# Linux OS Fundamentals for the SQL Admin

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# Overview

- Linux Architecture

- Interacting With Your Linux System

- I/O Redirection and Pipelines

- File System Basics

- Working With PowerShell on Linux

- Working With Packages

- Managing Services with systemd

- System Resource Management

- Getting Help

# Linux Architecture

| | | | |
|---|---|---|---|
| **User Space** | **Users** | **Interact with the Shell** | **Cause Problems :)** |
| | **Shell** | **Executes Your Commands… Your Interface to the Kernel** | **Commands, Editors…any User Program** |
| **Kernel Space** | **Kernel** | **Resource Management and Access** | **Process, Memory and File Systems** |
| | **Hardware** | **Physical Resources** | **CPU, Disk and Memory** |

# Interacting With Your Linux System

- Text

  - Console

  - SSH - Secure Shell

    - Terminal (Linux/Mac)

    - PuTTY (Windows)

- Graphically

  - Desktop Manager

  - VNC

# Access and Privileged Access

- Linux security is based on user ids

  - root - UID 0

    - # at the command prompt     `[root@rhel1 ~]#`

    - Try to avoid using root

  - Regular Name Users

    - $ at the command prompt     `[demo@rhel1 ~]$`

- Switching users

  - `su` - switch user, uses that users password

  - `sudo` - Allows for users to execute and individual command with escalated privileges. Your password.
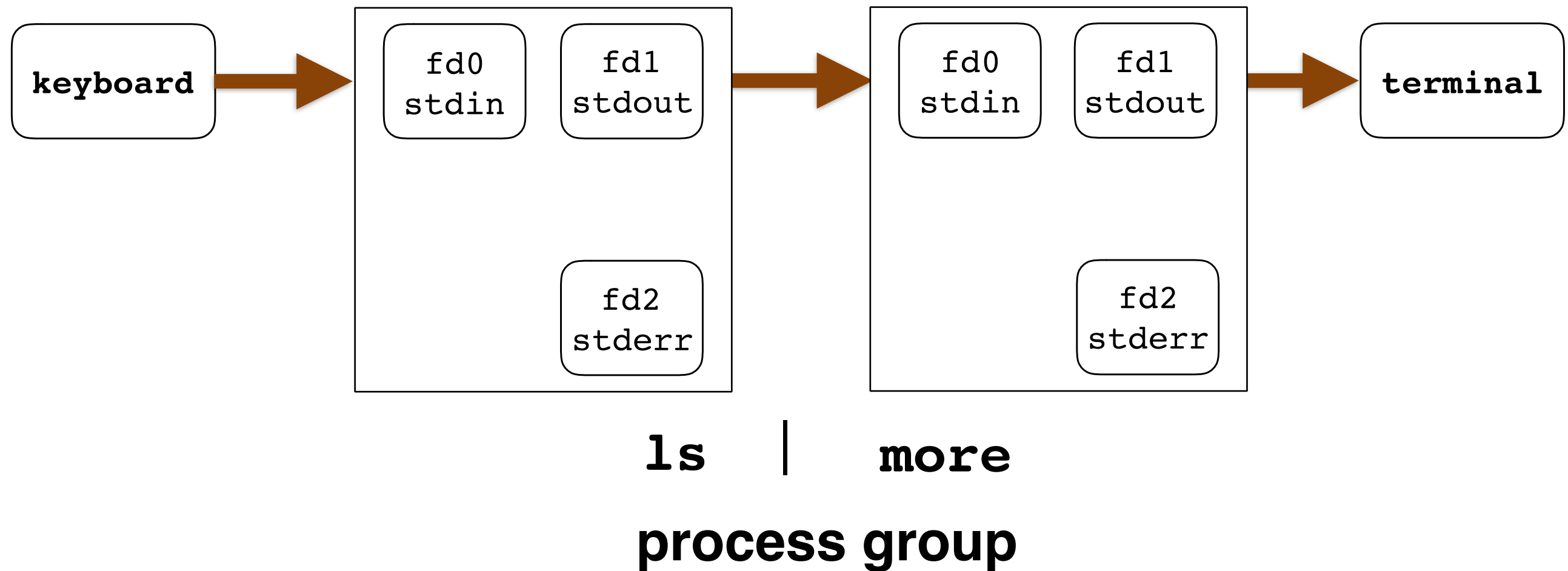
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Many UNIX programs do quite trivial things in isolation, but, combined with other programs, become general and useful tools

Kernighan and Pike

# IO Redirection

# Text Based Pipelines

```
keyboard  ─▶  ┌──────────────────────────┐  ─▶  ┌──────────────────────────┐  ─▶  terminal
              │  ┌──────┐   ┌─────────┐  │        │  ┌──────┐   ┌─────────┐  │
              │  │ fd0  │   │  fd1    │  │        │  │ fd0  │   │  fd1    │  │
              │  │ stdin│   │ stdout  │  │        │  │ stdin│   │ stdout  │  │
              │  └──────┘   └─────────┘  │        │  └──────┘   └─────────┘  │
              │              ┌────────┐  │        │              ┌────────┐  │
              │              │  fd2   │  │        │              │  fd2   │  │
              │              │ stderr │  │        │              │ stderr │  │
              │              └────────┘  │        │              └────────┘  │
              └──────────────────────────┘        └──────────────────────────┘
```

**ls  |  more**

**process group**
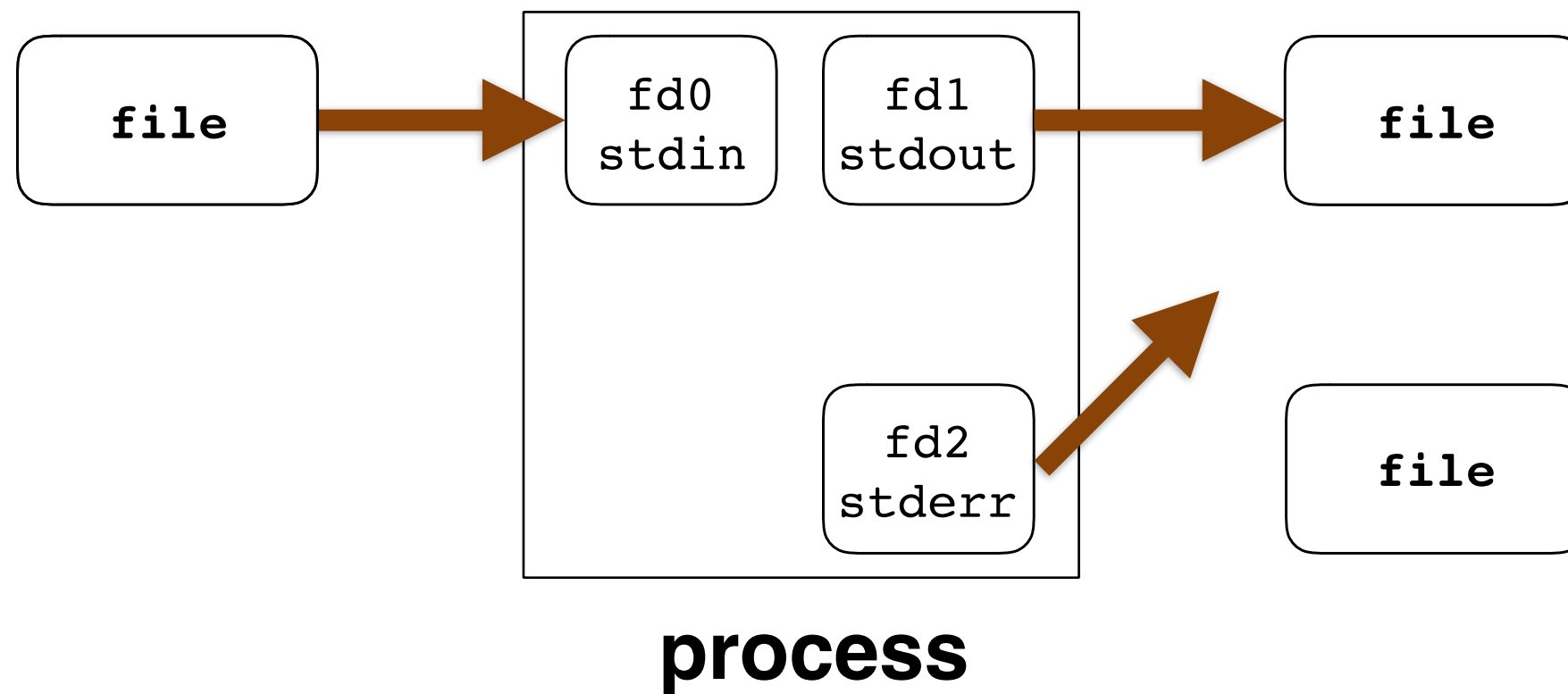
# I/O Redirection and Pipes

- Redirect standard output - `stdout ( > and >> )`

  - Normally directed to the terminal

  - Useful for redirecting the output of a command to file or another process

- Redirect standard input - `stdin ( < and << )`

  - Normally input via keyboard

  - Useful for directing input into a program from a file

- Redirect standard error - `stderr ( 2> )`

  - Normally output to terminal

  - Useful for separating error output from standard output and redirect to another location

- Using a pipe - `(  |  )`

  - Interprocess communication

  - Process groups

  - Internal buffers

# The LINUX File System

- Everything is a file - No really, EVERYTHING!

- File system tree

  - The most common analogy

- Filesystem Hierarchy Standard (FHS)

  - The standard UNIX filesystem layout
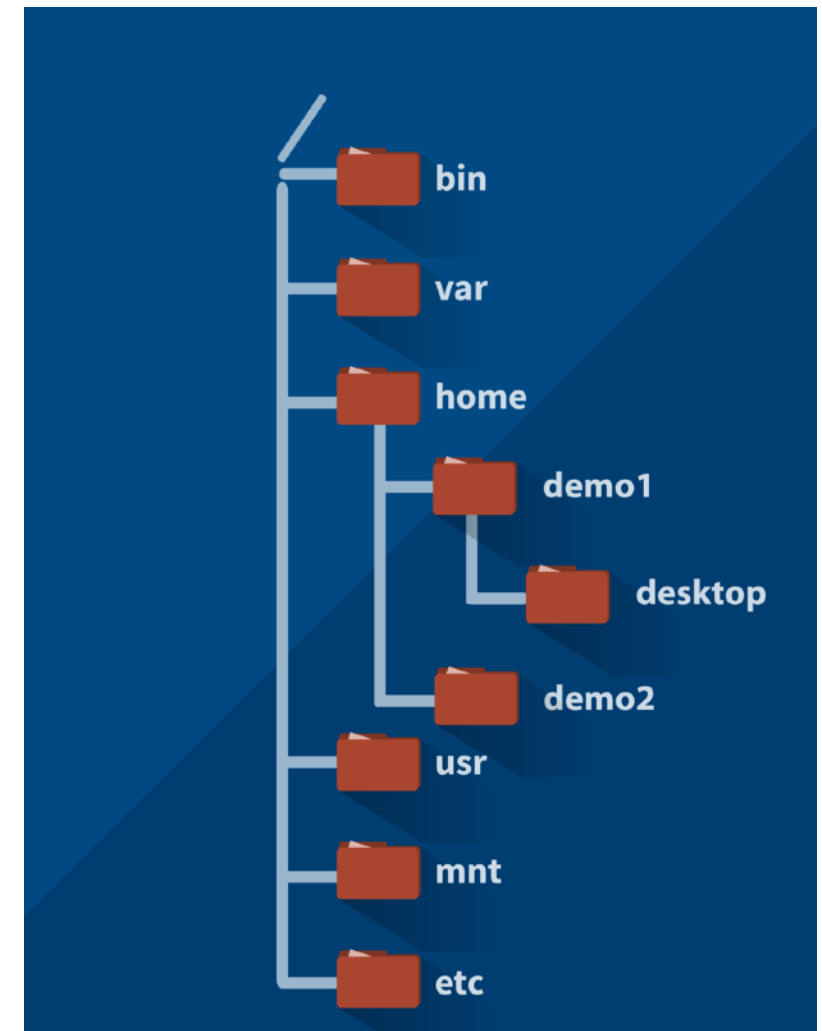
# Working with PowerShell on Linux

- Available now in Alpha

- PowerShell and be used as your default Linux shell - http://bit.ly/2iFOKuN

- Remoting

  - Currently relies on SSH

  - If you want to manage both Windows and Linux from Linux…you'll need OpenSSH on all the systems - http://bit.ly/2jcCjDc

  - More like legacy remoting, serial execution

  - WSMan/WinRM like remoting is coming

# Aliases in PowerShell on Linux

- Command aliases depend on your operation system

    - PowerShell on Windows

        - Linux/UNIX like commands are alias directly to PowerShell cmdlets

            - `mv` - calls `Move-Item`

    - PowerShell on Linux or Mac

        - Does not alias the Linux/UNIX commands

            - The command is executed natively

                - `mv` - calls the native move command

- If you're lost, use `Get-Alias`

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# Common Files and Directory Operations

| | File Operations | | Directory Operations | |
|---|---|---|---|---|
| | Linux | PowerShell | Linux | PowerShell |
| **Create** | touch | New-Item | mkdir | New-Item |
| **Delete** | rm | Remove-Item | rmdir | Remove-Item |
| **Move/Rename** | mv | Move-Item | mv | Move-Item |
| **View Contents** | cat | Get-Content | ls | Get-ChildItem |

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# Demo Linux and PowerShell

- Connecting to a system via SSH

- Process management

  - `Get-Process`

  - `ps`

- Building command pipelines

# RPM Package Manager (RPM)

- Package Management System

  - A package is a collection of programs, scripts and meta data

- Suite of management tools

- Used to install/upgrade/remove packages

- Does not provide dependency management

- apt

# yum

- Package manager

- Dependency management

- Software is stored in repositories

  - Software publishers {RedHat, CentOS}

  - Third Party {EPEL, RPMForge}

  - Your own

- System wide updates

- apt

# Demo

- Package management with yum

  - Install SQL Server on Linux from Microsoft's yum repository

# Managing Services with systemd

- Service Control - `systemctl`

- Verifying Services are Running

- Units and Unit Files

- Dependencies before/after

- Viewing Logs - `journalctl`

# Demo

- `systemctl`

  - `enable`

  - `disable`

  - `status`

  - `stop`

  - `start`

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# System Resource Management

- CPU

  - Load average and run queues

- Disk

  - Space and latency, IO waits

- Memory

  - Memory pressure and swapping

- Network

  - Throughput, latency and reliability

- SQL Server DMVs

# System Resource Management

- Included with your OS or it's repositories

  - `top`

  - `vmstat`

  - `free -m`

  - `du -chs ./dir`

  - `df -h`

  - `dstat`  (Monitoring Swiss Army Knife)

  - `sar` (system activity reporter)

# Performance Monitoring

| System | Windows | Linux Tool | Linux |
|---|---|---|---|
| **CPU** | %Processor Time | `top` | CPU usage, load average |
| **Memory** | %Committed bytes in use | `free -m` | Total, used, free, cache |
| **Disk - Space** | %Free Space | `df -h` | Total, used, available, mount |
| **Disk - IOs** | Disk Transfers/sec | `iostat -dx` | tps, r/s, w/s |
| **Disk - Latency** | Avg. Disk Sec/Transfer | `iostat -dx` | svctm*** |
| **Disk - IO Size** | Avg. Disk Bytes/Transfer | `iostat -dx` | avgrq-sz |
| **Interface** | Bytes/Sec | `ifstat/bwm-ng/nload` | Packets/sec, bits/sec |

**Check out `dstat` it will do most of these**

# Getting Help

- man pages

- `Get-Help`

- Local documentation

  - `/usr/share/doc`

    - Documentation about all of the install packages on your system

    - Help files

    - Example and default configuration files

# Key Takeaways

- It's just an operating system, once you get over the syntax and environmental changes

  - A lot of the concepts are the same

  - Architecture

  - I/O redirection and text based pipelines

  - File system basics

  - PowerShell on Linux

  - Packages

  - systemd

  - System resource management

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# Additional Resources

- **Pluralsight**

    - **Understanding and Using Essential Tools for Enterprise Linux 7**

        - Installation, command execution, managing files

        - Using VI, Advanced Shell Topics and Pipelining

    - **LFCE - Advanced Network and System Administration**

        - Managing services, performance monitoring, package management, NFS and Samba

    - **Play by Play: Microsoft Open Source PowerShell and Linux and Mac**

        - Where PowerShell fits in a heterogenous data center

        - Remoting, Linux management tasks, PowerShell functions and DSC

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# Need more data or help?

## http://www.centinosystems.com/blog/talks/

Links to resources
Demos
Presentation

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# Questions?

# Thank You!