UNIT 1:
HISTORY OF VIRTUALIZATION

History Of Virtualization

- Virtualization started out as a concept of time-sharing in the 1960s.

- The machines were large and there was need to split up the machines into multiple portions that can be used for different purposes simultaneously.

- This resulted in evolution of newer innovations related to hardware sharing, paging techniques and multiprogramming.

Time Sharing System

- Earlier systems in the 1960s allowed only one user/job at a time on the system.

- Major disadvantage to larger computers that were technically powerful enough to execute multiple jobs at a time, but not capable due to hardware/software constraints of the system.

- Simultaneous time-sharing of the system was seen as a solution to this.

- However, modifying legacy batch systems to accommodate multiple simultaneous users on the system made the operating system too complex to maintain and support.

Time Sharing System

- The first supercomputer to take advantage of the concepts of shared physical hardware was the Atlas Computer.
- The computer was developed at Manchester University.
- The computer allowed for separation of the supervisory (OS) components from the user components.
- The supervisory code monitored and managed system resources (CPU, memory and IO).
- The supervisory component responded to special instructions that enabled it to provision and monitor the user computing environment.

IBM Mainframe Virtualization

- The earliest pioneer of modern virtualization technology was IBM.
- IBM invented virtualization more than 40 years ago.
- IBM started with virtualization in the 1960s with the M44/44X project.
- This was developed at the IBM Thomas J. Watson Research Center in Yorktown, NY.
- The foundation of this technology was an IBM 7044 (M44) scientific computer.

IBM Mainframe Virtualization

- In addition to Mainframes, IBM currently provides virtualization on Power Servers – the midrange UNIX systems.

- The Power Servers are capable of advanced virtualization mechanisms some of the notable features are: micro-partitioning, Advanced memory sharing, Live partition mobility, Virtual IO Server for IO Virtualization.

- The first Power Server incorporating Advanced Power Virtualization (APV) was shipped in 2004.

- APV was rebranded to IBM PowerVM in 2008.

Extended Virtualization to X86

- Year 2003, marked the release of the first open-source hypervisor for x86 machines called Xen Hypervisor.

- The company XenSource that developed the hypervisor was later acquired by Citrix.

- Citrix is currently one of the major virtualization solution providers in the x86 market.

- In 2006/2007, Virtual Iron released Virtual-Iron, an x86 bare metal hypervisor for enterprise customers.
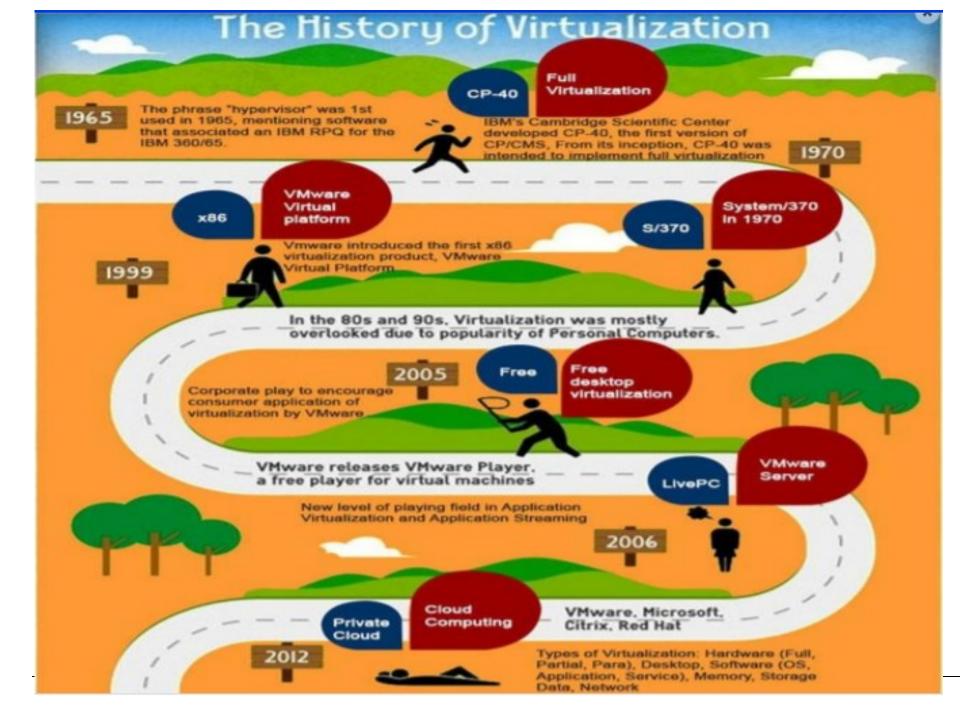
Extended Virtualization to X86

- In the recent years, a new technique to provide virtualization on Linux/x86 has been developed.

- This project is called the "KVM" Project.

- The source code for kvm is part of the main linux kernel tree.

- KVM relies on the support from x86 hardware (including the Intel VT or AMD-V support) for better performance.

- In absence of hardware support, Qemu is used in emulating the required hardware components.

- KVM is now part of the standard linux kernel distributed along with a standard Linux distribution – Redhat, Novell, Ubuntu, Debian etc

Hardware support for X86 virtualization

- Early x86 processors had no built-in support for Virtualization.

- The virtualization was achieved using a software-only hypervisor using complex techniques to multiplex resources among virtual machines.

- The performance of these systems was reasonable but not suitable for putting in production.

- The virtual machines were primarily used in the test and development teams or in places where performance was not a qualifying criteria.

- Hardware Assisted Virtualization began to take shape from 2005, which implemented some of the commonly used functions into x86 hardware.

Hardware support for X86 virtualization

- Intel introduced Intel VT-x and AMD introduced AMD-V to support virtualization in hardware.

- Pentium 4 (Model 662 and 672) were the first Intel processors to support VT-x.

- AMD Athlon processors starting from Athlon 64 ("Orleans") supported AMD-V, the technology to support Virtualization in hardware.

- As time progressed, in addition to hardware-assist for CPU virtualization, advanced hardware techniques to virtualize memory, and IO were introduced through different chipsets.

- A basic principle behind these techniques was to provide a shadow copy (technology that can create backup copies or snapshots) of the hardware to each virtual machine.

Areas where virtualization is not recommended

- Legacy software that are not designed for virtualization.
- Resource Intensive Applications that make assumptions on specific system characteristics to operate.
- Real-Time Applications where the timings are critical. We place these applications as close to the hardware as possible to guarantee turnaround times.
- Other large applications such as database.