Virtualization as Information System Consolidation Tool

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Agenda

- Common virtualization glitches
- Steps before start
- Available Hypervisors
- Why KVM
- Libvirt : abstraction layer
- Orchestrators
- Why Enomalism
- Useful related admin tools
- Useful related Virtualization tools
- A last word about OOM
- Demo

Introduction

- Use case of this presentation :
  - Multi-tier App (HTTPD, Tomcat, PostgreSQL)
  - Need a way to start easily a new instance of this App
  - Public Access to this app
  - Data life cycle very short
  - Virtualization seen as an opportunity to rethink the organisation (human include)
  - Prior experience with VMWare Esx

Common glitches about virtualization

- Processor physical arch
  - Tools are mainly x86
  - And need VT (means : bybye olddies)

- Network capacity
  - Rethinking network architecture for virtualization
  - More throuput (VM migration may stop all other traffic)
  - Need a QoS or a dedicated physical network
  - IP map

- Dealing the physical legacy
  - Obsolete machines
  - A lot of CPUs available but not much RAM
  - Obsolete systems (Windows NT) for action like Virtual2Physical
  - Hardware dependant systems (SSL, graphic cards, ...)

Common glitches about virtualization

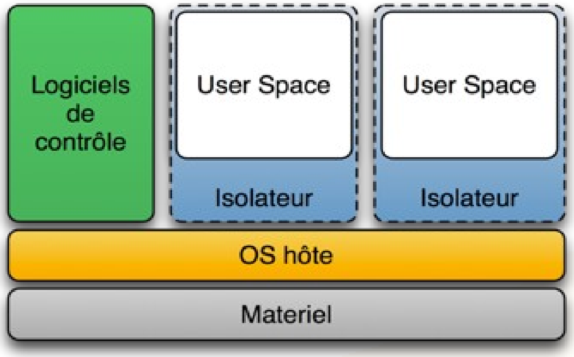
- **Hot services configuration within VM**
  - Add CPUs, RAM available on the host : add more RAM to the guest : GREAT NEWS !
  - But JVM process still limited to Xmx, HTTPD max client always same value.
- **Product support and licence**
  - Windows XP licence linked to the machine
  - Ask to your resellers
- **Hypervisor Interop**
  - Live migration between Xen / KVM
  - VM Image format
    - .vmdk, .vdi, .qcow2
  - OVF « Open Virtualization Format » (IBM, HP, Dell, Microsoft & XenSource) :
    - DMTF has since released the OVF Specification V1.0.0 as a preliminary standard in September, 2008

Steps before virtualization start

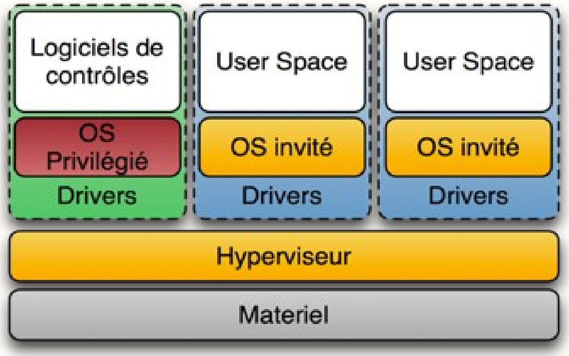
- **Legacy analysis**
  - What are the real needs of each application as a whole ?
    - An application is not just a simple process on a box but it is a gathering of elements that offers a service to an enduser.
    - CPU, RAM, I/O (disk & network) pick and average
  - Tools : sar, iozone
- **Applications relationship Map**
  - Put applications closed to their friends to avoid useless I/O network
  - Tools : YOU !!!
- **Physical Hardware Choice :**
  - Blade might be good but.... beware I/O network
    - IBM Blade Center E : 14 blades but 12 physical network interfaces...

Available hypervisors

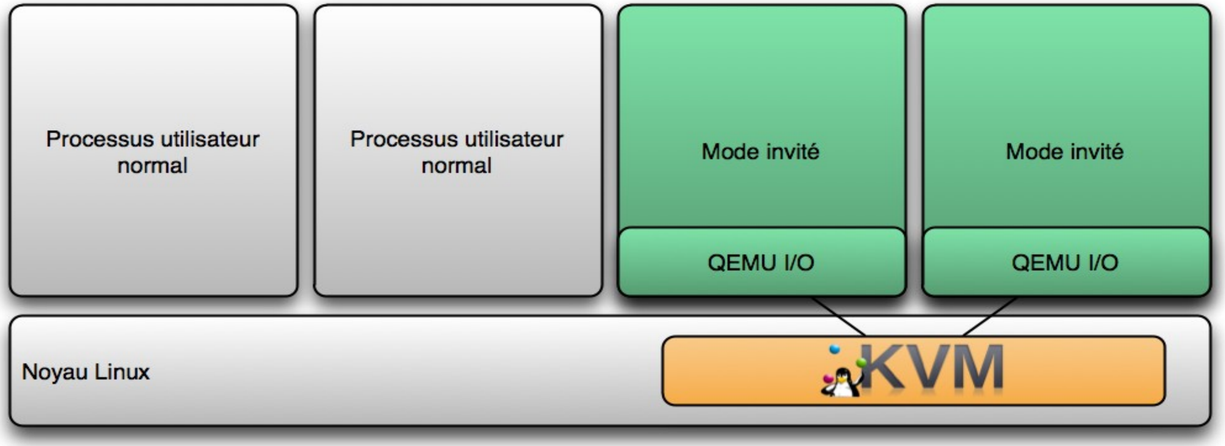
- OpenVZ
  - Virtualization on the OS level, a.k.a. containers virtualization
  - Multiple instances of a single operating system.



- Xen
  - Paravirtualization : enables running different OSs on a single server.
  - Privileged kernel.
- KVM
  - Paravirtualization
  - Turn linux kernel into hypervisor



why KVM



- Architecture is simple and easy to understand
- Fully integrated to linux kernel
- Reuse the knowledge of your linux administrator
- Rich QEMU tools
- vmdk ready
- open to others OS

KVM for beginners

- modprobe kvm_<amd|intel>
- qemu-img create -f <format> myFile <size>M|G
  - format : vmdk, qcow2 …
  - size : file will be autoextend to the size limit
- kvm -smp <X> -m <XYZ> -boot c -hda myFile
  - -smp : number of CPUs you need (default 1)
    - kvm is one process only
  - -m : memory you need (default 128) in Mb
    - 32bits : 1.6Go memory max. Some weird results if you try : -m 2047M (max size in the documentation) but 64bits : no limits ? :-)
- kvm -monitor stdio …
  - migrate : live migration
  - savevm|loadvm|delvm <snapshot_id> : create|apply|delete a snapshot
  - info

Image administration

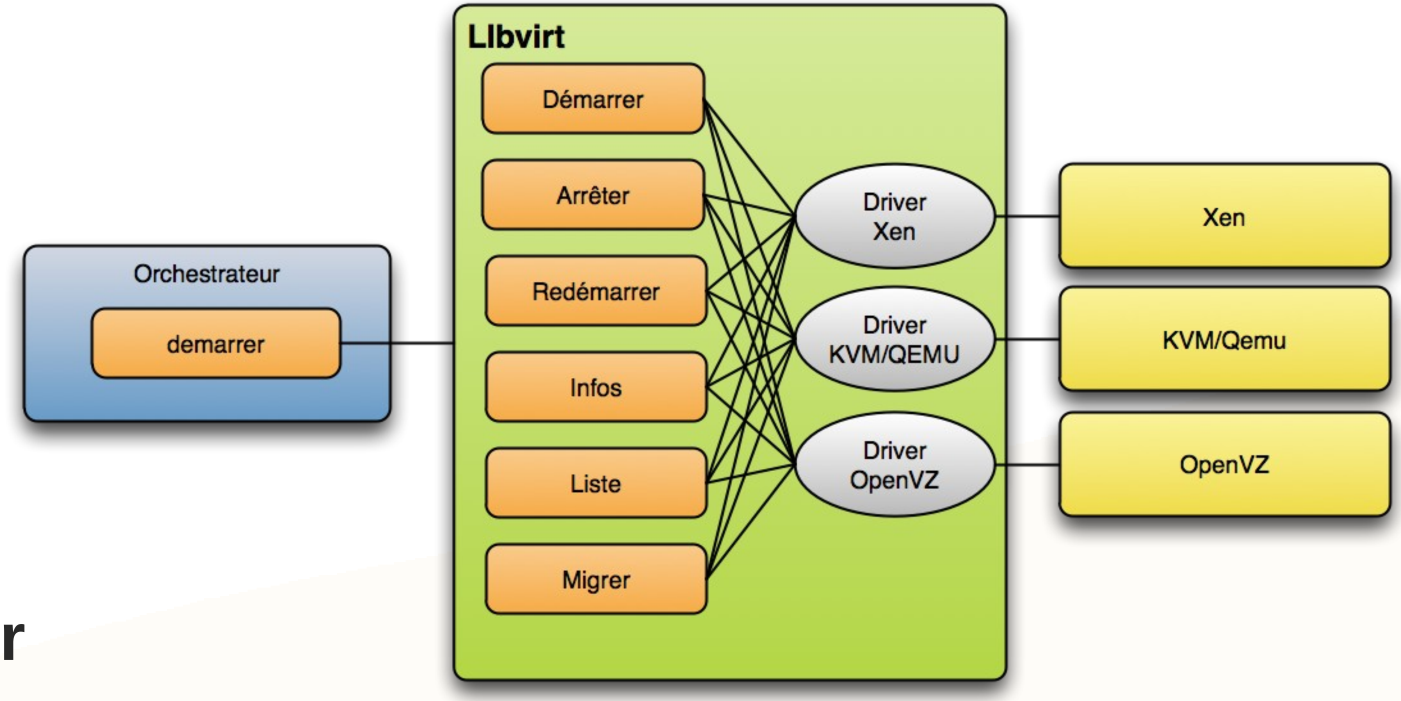
Snapshot administration with qemu-img

- qemu-img -l myFile : list all snapshot available in myFile
- qemu-img -c <snapshot_id> myFile : create a new snapshot
- qemu-img -a <snapshot_id> myFile : apply a snapshot
- qemu-img -d <snapshot_id> myFile : delete a snapshot

Format Interop

- qemu-img convert
- vmware-vdiskmanager -r windows2003.vmdk -t 0 windows2003-flattened.vmdk
- VBoxManage internalcommands converttoraw

Libvirt (RedHat Project)



- Abstract layer
- Offer same API to any hypervisor
  - Reality a little bit different : Xen well supported, KVM behind
- Sometime really buggy : 0.5.0
- Usually available in most distros

Libvirt for beginners

Fast setup for bridge network

- **/etc/sysconfig/network-scripts/ifcfg-eth0**

```
DEVICE=eth0
HWADDR=00:24:7E:10:EE:EE
ONBOOT=yes
BRIDGE=virbr0
```

- **/etc/sysconfig/network-scripts/ifcfg-virbr0**

```
DEVICE=virbr0
TYPE=Bridge
BOOTPROTO=dhcp
ONBOOT=yes
DHCP_CLIENT=dhclient
```

Libvirt for beginners

- **/etc/libvirt/qemu.conf**

```
vnc_listen = "0.0.0.0"
```

- **/etc/libvirt/qemu/network/default.xml**

```
<network>
  <name>default</name>
  <uuid>3618ae64-338c-4976-9157-6083092f754b</uuid>
  <bridge name="virbr0" />
  <forward/>
</network>
```

- **/etc/init.d/libvirtd start**
- **virsh version**

```
Compiled against library: libvir 0.6.1
Using library : libvir 0.6.1
Using API : QEMU 0.6.1
Running hypervisor : QEMU 0.10.1
```

Libvirt XML format

```
<domain type='kvm'>
  <name>myVM</name>
  <uuid>2e161d5c-2e61-11de-a734-0016d4e7e91f</uuid>
  <memory>524288</memory>
  <currentMemory>524288</currentMemory>
  <vcpu>1</vcpu>
  <os>
    <type arch='i686' machine='pc'>hvm</type>
    <boot dev='hd'/>
  </os>
  <clock offset='utc'/>
  <on_poweroff>destroy</on_poweroff>
  <on_reboot>restart</on_reboot>
  <on_crash>destroy</on_crash>
  <devices>
    <emulator>/usr/bin/kvm</emulator>
    <disk type='file' device='disk'>
      <source file='/home/fve/kvm/d0.img'/>
      <target dev='hda' bus='ide'/>
    </disk>
    <input type='mouse' bus='ps2'/>
    <graphics type='vnc' port='-1' autoport='yes'/>
  </devices>
</domain>
```

Libvirt command line : virsh

- **Uneasy to use but as usual powerful**
- **virsh # start /home/fve/kvm/myVM.xml**
  - start the VM describe in the XML file
- **virsh # setvcpus myVM 2**

```
libvir: QEMU error : this function is not supported by the hypervisor: cannot change vcpu count of an active
domain
```

- **Lot of attractive commands but not much information...**
- **virsh # vcpuinfo myVM**

```
VCPU:          0
CPU:           0
State:         running
CPU Affinity:  y-
```

- **virsh # vcpupin myVM 0 0,1**
- **virsh # vcpuinfo myVM**

```
VCPU:          0
CPU:           0
State:         running
CPU Affinity:  yy
```

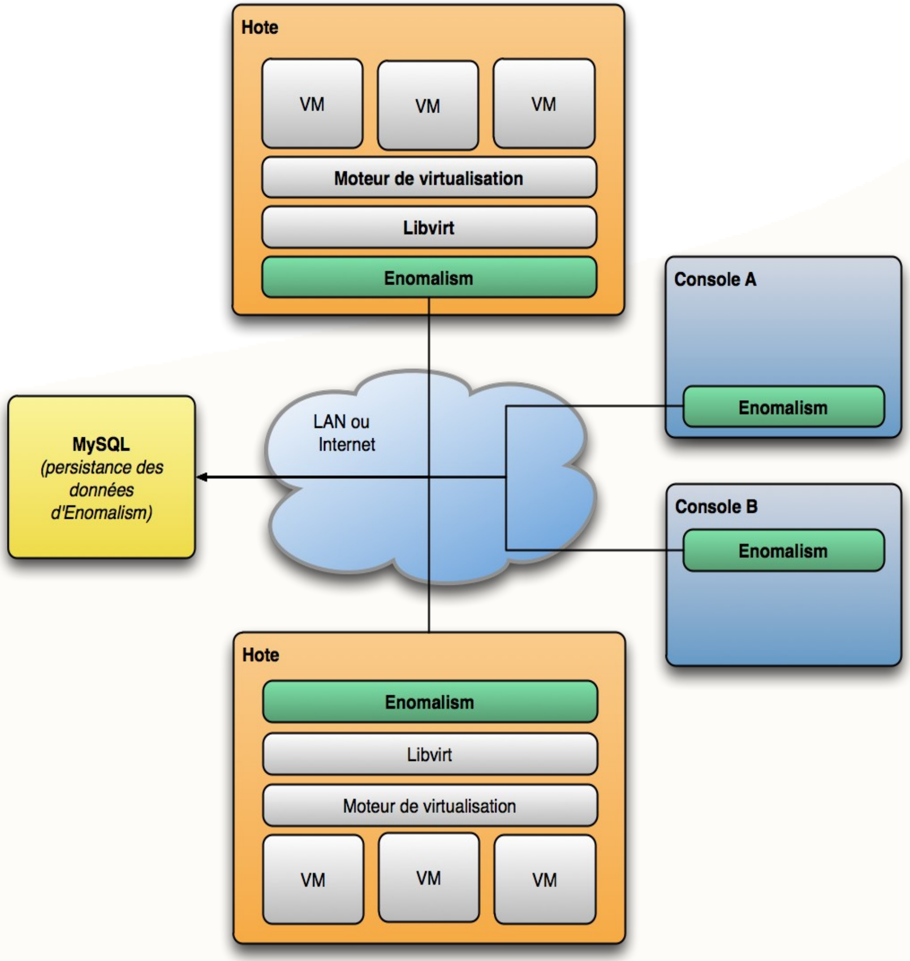
- **Libvirt shoud be used within an orchestrator**

Orchestrators

- **Desktop client :**
  - **Qemulator**
    - Easy to use, nice to play with but not a datacenter tool
  - **Virt-manager (RedHat Project)**
    - Datacenter tool but need to be install on a dedicated machine.
- **Browser App :**
  - **oVirt (RedHat projet)**
    - Last version 0.96
    - Only KVM
  - **Enomalism**
    - Last version 2.2.3
    - Xen, KVM
    - Cloud ready

Why Enomalism ?

- Distributed approch : you can pilot your datacenter from anywhere
- Developped in python
- Easily extensible
- Both Xen and KVM ready
- Nice AJAX interface
- VMcast tool
- VM pool



Enomalism for beginners

- Installation : deb / RPM package available
  - Watch out the libvirt version !
    - Ok with 0.4.1 or the 0.5.1
    - Broken with 0.5.0
    - Not tested with higher version
- MySQL server must be up and ready
- Need some python packages
  - python-mysql, python-setuptools
  - Package will install complementary python eggs
- Create the database :
  - [Enomalism_dir]/script/initdb.sh
  - Adapt the config/$hostname.cfg file

Enomalism

Great tool but

- **No snapshoting command directly available**
  - KVM package available but need to work with kvm userland =< 0.9.1
    - Use the /dev/pts listed by lsof
    - http://src.enomaly.com/browser/extension_modules/e2_kvmsnapshoting
- **Network provisionning not ready**
- **AJAX not really portable**
- **Python 2.4 or 2.5 only**
- **MySQL SPOF**
- **PostgreSQL not supported**

Useful related admin tools

- **CPU affinity : taskset**

```
[fve@localhost ~]$ taskset -p 8359
pid 8359's current affinity mask: 3
[fve@localhost ~]$ taskset -p 0x00000001 8359
pid 8359's current affinity mask: 3
pid 8359's new affinity mask: 1
```

  - Beware in case of live migration....

- **I/O QoS : ionice**
  - ionice -c <scheduling_class> -n <priority_class> -p <pid>

- **I/O network**
  - tc command

Useful related Virtualization tools

- **Physical 2 virtual :**
  - dd
  - Any ghost-like : clonezilla, g4u
  - virt-p2v (RedHat project)

- **Configuration tools :**
  - puppet
  - cobbler (Redhat project)

- **Virtual 2 physical :**
  - NO TOOLS AVAILABLE !!!

A last word : OOM

- **And what if there is no memory available ???**
- **oom_killer do his job ! VM die**
  - /proc/<pid>/oom_adj (value range : -17 to 15)
    - if -17 then no oom_killer on this process
  - echo 2 > /proc/sys/vm/overcommit_memory
    - Process cannot get more memory than available (RAM + SWAP).
    - May be a VM managing problem

Enomalism : some screenshots !!!

NO SCREENSHOTS !

IT'S DEMO TIME !

References

- Wikipedia
- http://www.linux-kvm.org & http://www.linux-kvm.com
- http://openvz.org
- http://libvirt.org
- http://www.enomaly.com
- RTFM

Any questions ?

Thank you for your attention
& thank to Antoine