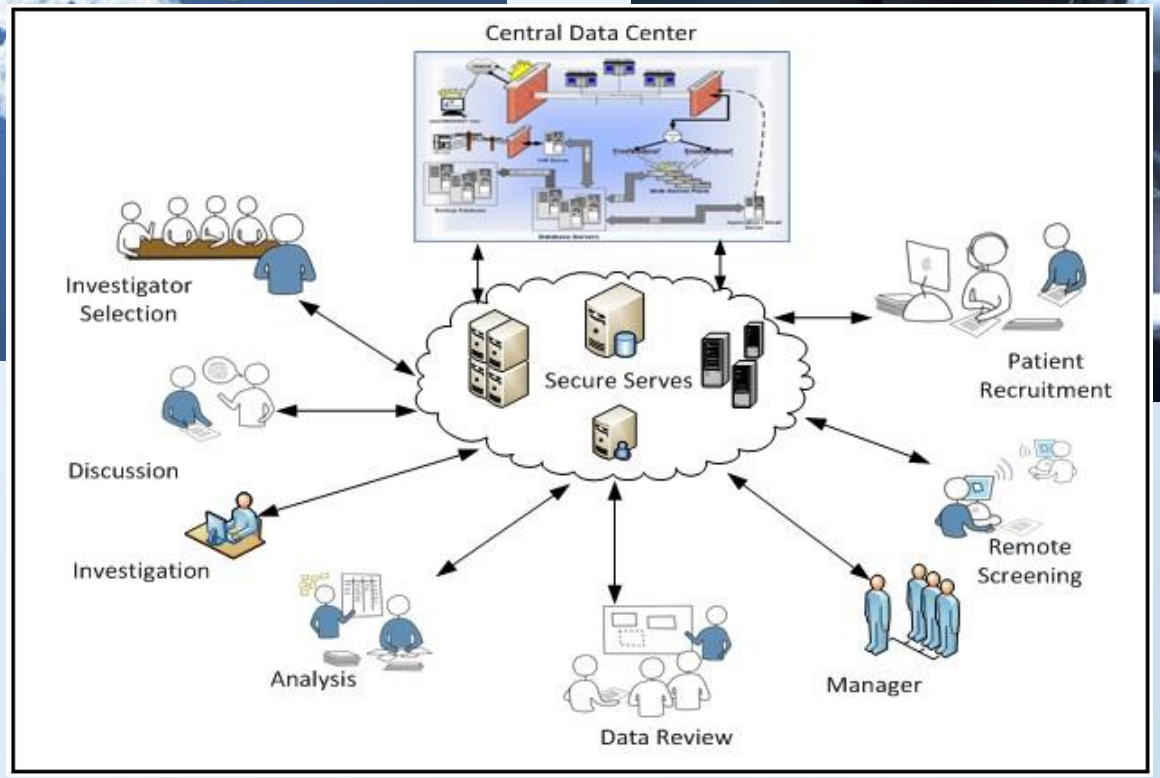
CLOUD TECHNOLOGIES - Dev Ops

WHAT IS CLOUD ?



VIRTUALIZATION

VIRTUALIZATION

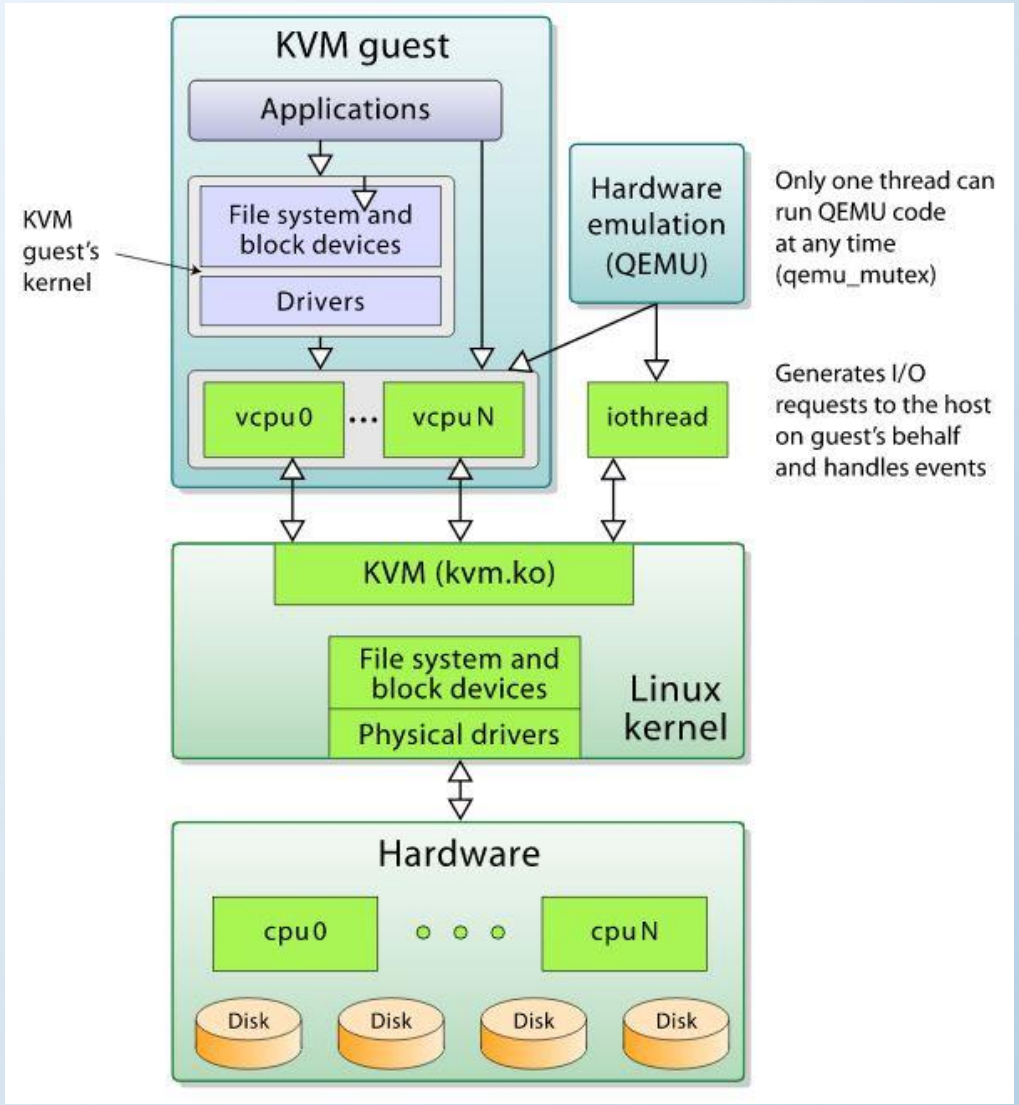
- Act of creating a virtual (rather than actual) version of something,
  - Virtual computer hardware platforms, operating systems, storage devices, and computer resources.
- Virtualization can be offered on different hardware and software layers, like CPU Disk, Memory, Filesystems, etc.
- Virtual Machines are created on top of a **Hypervisor**, which runs on top of the Host Machine's OS.
  - With **Hypervisors**, we emulate hardware like CPU, Disk, Network, Memory and install Guest Machines on it.
  - We can create multiple Guest Machines with different Operating Systems on a **Hypervisor**.

VIRTUALIZATION

- For example, we can take a **Linux** Machine running on bare-metal and, after setting up the **Hypervisor**, we can create multiple Guest Machines with **Linux** and **Windows** Operating Systems.
- Some examples of hypervisors are:
  - **KVM**,
  - **Xen**,
  - **VMWare**,
  - **VirtualBox**,
  - **Hyper-V**.
- Most of the recent CPUs will also support **Nested Virtualization**, which enables us to have a VM inside a VM.

INTRODUCTION TO KVM

- ***KVM -*** *(**K**ernel-based **V**irtual **M**achine) is a full virtualization solution for **Linux** on x86 hardware.*
- It is part of the main-line **Linux** Kernel. It is ported for **S/390**, **PowerPC**, **IA-64** and **ARM** as well.
- **KVM** is an Open Source software. It supports various Guest OSes, like **Linux**, **Windows**, **Solaris**, etc.



BENEFITS OF USING KVM

- Some of the benefits of using **KVM** are:
  - It is an Open Source solution, and, as such, free to customize.
  - Using **KVM** is efficient from a financial perspective as well, due to the lower costs associated with it.
  - It is highly scalable.
  - **KVM** employs advanced security features, utilizing **SELinux**. It provides **MAC** (**M**andatory **A**ccess **C**ontrol) security between Virtual Machines.

OTHER SOLUTIONS

- VirtualBox
  - It is an easy-to-use multi-platform Hypervisor.
  - Distributed under **GNU General Public License** (**GPL**) **version 2**.

- VmWare
  - It runs on **Linux**, **Windows**, **OS X**, **Solaris**.
  - It is an easy-to-use multi-platform Hypervisor.

INFRASTRUCTURE AS A SERVICE (IAAS)

INFRASTRUCTURE AS A SERVICE (IaaS)

- **IAAS** is a form of Cloud Computing which provides on-demand physical and virtual computing resources, storage, network, firewall, load balancers, etc.
- To provide virtual computing resources, **IaaS** uses some form of Hypervisor, like **Xen**, **KVM**,**VMware ESX/ESXi**, **Hyper-V**, etc.
- **Infrastructure as a Service** is the backbone of all cloud services, providing the compute resources.

EXAMPLE

- *Let's say that you want to have a set of 10* ***Linux*** *systems with 4GB RAM each, and two* ***Windows*** *systems with 8GB each to deploy your software.*
- *You can go to any of the* ***IaaS*** *providers and request these systems.*
- *Generally, a* ***IaaS*** *provider creates the respective VMs in the background, puts them in the same internal network, and shares the credentials with you, thus allowing you to access them.*
- *Other than VMs, some* ***IaaS*** *providers offer bare-metal machines for provisioning.*

CLOUD DEPLOYMENT

AMAZON ELASTIC COMPUTE (EC2)

- **Amazon** provides the **IaaS** infrastructure, on which most of the other services are built.
- **Amazon EC2** uses mostly the **XEN Hypervisor** to provision compute resources.
- **Features and Tools**
  - **t2.nano**: 512 MiB of memory, 1 vCPU, 3 CPU Credits/hour, EBS-only, 32 bit or 64-bit platform.
  - **c4.large**: 3.75 GiB of memory, 2 vCPUs, 64-bit platform.
  - **d2.8xlarge**: 244 GiB of memory, 36 vCPUs, 24 x 2000 GB of HDD-based instance storage, 64-bit platform, 10 Gigabit Ethernet.

BENEFITS OF EC2

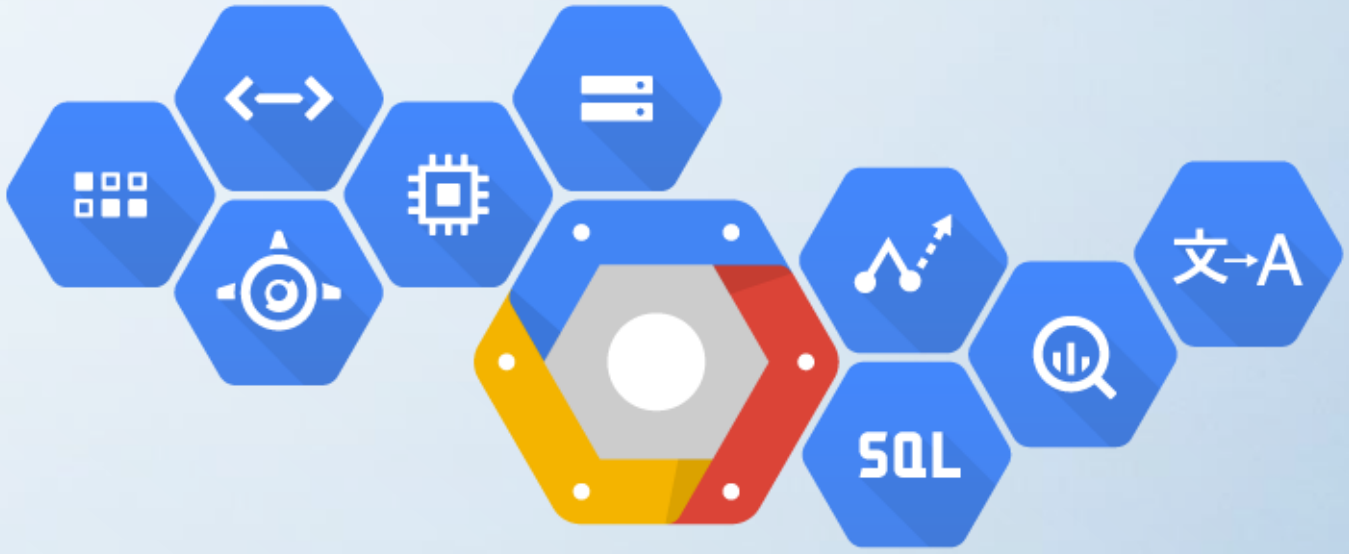
- **Amazon EC2** has many other features, allowing you to:
  - Create an **Elastic IP** for remapping the Static IP address automatically
  - Provision a **Virtual Private Cloud** for isolation
  - Use **CloudWatch** for monitoring resources and applications
  - Use **Auto Scaling** to dynamically resize your resources, etc.
- It provides a secure and robust functionality for your compute resources.
- It enables automation.
- It is cost-effective: you only pay for the time and resources you use.
- It is designed to work in conjunction with other **AWS** components.

MICROSOFT AZURE

- We can manage Virtual Machines from **Azure**'s web interface.
- **Azure** also provides a command line utility to manage resources and applications on the **Azure** Cloud.

GOOGLE CLOUD PLATFORM (GCP)

- Google Compute Engine provides the compute service.
- We can manage the instances through GUI, APIs or command line.



Google Cloud Platform

PYTHON

What is Python ?

- Multi-purpose (Web, GUI, Scripting, etc.)
- Object Oriented
- Interpreted
- Strongly typed and Dynamically typed
- Focus on readability and productivity

Hello World

```
#!/usr/bin/env python
print "Hello World!"
```

hello_world.py

Indentation

- Most languages don't care about indentation
- Most humans do
- We tend to group similar things together

```
/* Bogus C code */
if (foo)
    if (bar)
        baz(foo, bar);
else
    qux();
```

The else here actually belongs to the 2nd if statement

Indentation

```
/* Bogus C code */
if (foo) {
     if (bar) {
          baz(foo, bar);
}
else {
     qux();
}}
```

The else here actually belongs to the 2nd if statement

```
/* Bogus C code */
if (foo) {
     if (bar) {
          baz(foo, bar);
     }
     else {
          qux();
     }
}
```

You should always be explicit

Indentation

```
# Python code
if foo:
    if bar:
        baz(foo, bar)
    else:
        qux()
```

Python embraces indentation

Comments

```
# A traditional one line comment

"""
Any string not assigned to a variable is
considered a comment.
This is an example of a multi-line comment.
"""

"This is a single line comment"
```

PYTHON DATA - TYPES

Strings

```
# This is a string
name = "Nowell Strite (that\"s me)"

# This is also a string
home = 'Huntington, VT'

# This is a multi-line string
sites = '''You can find me online
on sites like GitHub and Twitter.'''

# This is also a multi-line string
bio = """If you don't find me online
you can find me outside."""
```

Numbers

```
# Integers Numbers
year = 2010
year = int("2010")

# Floating Point Numbers
pi = 3.14159265
pi = float("3.14159265")

# Fixed Point Numbers
from decimal import Decimal
price = Decimal("0.02")
```

Lists

```
# Lists can be heterogeneous
favorites = []

# Appending
favorites.append(42)

# Extending
favorites.extend(["Python", True])

# Equivalent to
favorites = [42, "Python", True]
```

Lists

```
numbers = [1, 2, 3, 4, 5]

len(numbers)
# 5

numbers[0]
# 1

numbers[0:2]
# [1, 2]

numbers[2:]
# [3, 4, 5]
```

Dictionaries

```
person = {}

# Set by key / Get by key
person['name'] = 'Nowell Strite'

# Update
person.update({
     'favorites': [42, 'food'],
     'gender': 'male',
     })

# Any immutable object can be a dictionary key
person[42] = 'favorite number'
person[(44.47, -73.21)] = 'coordinates'
```

Dictionary Methods

```
person = {'name': 'Nowell', 'gender': 'Male'}

person['name']
person.get('name', 'Anonymous')
# 'Nowell Strite'

person.keys()
# ['name', 'gender']

person.values()
# ['Nowell', 'Male']

person.items()
# [['name', 'Nowell'], ['gender', 'Male']]
```

PYTHON CONTROL - FLOW

Conditionals

```
grade = 82
if grade >= 90:
    if grade == 100:
        print 'A+'
    else:
        print "A"
elif grade >= 80:
    print "B"
elif grade >= 70:
    print "C"
else:
    print "F"
```

For Loop

```
for x in range(10): #0-9
    print x
```

```
fruits = ['Apple', 'Orange']

for fruit in fruits:
    print fruit
```

LINUX BASH SHELL

DIRECTORIES

- Show the current directory - $ pwd /home/
- Make a new directory - $ mkdir hll
- Show directories - $ ls abc abc.txt hll sum.c
- Remove directory - $ rmdir hll
- Change directory - $ cd abc
- Jump to previous directory - $ cd ..

DIRECTORIES

- Show the details of directories - $ ls -l

```
total 150
drwx---r-x+ 1 aditya aditya     0 Nov  6 14:29 abc
-rw----r--  1 aditya aditya    58 Apr  6 08:03 abc.txt
-rw----r--  1 aditya aditya    60 Apr  6 08:34 sum.c
```

- Show hidden directories - $ ls -a

```
.   .bash_history  .bashrc   .profile  .zenmap  abc
..  .bash_profile  .inputrc  abc.txt  sum.c
```

FILES

- Make new file - $ cat>file1
- Show file content - $ cat file1
- Print command - $ echo "Hello To Linux WOrld“
  Hello To Linux WOrld
- Make multiple files - $ touch file2 file3 file4
- Remove files - $ rm file2
- Show files - $ ls
  abc.txt file3 hel.txt sum.c abc file1 file4
- Move files - $ mv file2.txt hel
- Copy files - $ cp file3.txt hel

REDIRECTION

- Show all directories - $ ls

  barry.txt bob
  example.png
  firstfile
  foo1
  myoutput
  video.mpeg

- Pipe it to head - $ ls | head -3

  barry.txt
  bob
  example.png

SCRIPTS

- What are they?

  A Bash script is a plain text file which contains a series of commands.

- How to make them?

  A script ends with .sh file ext.
  $cat>myscript.sh
  echo “Hello World!”

SCRIPTS

- How to run them? - A script must have the execute permission.
- $ ./myscript.sh
  bash: ./myscript.sh: Permission denied
- $ ls -l myscript.sh
  -rw-r--r-- 18 ryan users 4096 Feb 17 09:12 myscript.sh
- $ chmod 755 myscript.sh
- $ ls -l myscript.sh
  -rwxr-xr-x 18 ryan users 4096 Feb 17 09:12 myscript.sh
- $ ./myscript.sh
  Hello World!

SCRIPTS

- Make a shell script to run all commands
  - Use the script utility to capture the screen output and save into a file with your choice of filename
  - Make a directory test3
  - Create 3 empty files called test3a, test3b, test3c
  - Copy file test3a to test3
  - Use an option of the ls command to see the size in bytes of file test3a
  - Rename test3a to temp2

GIT VERSION CONTROL

What is GIT?

- How to run them? - A script must have the execute permission.
- $ ./myscript.sh
  bash: ./myscript.sh: Permission denied
- $ ls -l myscript.sh
  -rw-r--r-- 18 ryan users 4096 Feb 17 09:12 myscript.sh
- $ chmod 755 myscript.sh
- $ ls -l myscript.sh
  -rwxr-xr-x 18 ryan users 4096 Feb 17 09:12 myscript.sh
- $ ./myscript.sh
  Hello World!

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