QEMU-KVM Upgrade Test

Stable Guest ABI / In Place Upgrade

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About me

• I’m Min Deng
• I’m QE from KVM-QE team Red Hat
• I’m responsible for Stable Guest ABI and In Place Upgrade and some other features’ tests on x86 and ppc
Agenda

• Stable Guest ABI
  – Machine type
  – PC and Q35 on x86
  – Seabios and OVMF on x86
  – Upper Layer Products and Stable Guest ABI test
  – Test workflow

• In place upgrade
  – What’s in place upgrade
  – Upgrade paths
  – Test
QEMU-KVM Upgrade Test

• Stable Guest ABI allows virtual machines to be presented with the same ABI across QEMU upgrade.
  – Regarding it as sub feature of migration (test point of view)
• Why need the test ?
  – Avoiding breaking down virtual machines
    • Apply critical bug fix, security mitigation
    • Support new features and new capabilities of existing features
QEMU-KVM Machine Type

- Machine Type
  - Emulate different chipsets and related devices
  - Provide Stable Guest ABI

- Know machine type on different architectures
  - Check it on qemu-kvm by
    - /usr/libexec/qemu-kvm -M ?
  - You can refer to source code if you need

Machine type on different architectures

- x86_64
  - The pc machine type
  - The q35 machine type
- ppc64le
  - The pseries machine type
- s390x
  - The s390-ccw-virtio machine type
- aarch64
  - The virt machine type
QEMU-KVM Machine Type

• PC and Q35
  – PC
    • QEMU corresponds to Intel® i440FX chipset (released in 1996)
      – pc RHEL 7.6.0 PC (i440FX + PIIX, 1996) (alias of pc-i440fx-rhel7.6.0)
  – Q35
    • QEMU corresponds to Intel® 82Q35 chipset (released in 2007)
      – Supported modern features
      – q35 RHEL-8.6.0 PC (Q35 + ICH9, 2009) (alias of pc-q35-rhel8.6.0)
QEMU-KVM Machine Type

Q35 chipset Overview

- Two primary components:
  - Graphic Memory Controller Hub
  - IO Controller Hub (ICH9/ICH9 DO)

- New features:
  - PCIe
  - AHCI storage controller
  - vIOMMU emulation
  - “Secure” Secure Boot
  - …

QEMU-KVM Machine Type
Seabios and OVMF (Open Virtual Machine Firmware)

- **Seabios**
  - SeaBIOS runs inside an emulator, it’s the default BIOS for the QEMU-KVM

- **OVMF**
  - UEFI (Unified Extensible Firmware Interface) for x86 VMs is called OVMF

- **Test Matrix of Stable Guest ABI on x86**
  - PC and Seabios
  - Q35 and Seabios
  - Q35 and OVMF
Upper Layer Products And Stable Guest ABI

- **Red Hat OpenStack Platform**
  - Red Hat OpenStack Platform-16.1
  - Red Hat OpenStack Platform-16.2
  - ...

- **Red Hat OpenShift**
  - Container-native virtualization 4.8
  - Container-native virtualization 4.9
  - Container-native virtualization 4.10
  - ...

- **Red Hat Virtualization**
  - RedHat Virtualization 4.4.8
  - RedHat Virtualization 4.4.9
  - RedHat Virtualization 4.4.10
  - ...

[Image of Red Hat products]
Upper Layer Products And Stable Guest ABI

- Red Hat OpenShift virtualization support for mixed applications running on virtual machines (“VMs”) and containers. Previously known as container-native virtualization (“CNV”)
- OpenShift virtualization is a feature of the OpenShift platform
## Four aspects

<table>
<thead>
<tr>
<th>Product line</th>
<th>Cover supported features</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ RHEL.7 to RHEL.8</td>
<td>○ New supported features</td>
</tr>
<tr>
<td>○ RHEL.8 to RHEL.9</td>
<td>○ New capabilities of existing features</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Versioned machine type</th>
<th>Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>on different architectures</td>
<td>○ x86_64</td>
</tr>
<tr>
<td>○ x86_64</td>
<td>■ Intel, AMD</td>
</tr>
<tr>
<td>○ ppc64le</td>
<td>■ Power 8, Power 9</td>
</tr>
<tr>
<td>○ S390x</td>
<td>○ s390x</td>
</tr>
<tr>
<td></td>
<td>■ IBM z</td>
</tr>
</tbody>
</table>
● Test Principles
  ○ Ping-Pong migration
    ■ Live migration
    ■ Post copy
  ○ Test intersection of machine types
  ○ Consider priority of Seabios and OVMF for VM on different product lines. (x86_64)
Test Workflow

- x86_64
- ppc64le
- s390x

Ping-pong migration

The Intersection of machine types between both src and dst qemu-kvm

Source Host

Destination Host
In Place Upgrade

- **What’s In Place Upgrade?**
  - In place upgrade (IPU) is a way of upgrading a system to a new major release of Red Hat Enterprise Linux by replacing the existing operating system.
  - The in place upgrade tool is leapp utility.

- **QEMU-KVM related test on x86_64, ppc64le and s390x**
  - IPU on the VM
  - IPU on the host
## Advantages

### In place upgrade vs re-deployment

<table>
<thead>
<tr>
<th></th>
<th>Preserve configuration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>● Old configuration will be removed and need to set up new configuration again</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Retain subscription management</td>
<td>● Machines have to be re-subscribed</td>
</tr>
<tr>
<td>03</td>
<td>Save time and cost</td>
<td>● Additional time and cost</td>
</tr>
<tr>
<td>04</td>
<td>Low bar of seniority required</td>
<td>● Require expertise to ensure the setup</td>
</tr>
</tbody>
</table>
## Upgrade paths

<table>
<thead>
<tr>
<th>In place upgrade from RHEL 7 to RHEL 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HOST</strong></td>
</tr>
<tr>
<td>Virtual Machine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In place upgrade from RHEL 8 to RHEL 9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HOST</strong></td>
</tr>
<tr>
<td>Virtual Machine</td>
</tr>
</tbody>
</table>
Implementation

- Get RHEL content from Red Hat Content Delivery Network
  - Red Hat Satellite
  - Red Hat Satellite

- Custom repositories
  - Without Red Hat Subscription Management

- With Red Hat Subscription Management

- To be upgraded system

- Leapp utility

- Leapp preupgrade -> Leapp upgrade

- New system

Post checking:
- VM: all features' functionalities and etc.
- Host: qemu-kvm component is upgraded to expected version and etc.
In Place Upgrade With/Without RHSM

• **With RHSM**
  – Red Hat Subscription Management (RHSM)
    • RHSM is the service which manages your Red Hat subscriptions and entitlements

• **Without RHSM**
  – Custom repos should be provided at the beginning of In Place Upgrade
In Place Upgrade with RHSM

REGISTER

subscription-manager register

Enable rhel contents

subscription-manager repos
--enable

Run

yum install leapp tool
In Place Upgrade with RHSM

- `subscription-manager config --rhsm.baseurl=https://xxx.redhat.com`
  - configure your server first
- `subscription-manager register --username in_place_upgrade --password in_place_upgrade --serverurl "subscription.xxxx.redhat.com"`
  - register your system by the user attached the SKU already
In Place Upgrade with RHSM

- `subscription-manager list --available`
  - According to user's account information and then you can get a pool id

- `subscription-manager attach --pool poolid`
  - Attach your old system to above pool where you can get the product(rhel) content for upgrading your system later.

- `subscription-manager list --installed`
  - Check if you have the Red Hat Enterprise Linux Server subscription attached

- `subscription-manager repos --enable rhel-7-server-extras-rpms`
  - Enable the base repository and enable the extras repository where leapp and its dependencies are available

- `subscription-manager repos --enable rhel-7-server-rpms`
  - It's RHEL 7 repos here, and you need to adjust repos according to your current upgrade path

- `yum update`
  - Update old system to the corresponding minor version

- `reboot`
  - Reboot your old system if required
In Place Upgrade with RHSM

- #yum install leapp-upgrade
  - Install leapp tool
- #leapp preupgrade
  - To assess upgradability of your system, start the pre-upgrade process by the leapp preupgrade command
- #leapp upgrade (eg. --target 8.6/9.0)
  - Leapp takes over the role to upgrade your system
- … less one hour, just need to wait!
  - New system will be ready soon … :)
In Place Upgrade with RHSM

- ---------------------------Finish Upgrade --------------------------------
- Verify that the current OS version is Red Hat Enterprise Linux X:
  - #cat /etc/redhat-release
  - #uname -r

- Verify that the correct product is installed
  - #subscription-manager list --installed
  - #subscription-manager release

Results
Reference

[Reference]
https://github.com/qemu/qemu/blob/master/docs/pcie.txt
https://wiki.qemu.org/Features/Q35
Q&A