LPIC-3 Virtualization and Containerization Exam 305 Objectives

This exam results from a split of version 2.0 of the exam 304.

Exam Objectives Version: 3.0

Exam Code: 305-300

About Objective Weights: Each objective is assigned a weighting value. The weights indicate the relative importance of each objective on the exam. Objectives with higher weights will be covered in the exam with more questions.

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Full Virtualization

Container Virtualization

VM Deployment and Provisioning

Topic 351: Full Virtualization

351.1 Virtualization Concepts and Theory (weight: 6)

Weight	6
Description	Candidates should know and understand the general concepts, theory and terminology of virtualization. This includes Xen, QEMU and libvirt terminology.

Key Knowledge Areas:

- Understand virtualization terminology
- Understand the pros and cons of virtualization
- Understand the various variations of Hypervisors and Virtual Machine Monitors
- Understand the major aspects of migrating physical to virtual machines
- Understand the major aspects of migrating virtual machines between host systems
- Understand the features and implications of virtualization for a virtual machine, such as snapshotting, pausing, cloning and resource limits
- Awareness of oVirt, Proxmox, systemd-machined and VirtualBox
- Awareness of Open vSwitch

The following is a partial list of the used files, terms and utilities:

- Hypervisor
- Hardware Virtual Machine (HVM)
- Paravirtualization (PV)
- Emulation and Simulation
- CPU flags
- /proc/cpuinfo
- Migration (P2V, V2V)

351.2 Xen (weight: 3)

Weight	3
Description	Candidates should be able to install, configure, maintain, migrate and troubleshoot Xen installations. The focus is on Xen version 4.x.

Key Knowledge Areas:

- Understand architecture of Xen, including networking and storage
- Basic configuration of Xen nodes and domains
- Basic management of Xen nodes and domains
- Basic troubleshooting of Xen installations
- Awareness of XAPI
- Awareness of XenStore
- Awareness of Xen Boot Parameters
- Awareness of the xm utility

The following is a partial list of the used files, terms and utilities:

- Domain0 (Dom0), DomainU (DomU)
- PV-DomU, HVM-DomU
- /etc/xen/
- xl
- xl.cfg
- xl.conf
- xentop

351.3 QEMU (weight: 4)

Weight	4
Description	Candidates should be able to install, configure, maintain, migrate and troubleshoot QEMU installations.

Key Knowledge Areas:

- Understand the architecture of QEMU, including KVM, networking and storage
- Start QEMU instances from the command line
- Manage snapshots using the QEMU monitor
- Install the QEMU Guest Agent and VirtIO device drivers
- Troubleshoot QEMU installations, including networking and storage
- Awareness of important QEMU configuration parameters

The following is a partial list of the used files, terms and utilities:

- Kernel modules: kvm, kvm-intel and kvm-amd
- /dev/kvm

- QEMU monitor
- qemu
- qemu-system-x86_64
- ip
- brctl
- tunctl

351.4 Libvirt Virtual Machine Management (weight: 9)

Weight   9

Description   Candidates should be able to manage virtualization hosts and virtual machines ('libvirt domains') using libvirt and related tools.

Key Knowledge Areas:

- Understand the architecture of libvirt
- Manage libvirt connections and nodes
- Create and manage QEMU and Xen domains, including snapshots
- Manage and analyze resource consumption of domains
- Create and manage storage pools and volumes
- Create and manage virtual networks
- Migrate domains between nodes
- Understand how libvirt interacts with Xen and QEMU
- Understand how libvirt interacts with network services such as dnsmasq and radvd
- Understand libvirt XML configuration files
- Awareness of virtlogd and virtlockd

The following is a partial list of the used files, terms and utilities:

- libvirtd
- /etc/libvirt/
- virsh (including relevant subcommands)

351.5 Virtual Machine Disk Image Management (weight: 3)

Weight   3

Description   Candidates should be able to manage virtual machines disk images. This includes converting disk images between various formats and hypervisors and accessing

data stored within an image.

Key Knowledge Areas:

- Understand features of various virtual disk image formats, such as raw images, qcow2 and VMDK
- Manage virtual machine disk images using qemu-img
- Mount partitions and access files contained in virtual machine disk images using libguestfish
- Copy physical disk content to a virtual machine disk image
- Migrate disk content between various virtual machine disk image formats
- Awareness of Open Virtualization Format (OVF)

The following is a partial list of the used files, terms and utilities:

- qemu-img
- guestfish (including relevant subcommands)
- guestmount
- guestumount
- virt-cat
- virt-copy-in
- virt-copy-out
- virt-diff
- virt-inspector
- virt-filesystems
- virt-rescue
- virt-df
- virt-resize
- virt-sparsify
- virt-p2v
- virt-p2v-make-disk
- virt-v2v
- virt-sysprep

Topic 352: Container Virtualization

352.1 Container Virtualization Concepts (weight: 7)

Weight	7
Description	Candidates should understand the concept of container virtualization. This includes understanding the Linux components used to implement container virtualization as well as using standard Linux tools to troubleshoot these components.

Key Knowledge Areas:

- Understand the concepts of system and application container
- Understand and analyze kernel namespaces
- Understand and analyze control groups
- Understand and analyze capabilities
- Understand the role of seccomp, SELinux and AppArmor for container virtualization
- Understand how LXC and Docker leverage namespaces, cgroups, capabilities, seccomp and MAC
- Understand the principle of runc
- Understand the principle of CRI-O and containerd
- Awareness of the OCI runtime and image specifications
- Awareness of the Kubernetes Container Runtime Interface (CRI)
- Awareness of podman, buildah and skopeo
- Awareness of other container virtualization approaches in Linux and other free operating systems, such as rkt, OpenVZ, systemd-nspawn or BSD Jails

The following is a partial list of the used files, terms and utilities:

- nsenter
- unshare
- ip (including relevant subcommands)
- capsh
- /sys/fs/cgroups
- /proc/[0-9]+/ns
- /proc/[0-9]+/status

352.2 LXC (weight: 6)

Weight	6
Description	Candidates should be able to use system containers using LXC and LXD. The version of LXC covered is 3.0 or higher.

Key Knowledge Areas:

- Understand the architecture of LXC and LXD
- Manage LXC containers based on existing images using LXD, including networking and storage
- Configure LXC container properties
- Limit LXC container resource usage
- Use LXD profiles
- Understand LXC images
- Awareness of traditional LXC tools

Partial list of the used files, terms and utilities:

- lxd
- lxc (including relevant subcommands)

352.3 Docker (weight: 9)

Weight	9
Description	Candidate should be able to manage Docker nodes and Docker containers. This include understand the architecture of Docker as well as understanding how Docker interacts with the node's Linux system.

Key Knowledge Areas:

- Understand the architecture and components of Docker
- Manage Docker containers by using images from a Docker registry
- Understand and manage images and volumes for Docker containers
- Understand and manage logging for Docker containers
- Understand and manage networking for Docker
- Use Dockerfiles to create container images
- Run a Docker registry using the registry Docker image

Partial list of the used files, terms and utilities:

- dockerd
- /etc/docker/daemon.json
- /var/lib/docker/
- docker
- Dockerfile

352.4 Container Orchestration Platforms (weight: 3)

Weight	3
Description	Candidates should understand the importance of container orchestration and the key concepts Docker Swarm and Kubernetes provide to implement container orchestration.

Key Knowledge Areas:

- Understand the relevance of container orchestration
- Understand the key concepts of Docker Compose and Docker Swarm
- Understand the key concepts of Kubernetes and Helm
- Awareness of OpenShift, Rancher and Mesosphere DC/OS

Topic 353: VM Deployment and Provisioning

353.1 Cloud Management Tools (weight: 2)

Weight	2
Description	Candidates should understand common offerings in public clouds and have basic feature knowledge of commonly available cloud management tools.

Key Knowledge Areas:

- Understand common offerings in public clouds
- Basic feature knowledge of OpenStack
- Basic feature knowledge of Terraform
- Awareness of CloudStack, Eucalyptus and OpenNebula

Partial list of the used files, terms and utilities:

- IaaS, PaaS, SaaS
- OpenStack
- Terraform

353.2 Packer (weight: 2)

Weight	2
Description	Candidates should be able to use Packer to create system images. This includes running Packer in various public and private cloud environments as well as building container images for LXC/LXD.

Key Knowledge Areas:

- Understand the functionality and features of Packer
- Create and maintain template files
- Build images from template files using different builders

Partial list of the used files, terms and utilities:

- packer

353.3 cloud-init (weight: 3)

Weight	3
Description	Candidates should able to use cloud-init to configure virtual machines created from standardized images. This includes adjusting virtual machines to match their available hardware resources, specifically, disk space and volumes. Additionally, candidates should be able to configure instances to allow secure SSH logins and install a specific set of software packages. Furthermore, candidates should be able to create new system images with cloud-init support.

Key Knowledge Areas:

- Understanding the features and concepts of cloud-init, including user-data, initializing and configuring cloud-init
- Use cloud-init to create, resize and mount file systems, configure user accounts, including login credentials such as SSH keys and install software packages from the distribution's repository
- Integrate cloud-init into system images
- Use config drive datasource for testing

Partial list of the used files, terms and utilities:

- cloud-init
- user-data
- /var/lib/cloud/

353.4 Vagrant (weight: 3)

Weight	3

Description   Candidate should be able to use Vagrant to manage virtual machines, including provisioning of the virtual machine.

Key Knowledge Areas:

- Understand Vagrant architecture and concepts, including storage and networking
- Retrieve and use boxes from Atlas
- Create and run Vagrantfiles
- Access Vagrant virtual machines
- Share and synchronize folder between a Vagrant virtual machine and the host system
- Understand Vagrant provisioning, i.e. File and Shell provisioners
- Understand multi-machine setup

Partial list of the used files, terms and utilities:

- vagrant
- Vagrantfile

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