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LHCb Vcycle

LHCb uses Vcycle to manage resources on the CERN and Yandex OpenStack sites. Currently lbvobox200 hosts the Vcycle agent. Vcycle is not part of DIRAC and so not currently managed through the DIRAC system administration framework.

Vcycle's configuration files are in `/etc/vcycle.d/` with one file per `space' where a space is an OpenStack project in this case. Vcycle's log files are in `/var/log/vcycle`. The rest of Vcycle's files are in `/var/lib/vcycle` which is in reality a symbolic link to `/opt/dirac/vcycle` for disk space reasons.

The three OpenStack spaces currently managed by lbvobox200 are `vcycle-cern.lhcb.cern`, `vcycle-yandex.lhcb.cern`, `vcycle-in2p3.lhcb.cern`. They have `lhcb.cern` domains because they are managed by LHCb at CERN, and then have the site name as part of the hostname. They do not need to be registered in DNS but can be used in places that expect a FQDN CE name. eg in the DIRAC configuration, and they could be put into GOCDB, APEL etc as CEs if we wanted.

Configuration

There is a file in `/etc/vcycle.d` for each of CERN and Yandex. `cern-prod.conf` and `yandex.conf`. Each file has a `[space ...]` section with general configuration options. This includes the username and password to contact the OpenStack API. The password is base64 encoded to prevent casual 'over the shoulder' disclosure of passwords and it can be encoded or decoded from the command line using the `base64` command (Vcycle strips off extra newlines if they are included in the encoding by mistake.)

Then there is a `[vacuum_pipe ...]` section which gives the URL of the LHCb vacuum pipe JSON file which describes how to create LHCb VMs. The pipe is at <https://lhcb-portal-dirac.cern.ch/pilot/lhcb.pipe> [↗](#) The same pipe is also used for the Vac sites, which run the same LHCb VMs. Yandex has some additional configuration options, due to the Squid caches we run there.

It is not necessary to restart Vcycle when the configuration changes: a new configuration is assembled and printed to the Vcycle log file at the start of each cycle - once every few minutes.

Machinetypes

Vcycle keeps a cached copy of the pipe file in `/var/lib/vcycle/spaces/vcycle-cern.lhcb.cern/machinetypes/lhcb/vacuum.pipe` and processes options from it as if they were included in configuration files in `/etc/vcycle.d` (some of the options are disallowed for security reasons.) The resulting configuration is included in the overall configuration written to the Vcycle log file. The options can be compared with the `vcycle.conf` man page to see their implications. The pipe file defines several machinetypes, each of which gets its own section in the configuration Vcycle works from. `lhcb-vm-prod` is the one used to run DIRAC jobs.

The configuration refers to an X.509 host certificate and key, which are given to the VMs to allow them to authenticate to DIRAC. These files are stored in `/var/lib/vcycle/certs`

Yandex has `lhcb-vm-prod` VMs and also `lhcb-squid` VMs which provide the squid caching proxies used by `CernVM -FS` inside the prod VMs. Unlike the prod VMs, the squid VMs use static CentOS 6 images. Vcycle maintains a list of active squid VMs (based on whether they are sending heartbeats) and gives this list to the prod VMs when they are created as their list of squid URLs for `CernVM -FS` to use.

Machines

When Vcycle decides to create a VM, it first creates a directory to shadow it in `/var/lib/vcycle/shared/spaces/SPACE/current/MACHINE` where `SPACE` is the space name (eg `vcycle-cern.lhcb.cern`) and `MACHINE` is the hostname of the VM. Files are created and updated in the directory during the lifetime of the VM, until finally the VM is no longer visible in OpenStack and the directory is then moved to `/var/lib/vcycle/shared/spaces/SPACE/deleted/MACHINE` where it can be examined for debugging for two or three days. To find the machine directory corresponding to a DIRAC payload job, look for the hostname parameter in DIRAC and then for the directory with the same name in the current or deleted directory for that space. eg

```
/var/lib/vcycle/shared/spaces/vcycle-yandex.lhcb.cern/deleted/vcycle-lhcb-vm-prod-hxuq0o4qj8
```

In particular, the `joboutputs` subdirectory of the machine's directory receives heartbeat files every few minutes and eventually log files (include DIRAC pilot and jobagent log files) just before the VM shuts down.

httpd

There is an Apache web server running on `lbvobox200` which receives the `joboutputs` files and publishes the `machinefeatures` and `jobfeatures` directories specific to each machine. The host certificate and key for the web server are maintained automatically in the usual place: `/etc/pki/tls/` and there are symbolic links to them from `/etc/grid-security` where the web server configuration expects them. The Apache `httpd` log files are in `/var/log/httpd` as usual.

-- AndrewMcNab - 2019-06-18

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