INDIGO-Datacloud

WP4.1 - Update on Computing Virtualization

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Summarized (DoW) Roadmap

- **MS19 (Month 15)**: Support for container execution with trusted container repository and standard interfaces.
- **MS22 (Month 15)**: Implementation of spot-instances mechanisms
- **MS20 (Month 23)**: Execution of containers through batch systems.
- **MS21 (Month 30)**: Proof of concept for accessing hardware accelerators (GPUs) and low latency networks (IB) in containers.
- **MS23 (Month 30)**: Implementation of Advanced Scheduling Policies
- **MS24 (Month 30)**: Delivery of the orchestration engine with standard interfaces whenever possible (TOSCA)

Where are we?

- Month 8th.
- Detailed roadmap and current progress tracked in OpenProject:
  https://project.indigo-datacloud.eu/projects/wp4/timelines/16

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- Docker is the container technology chosen.
- Objective: Execute containers as light-weight virtual machines.
- Try to not introduce API changes, treat them as normal resources form the Cloud Management Framework (CMF) point of view.
- Try to offer **similar functionality** on both CMFs.
- Higher level features are outside WP: orchestration, application management done in other WPs.

- OpenStack initial considerations:
  - LXC support in-tree, officially supported.
  - OpenStack nova-docker [1] driver available out-tree.
  - OpenStack Magnum: new component for managing containers (Kubernetes).
    - ▶ Gaining a lot of momentum.
    - ▶ Overlaps with WP5 components.
    - ▶ We will follow up the developments, but not focusing on them.

- OpenNebula initial considerations:
  - Driver available only for LXC.
  - No Docker driver.
  - Several approachs to dcker integration presented in ONE Conf. in Barcelona [2].
  - Megam project, similar to OpenStack Magnum.

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[1] https://github.com/openstack/nova-docker
[2] http://opennebula.org/docker-machine-and-opennebula/, slides: http://goo.gl/2kA9uv

Container Support in OpenStack

- Evaluation floating document https://goo.gl/SViKGj.
  - Evaluation of LXC driver, following up development.
  - Evaluation of nova-docker driver, following up development.
    - Some functionality missing: e.g. attach/detach volume.
  - Evaluation of Magnum project will start next month.
- Openstack + Docker testbeds deployed at LIP and INFN-PD, currently under testing
- No API changes introduced (nova-docker, LXC), Magnum implies an API change.

Summary ¹³

1. Docker as a hypervisor ⇒ NO

2. Distribute OpenNebula in Docker ⇒ NO

3. **Integrate with Docker-Machine ⇒ WIP**

4. **OneFlow + Docker ⇒ Medium-term Roadmap**

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Slide from OpenNebula Conference in
Barcelona, October 2015
http://goo.gl/2kA9uv

- ONE is focusing on Docker, but using a different approach (see slide on the left).
- No Docker hypervisor driver foreseen.
- **WP4.1 is developing it, filling one of the gaps in ONE development**.
- Initial implementaiton of **onedock** driver available https://github.com/indigo-dc/onedock.
- No API changes introduced.

Container support issues I

Docker-related issues

- Not possible to attach a volume (i.e. block device) in runtime.
- Do we need this? Not possible in Docker, therefore not possible in both ONE and OpenStack.
- Functionality is implemented, developers are doing bikeshedding: they do not agree on the CLI.
- If we need this we need to push for this functionality.
- OpenStack (nova-docker) and Docker related bugs:
  - https://bugs.launchpad.net/nova-docker/+bug/1321817
  - https://github.com/docker/docker/pull/8348
  - https://github.com/docker/docker/pull/8826
  - https://github.com/docker/docker/issues/8829

Container support issues II

Other related issues

- OpenStack nova only makes possible to run one driver in each compute node.
- Therefore, running nova-docker needs a dedicated compute node, excluding those nodes from running other VMs.
- Initial work on running two hypervisor drivers in OpenStack (e.g. KVM/Xen + nova-docker) in one host.
- If the functionality is required by several resource providers we should formalize this and submit it to OpenStack.

- Work depends on ONE and OpenStack Docker driver implementations.
- Activity will start next month.

OCCI container support

- Starting testing of OCCI + OpenStack + nova-docker.
- Small changes foreseen in current implementation.
- Available testbed by end of year (end of M9).

Outline

Fair-share scheduling

- Synergy being already tested and INFN-PD.
- Unfunded contribution expected from CENSNET student.
- Waiting for the instructions on how to proceed with is repo (OpenStack CI – INDIGO sync).
- Initial problems with the SLURM priority multi-factor algorithm.
  - Scheduling algorithm being re-adapted.
  - This work will take about 1 month.
- ONE integration with existing protorype not possible due to ONE architecture.
  - Requirements collected[3] and new design available[4].
  - Implementation phase started.

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[3] https://project.indigo-datacloud.eu/work_packages/685
[4] https://project.indigo-datacloud.eu/work_packages/610

Spot-instances support

- Blueprint submitted to OpenStack developers[5].
  - Feedback received, initial design slightly modified.
  - Deciding how to explose functionality.
    - ▶ Via API extension, introducing API changes.
    - ▶ Via flavors, no API changes.
    - ▶ Via tags, no API changes.
- Implementation has started regardless of BP status, taking into account OpenStack devs suggestions.
- Changes in the implementation foreseen, **not in the functionality**.
- Code will be published as a fork inside INDIGO namespace before end of November.
- Deciding how to explose the spot-instances functionality.
- Initial prototype being tested at CSIC testbed.

[5]https://review.openstack.org/#/c/104883/

Partition director

- Implementation started.
- Work stalled a bit, as Stefano had a car accident.

Outline

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- Two different approaches being tested.
  - epilog/prolog -based
  - nodocker/shipper being more promising.
- Docker with CUDA 7.5 and pyOpenCL.
- Testing together job sumission + GPGPUS together.
- Planning to use the CAFFEE CUDA neural network.
- Writing the procedure for running those applications.

Outline

TOSCA in OpenStack

- Orchestration is done trough OpenStack HEAT.
- TOSCA parser + TOSCA to HOT translator based support.
- The translator is a CLI tool supporting only HOT translation so far.
- Possible issues doing the translation at the API level.
- We had a meeting with IBM people (the team responsible of the TOSCA tools).
  - Planning to have regular meetings with them.
  - IBM people is developing a translation service, details are coming in the following weeks.

TOSCA in OpenNebula

- Work has been shifted 6 months back, already started, aligned with OpenStack task.
- Orchestration support is done trough the Infrastructure Manager (IM).
- TOSCA parser + TOSCA to RADL translator based support.
- RADL target language plugin will be developed as a plugin for the existing translator.
    - The same tool will be used for both translations.
- Implementation already started

TOSCA parser

- Parser is being extended to support INDIGO requirements.
- Initial work started by UPV.
- Fork already available at
  https://github.com/indigo-dc/tosca-parser.
- Need to check how INDIGO changes can be
  pushed/integrated to upstream parser.
  - General changes must be pushed upstream.
  - What about INDIGO-only related changes?
  - Need to check how we can extend the parser for those cases
    where integration is not possible.

General remarks

- Developers demand for clear procedures on how to comply with WP3 requirements.
- Code needs to be pushed in a controlled way into http://github.com/indigo-dc.
  - Specially if it is going to be pushed to upstream projects.
  - Ensure things merged are compliant with INDIGO QA (WP3.1).
- We will be releasing pilots from next month.
  - Communcation channels with WP3 for deployment on pilot testbeds.
  - Communication channels with WP4, WP5 for testing.

Next steps and ETAs

- M9: OpenStack + nova-docker + OCCI pilot.
- M9: ONE + onedock + OCCI pilot.
- Madrid 2nd architecture meeting
- M10: Spot instances pilot prototype.
- M10: Fair-share scheduling pilot prototype.
- M11: Automatic sync with INDIGO DockerHub at the site-level.
- Q1 2016: initial TOSCA orchestration service available.

Thanks

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