 4
compress
mail charles@dbaexpert.com
}
```

Follow Us Online!


Facebook.com/ViscosityNA


Linkedin.com/company/Viscosity-North-America


@ViscosityNA

Viscosity North America


Facebook.com/ViscosityNA


@Viscosity_NA

VISCOSITY

NORTH AMERICA