oVirt Hosted Engine

The Egg That Hosts its Parent Chicken

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Agenda

- Fundamental question
- Reason
- Architecture
- Setup
- Simulations
- Summary
Why did the chicken cross the road?
What is it?

- Standard oVirt installation
- Running in a highly available VM
- The VM is managed... by the engine it's hosting

- Sound challenging?...
Why do we need it?

• Saves $ / £ / € / ₪ /...
  • No need for dedicated box

• Actually, saves $$$ / £££ / €€€ / ₪₪₪ /...
  • If you have a failover solution
Challenges

- Setup...
  - How do we set up an egg (VM) that hosts its parent chicken (oVirt engine)?

- VM availability
  - Network connectivity lost
  - Engine unexpectedly down
  - Load balancing
  - Maintenance
  - ...

oVirt
Solutions

• Existing solutions

  • Clustering File system + file locking
    • Proprietary

  • RHCS / Pacemaker
    • Standard file system
    • Uses Corosync
    • Limits number of nodes
    • No oVirt node support
Solutions

• Here's a thought
  • Standard file system
  • Sanlock leases

• Simpler
• Focused on Virtual Machines
• Less logic
Architecture

CAUTION!

THIS PRODUCT MAY CONTAIN COMICS
Classic 3-layers architecture
Architecture

- CLI: /usr/sbin/hosted-engine
  - --help
    - show this help.
  - --deploy
    - run ovirt-hosted-engine deployment
  - --vm-start
    - start VM on this host
  - --vm-shutdown
    - gracefully shut down the VM on this host
  - --vm-poweroff
    - forcefully power off the VM on this host
  - --vm-status
    - VM status according to HA agent
Architecture

- CLI: `/usr/sbin/hosted-engine`
  - `--add-console-password=<password>`
    - Create a temporary password for vnc/spice connection
  - `--check-liveliness`
    - Checks liveliness page of engine
  - `--connect-storage`
    - Connect the storage domain
  - `--start-pool`
    - Start the storage pool manually
  - `--console`
    - Open the configured console using remote-viewer on localhost
  - `--set-maintenance=<local|global|none>`
Architecture

- **ovirt-ha-agent**
  - AKA 'The Brain'
  - Standalone system service
  - Contains the HA logic, state machine, etc
  - Takes action if needed to ensure high availability
  - Communicates locally with the broker to get data

 CLI
 ovirt-ha-agent
 ovirt-ha-broker
Architecture

- **ovirt-ha-broker**
  - AKA 'The Middleman'
  - Standalone system service
  - Shared storage
    - Used by ovirt-ha-agent to read from/write to storage
  - Monitoring
    - Includes pluggable monitoring (…/submonitors/)
    - Ping
    - CPU load
    - Memory use
    - Management network bridge status
    - Engine VM status
• Host Score
  • Single number representing a host's suitability for running the engine VM
  • Range is 0 (unsuitable) to 2400 (all is well)
  • Calculated based on host status: each monitor (ping, cpu load, gateway status, ...) has a weight and contributes to the score

  Score weights:
  1000 - gateway address is pingable
  800 - host's management network bridge is up
  400 - host has 4GB of memory free to run the engine VM
  100 - host's cpu load is less than 80% of capacity
  100 - host's memory usage is less than 80% of capacity

  Adjustments:
  - 50 - subtraction for each failed vm startup attempt
  0 - score reset to 0 after 3 attempts, for 10 minutes
Hosted engine storage

- Storage domain created during setup
  - First host only
  - Holds engine VM disks, sanlock metadata, agent metadata
  - NFS only (support for GlusterFS/iSCSI/FC coming later)

- Special files (created during setup):
  - `/rhev/data-center/mnt/<host:domain>/<uuid>/ha_agent/`
  - ` [...] hosted-engine.lockspace` – for sanlock
  - ` [...] hosted-engine.metadata` – for agent
Hosted engine storage

- hosted-engine.metadata
  - 4KiB chunks, one per host
  - Chunk ownership defined by host_id (Sanlock)
  - host_id starts at 1... offset 0 reserved for cluster-wide settings such as maintenance bit

<table>
<thead>
<tr>
<th>0</th>
<th>4096</th>
<th>8192</th>
<th>12288</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster-wide Data (reserved)</td>
<td>host_id 1</td>
<td>host_id 2</td>
<td>host_id 3</td>
</tr>
</tbody>
</table>
Hosted engine storage

- hosted-engine.metadata: each 4KiB
  - First 512 bytes of chunks store critical data, atomic
  - Remaining space to assist in debugging
Setup
Host1

1. oVirt Hosted engine setup
2. oVirt Hosted engine HA
3. VDSM + create SD
4. Start a VM
5. Install OS + oVirt, reboot
6. VM running the oVirt engine

Shared Storage (NFS)

Host N

1. oVirt Hosted engine setup
2. oVirt Hosted engine HA
3. VDSM

Setup flow
Setting up the first node

```
[root@cougar08 ~]# ovirt-hosted-engine-setup
[ INFO ] Stage: Initializing
    Continuing will configure this host for serving as hypervisor and create a VM where oVirt Engine will be installed afterwards.
    Are you sure you want to continue? (Yes, No)[Yes]: Yes

[ INFO ] Stage: Environment setup
    Configuration files: []
    Version: otopi-1.1.2 (otopi-1.1.2-1.el6ev)

[ INFO ] Stage: Environment packages setup

[ INFO ] Stage: Environment customization

    --- STORAGE CONFIGURATION ---

    During customization use CTRL-D to abort.
    Please specify the storage you would like to use (glusterfs, nfs)[nfs]:
    Please specify the full shared storage connection path to use (example: host:/path): orion.qa.example.com:/kaka/heim-ha

[ INFO ] Stage: Environment customization
    Installing on first host
    Please provide storage domain name [hosted_storage]:
    Local storage datacenter name [hosted_datacenter]:
```
Setting up the first node

```shell
[root@cougar08 ~]# ovirt-hosted-engine-setup

[ INFO ] Stage: Initializing

    Continuing will configure this host for serving as hypervisor and create a VM where oVirt Engine will be installed afterwards.

    Are you sure you want to continue? (Yes, NO)[Yes]: Yes

[ INFO ] Stage: Environment setup

    Configuration files: []
    Version: otopi-1.1.2 (otopi-1.1.2-1.el6ev)

[ INFO ] Stage: Environment packages setup

[ INFO ] Stage: Programs detection

[ INFO ] Stage: Environment setup

[ INFO ] Stage: Environment customization

--- STORAGE CONFIGURATION ---

During customization use CTRL-D to abort.
Please specify the storage you would like to use (glusterfs, nfs)[nfs]:

Local storage datacenter name [hosted_datacenter]:
```
Setting up the first node

----- SYSTEM CONFIGURATION -----

----- NETWORK CONFIGURATION -----

Please indicate a nic to set rhevm bridge on: [eth3, eth2, eth1, eth0] [eth3], eth2
iptables was detected on your computer, do you wish setup to configure it? (Yes, No) [Yes]: Yes
Please indicate a pingable gateway IP address: 10.35.150.254

----- VM CONFIGURATION -----

Please specify the device to boot the VM from (cdrom, disk, pxe) (cdrom): pxe
The following CPU types are supported by this host:
  - model_Opteron_G3: AMD Opteron G3
  - model_Opteron_G2: AMD Opteron G2
  - model_Opteron_G1: AMD Opteron G1
Please specify the CPU type to be used by the VM [model_Opteron_G3]:
Please specify the number of virtual CPUs for the VM [Defaults to minimum requirement: 2]:
Please specify the disk size of the VM in GB [Defaults to minimum requirement: 25]:
Please specify the memory size of the VM in MB [Defaults to minimum requirement: 4096]:
Please specify the console type you would like to use to connect to the VM (vnc, spice) [vnc]:

----- HOSTED ENGINE CONFIGURATION -----

Enter the name which will be used to identify this host inside the Administrator Portal [hosted_engine_1]:
Enter 'admin@internal' user password that will be used for accessing the Administrator Portal:
Confirm 'admin@internal' user password:
Please provide the FQDN for the engine you would like to use. This needs to match the FQDN that you will use for the engine installation within the VM: haim-ha.qa.

[WARNING]
Failed to resolve haim-ha.qa from 10.35.150.254. Using [INFO]
Stage: Setup validation
Setting up the first node

INFO] Stage: Package installation
INFO] Stage: Misc configuration
INFO] Configuring libvirtd
INFO] Configuring the management bridge
INFO] Generating VDSM certificates
INFO] Generating libvirt-spice certificates
INFO] Configuring VDSM
WARNING] VDSM configuration file not found: creating a new configuration file
INFO] Starting vdsmd
INFO] Waiting for VDSM hardware info
INFO] Waiting for VDSM hardware info
INFO] Creating Storage Domain
INFO] Creating Storage Pool
INFO] Connecting Storage Pool
INFO] Verifying sanlock lockspace initialization
INFO] Initializing sanlock lockspace
INFO] Initializing sanlock metadata
INFO] Creating VM Image
INFO] Disconnecting Storage Pool
INFO] Start monitoring domain

INFO] Creating VM
You can now connect to the VM with the following command:
/usr/bin/remote-viewer vnc://localhost:5900
Use temporary password "9944vfAX" to connect to vnc console.
Setting up the first node

Please install the OS on the VM.
When the installation is completed reboot or shutdown the VM: the system will wait until then
Has the OS installation been completed successfully?
Answering no will allow you to reboot from the previously selected boot media. (Yes, No)[Yes]: Yes

[ INFO ] Creating VM

You can now connect to the VM with the following command:
/usr/bin/remote-viewer vnc://localhost:5900
Use temporary password "9944vfAX" to connect to vnc console.

If you need to reboot the VM you will need to start it manually using the command:
hosted-engine --vm-start
You can then set a temporary password using the command:
hosted-engine --add-console-password=<password>
Please install the engine in the VM, hit enter when finished.

[ INFO ] Engine replied: DB Up!Welcome to Health Status!
[ INFO ] Waiting for the host to become operational in the engine. This may take several minutes...
[ INFO ] Still waiting for VDSM host to become operational...
[ INFO ] Still waiting for VDSM host to become operational...
[ INFO ] Still waiting for VDSM host to become operational...

[ INFO ] Enabling and starting HA services
Hosted Engine successfully set up

[ INFO ] Stage: Clean up
[ INFO ] Stage: Pre-termination
[ INFO ] Stage: Termination
Hosted engine is alive!

<table>
<thead>
<tr>
<th>Name</th>
<th>Hostname/IP</th>
<th>Cluster</th>
<th>Data Center</th>
<th>Status</th>
<th>Virtual Machines</th>
<th>Memory</th>
<th>CPU</th>
<th>Network</th>
<th>SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>hosted_engine_1</td>
<td>10.35.109.10</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>1</td>
<td>12%</td>
<td>16%</td>
<td>0%</td>
<td>Normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Host</th>
<th>IP Address</th>
<th>Cluster</th>
<th>Data Center</th>
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<th>CPU</th>
<th>Network</th>
<th>Display</th>
<th>Status</th>
<th>Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>HostedEngine</td>
<td>hosted_engine_1</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
<td>VNC</td>
<td>Up</td>
<td>3 h</td>
</tr>
</tbody>
</table>
Setting up the 2nd+ node

[root@thinkerbell ~]# hosted-engine --deploy --config-append=answers.conf
[ INFO ] Stage: Initializing
    Continuing will configure this host for serving as hypervisor and create a VM where oVirt Engine will be installed afterwards.
    Are you sure you want to continue? (Yes, No)[Yes]:
[ INFO ] Generating a temporary VNC password.
[ INFO ] Stage: Environment setup
    Configuration files: ['/root/answers.conf']
    Version: otopi-1.2.0_master (otopi-1.2.0-0.0.master.20131007.git6f8ac6d.fc19)
[ INFO ] Hardware supports virtualization
[ INFO ] Bridge ovirtmgmt already created
[ INFO ] Stage: Environment packages setup
[ INFO ] Stage: Programs detection
[ INFO ] Stage: Environment setup
[ INFO ] Stage: Environment customization

---= STORAGE CONFIGURATION ==---

During customization use CTRL-D to abort.
The specified storage location already contains a data domain. Is this an additional host setup (Yes, No)[Yes]?
[ INFO ] Installing on additional host
Please specify the Host ID [Must be integer, default: 2]:
Setting up the 2nd+ node

--- HOSTED ENGINE CONFIGURATION ---

Enter the name which will be used to identify this host inside the Administrator Portal [hosted_engine_2]:

Enter 'admin@internal' user password that will be used for accessing the Administrator Portal:

Confirm 'admin@internal' user password:

[ INFO ] Stage: Setup validation

....

[ INFO ] The VDSM Host is now operational
[ INFO ] Enabling and starting HA services

Hosted Engine successfully set up

[ INFO ] Stage: Clean up
[ INFO ] Stage: Pre-termination
[ INFO ] Stage: Termination
Hosted engine is alive, 2 nodes running

<table>
<thead>
<tr>
<th>Name</th>
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<th>Memory</th>
<th>CPU</th>
<th>Network</th>
<th>SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>hosted_engine_1</td>
<td>10.35.109.10</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>0</td>
<td>12%</td>
<td>16%</td>
<td>0%</td>
<td>Normal</td>
</tr>
<tr>
<td>hosted_engine_2</td>
<td>10.35.102.54</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>4</td>
<td>11%</td>
<td>6%</td>
<td>0%</td>
<td>SPM</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Network</th>
<th>Display</th>
<th>Status</th>
<th>Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>HostedEngine</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>2%</td>
<td>0%</td>
<td>VNC</td>
<td>Up</td>
<td>3 h</td>
</tr>
<tr>
<td>pool-1</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool-1-1</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-2</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-3</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-4</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-5</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool-2</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool-3</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool-4</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>6%</td>
<td>0%</td>
<td>SPICE</td>
<td>Up</td>
<td>10 min</td>
</tr>
<tr>
<td>pool-5</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>6%</td>
<td>0%</td>
<td>SPICE</td>
<td>Up</td>
<td>10 min</td>
</tr>
<tr>
<td>vm-1</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>4%</td>
<td>0%</td>
<td>SPICE</td>
<td>Up</td>
<td>2 h</td>
</tr>
</tbody>
</table>
HA simulation
Hosted engine simulation

- Initial state: VM up on host 2, both hosts healthy

--- Host 1 status ---

Hostname : hosted_engine_2
Host ID : 1
Engine status : **vm-up good-health-status**
Score : **2400**
Host timestamp : 1378510362
Extra metadata :
  timestamp=1378510362 (Sun Oct 20 19:32:42 2013)
  host-id=1
  score=2400
  engine-health=vm-up good-health-status
gateway=True

--- Host 2 status ---

Hostname : hosted_engine_3
Host ID : 2
Engine status : **vm-down**
Score : 2400
Host timestamp : 1378510365
Extra metadata :
  timestamp=1378510365 (Sun Oct 20 19:32:45 2013)
  host-id=2
  score=2400
  engine-health=vm-down
gateway=True
Now, let's block GW in hosted_engine_2....
## Hosted engine simulation

### Hosts Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Hostname/IP</th>
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<th>SPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>hosted_engine_1</td>
<td>10.35.100.10</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>0</td>
<td>12%</td>
<td>15%</td>
<td>0%</td>
<td>Normal</td>
</tr>
<tr>
<td>hosted_engine_2</td>
<td>10.35.102.54</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>2 (1, 1)</td>
<td>24%</td>
<td>14%</td>
<td>23%</td>
<td>SPM</td>
</tr>
<tr>
<td>hosted_engine_3</td>
<td>10.35.102.12</td>
<td>Default</td>
<td>Default</td>
<td>Up</td>
<td>1 (1)</td>
<td>12%</td>
<td>2%</td>
<td>23%</td>
<td>Normal</td>
</tr>
</tbody>
</table>

### Virtual Machines Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Host</th>
<th>IP Address</th>
<th>Cluster</th>
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<th>Memory</th>
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<th>Network</th>
<th>Display</th>
<th>Status</th>
<th>Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>HostedEngine</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>4%</td>
<td>0%</td>
<td>VNC</td>
<td>Migrating For 18 min</td>
<td></td>
</tr>
<tr>
<td>pool-1</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-1</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool1-2</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
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<tr>
<td>pool1-3</td>
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<td></td>
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<td>Default</td>
<td>0%</td>
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<td>0%</td>
<td>Down</td>
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<tr>
<td>pool1-4</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
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<td>0%</td>
<td>Down</td>
<td></td>
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</tr>
<tr>
<td>pool1-5</td>
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<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
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<td></td>
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<tr>
<td>pool-2</td>
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<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pool-3</td>
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<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
<td></td>
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</tr>
<tr>
<td>pool-4</td>
<td></td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
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<td></td>
</tr>
<tr>
<td>pool-5</td>
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<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vm-1</td>
<td>hosted_engine_2</td>
<td></td>
<td>Default</td>
<td>Default</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>SPICE</td>
<td>Up</td>
<td>25 min</td>
</tr>
</tbody>
</table>
Hosted engine simulation

- Node 1's gateway down; VM migrated to node 2

---== Host 1 status ==---

<table>
<thead>
<tr>
<th>Hostname</th>
<th>hosted_engine_2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host ID</td>
<td>1</td>
</tr>
<tr>
<td>Engine status</td>
<td>vm-down</td>
</tr>
<tr>
<td>Score</td>
<td>1400</td>
</tr>
<tr>
<td>Host timestamp</td>
<td>1378510422</td>
</tr>
<tr>
<td>Extra metadata</td>
<td></td>
</tr>
<tr>
<td>timestamp=1378510422</td>
<td>(Sun Oct 20 19:33:42 2013)</td>
</tr>
<tr>
<td>host-id=1</td>
<td></td>
</tr>
<tr>
<td>score=1400</td>
<td></td>
</tr>
<tr>
<td>engine-health=vm-down</td>
<td></td>
</tr>
<tr>
<td>gateway=False</td>
<td></td>
</tr>
</tbody>
</table>

---== Host 2 status ==---

<table>
<thead>
<tr>
<th>Hostname</th>
<th>hosted_engine_3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host ID</td>
<td>2</td>
</tr>
<tr>
<td>Engine status</td>
<td>vm-up good-health-status</td>
</tr>
<tr>
<td>Score</td>
<td>2400</td>
</tr>
<tr>
<td>Host timestamp</td>
<td>1378510425</td>
</tr>
<tr>
<td>Extra metadata</td>
<td></td>
</tr>
<tr>
<td>timestamp=1378510425</td>
<td>(Sun Oct 20 19:33:45 2013)</td>
</tr>
<tr>
<td>host-id=2</td>
<td></td>
</tr>
<tr>
<td>score=2400</td>
<td></td>
</tr>
<tr>
<td>engine-health=vm-up</td>
<td></td>
</tr>
<tr>
<td>gateway=True</td>
<td></td>
</tr>
</tbody>
</table>
Back to the fundamental question...

Why did the chicken cross the road?
It did not,

It was migrated by the HA services.
Questions?

Note: no chickens or eggs were hurt during the making this presentation
THANK YOU!

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http://www.ovirt.org/Category:SLA

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