Machine Learning Workshop

슈퍼컴퓨팅 본부 대용량데이터허브실

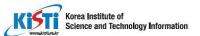
류 건 모 2017년 09월 07일





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About GPU machine

Server Spec

- ✓ Server Product : Dell R730 (2U)
- ✓ CPU : 2x Xeon 2.6GHz 14Core
- ✓ RAM : 384GB

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- ✓ GPU : NVIDIA P100
 - Double-Precision : 4.7TFLOPS
 - Single-Precision : 9.3TFLOPS
- ✓ Provisioning and Available Date : End of Oct.



System information

Plan of System Setup

- ✓ OS : CentOS7 but changeable. ex) Ubuntu
- ✓ Software
 - CVMFS
 - Singularity (or Docker)
 - CUDA Toolkit
 - Development Packages
- ✓ Singularity (or Docker) Images
 - tensorflow with GPU support
 - MXNet with GPU support
 - EL6 (or SLC6) image for legacy
- ✓ Mount point
 - /cms : CMS Tier3 home and scratch directories
 - /xrootd : CMS Tier3 XRootD Fuse mount point
 - + additional endpoint if a user requests,





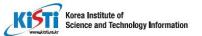
Singularity

Introduction

- Singularity is a container-based server virtualization tool like as the "Docker"
- "Singularity" don't need to additional daemon for super user privilege
 - Instead of the "Docker", a regular user can use "Singularity" to run the image and to interactive the shell with container environment
 - This is a good attribute for batch system
 - If you already know admin password, you can not escalate to admin in container
- *singularity* can use the "Docker" images
 directly Web Page : <u>http://singularity.lbl.gov/</u>







Pull the images from hub

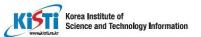
✓ singularity pull **docker://**ubuntu:latest

<-> Docker : docker pull ubuntu:latest

✓ To search image is not yet included (docker search)

– Please, search image on docker hub page

[geonmo@ui10 simages]\$ singularity pull docker://ubuntu:latest Initializing Singularity image subsystem Opening image file: ubuntu-latest.img Creating 225MiB image Binding image to loop Creating file system within image Image is done: ubuntu-latest.img Docker image path: index.docker.io/library/ubuntu:latest Cache folder set to /share/geonmo/.singularity/docker Importing: base Singularity environment Importing: /share/geonmo/.singularity/docker/sha256:d5c6f90da05dc7e77d2e5fef63c341ab05ba2a03396ab5ae8f18814a7bbf5265.tar.gz Importing: /share/geonmo/.singularity/docker/sha256:1300883d87d5ae0582a4e0f3f86ad93985b18676e8d829f6f3b4990403fdf145.tar.gz Importing: /share/geonmo/.singularity/docker/sha256:c220aa3cfc1bff0c1df733eac869a66476ea35136c69d881da1e297ed8d0af2f.tar.gz Importing: /share/geonmo/.singularity/docker/sha256:2e9398f099dcc5a3e5521205e1f55ee5d7665e203193cf48b32553eabcca323c.tar.gz Importing: /share/geonmo/.singularity/docker/sha256:dc27a084064fee108f4d486469939bbfa6a5b16f6d6d3c6b5b2475e938f4c71e.tar.gz Importing: /share/geonmo/.singularity/metadata/sha256:fe44851d529f465f9aa107b32351c8a0a722fc0619a2a7c22b058084fac068a4.tar.gz Done. Container is at: ubuntu-latest.img





- "shell" command : interactive task in container
 - singularity shell --home \$HOME:/home/\$USER --pwd /home/\$USER --bind /cvmfs --scratch /var/tmp --scratch /tmp --shell /bin/bash --pid ubuntu-latest.img (or directory)
 - Options
 - --home
 - » it is necessary that if your home dir is not under /home
 - --pwd
 - » Changing current dir after login to container
 - --bind
 - » Bind the directories to container. The directory must be existed in image
 - --ірс
 - » IPC Isolation (Pipe X)
 - --pid
 - » Process Isolation (/bin/bash's PID=>1)
 - --contain
 - » Disconnect /dev, \$HOME, /tmp dirs between host and container
 - --writable



» Read/Write mode to change container contents



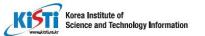
"shell" command

singularity shell –help : Display full help message for shell command

"—writeable" option is meaningless if you do not run the contain as root

geonmo@ui10 simages]\$ singularity shell --home \$HOME:/home/\$USER --pwd /home/\$USER --bind /cvmfs --scratch /var/tmp --scratch /tmp --shell /bin/bash --ip, c --pid -w ubuntu-latest.img WARNING: Skipping user bind, non existant bind point (directory) in container: '/cvmfs' Singularity: Invoking an interactive shell within container... geonmo@ui10:~\$ cat /etc/lsb-release DISTRIB ID=Ubuntu DISTRIB_RELEASE=16.04 DISTRIB_CODENAME=xenial DISTRIB DESCRIPTION="Ubuntu 16.04.3 LTS" geonmo@ui10:~\$ apt search gimp Sorting... Done Full Text Search... Done /xenial-updates 2:1.2498-1 amd64 Perl interface to the 2.x series of the Gimp Toolkit library geonmo@ui10:~\$ id uid=556800422(geonmo) gid=556800422(geonmo) groups=556800422(geonmo),55680000(admins),556800004(foreman_users),556800020(cms_admins),556800023(jira_users)),556800025(stash users),556800026(confluence users),556800038(hcp users),556800039(hcp admins),556800061(cms managers),556800062(cms users),556800065(hcp _managers),556800068(infra_managers) geonmo@ui10:~\$ ps PID TTY TIME CMD 1 pts/23 00:00:00 bash 10 pts/23 00:00:00 ps geonmo@ui10:~\$

geonmo@ui10:~\$ apt install libgtk2-perl
E: Could not open lock file /var/lib/dpkg/lock - open (13: Permission denied)
E: Unable to lock the administration directory (/var/lib/dpkg/), are you root?





Create images

✓ singularity create –s 3000 testimage.img

=> create about 3000MByte testimage.img which is blank.

Import container

✓ singularity import testimage.img docker://ubuntu:latest

=> Fill the contents from docker image

Expand images

- ✓ singularity expand -s 6000 testimage.img
- => Expand the image's size to 6000MB





Bootstrap (admin only)

- ✓ singularity bootstrap <dir path> <recipe file>
- ✓ egs) singularity bootstrap ubuntu-latest-test Singularity.txt
- ✓ "Docker" is better than "Singularity" during bootstrapping
- An Example of recipe file (Singularity.txt)

Bootstrap: docker From: ubuntu:latest **%runscript** ## only use "singularity run~~" exec echo "The runscript is the containers default runtime command!" ## copy files from host to container %files %environment VARIABLE=MEATBALLVALUE export VARIABLE %labels AUTHOR your@email.address %post ## Build command to your own container. Same as bash script. apt-get update && apt-get -y install python3 git wget mkdir /cvmfs echo "The post section is where you can install, and configure your container."



Final Tutorial

Simple tensorflow

- ✓ Login to ui10,
- ✓ run "s_tensorflow"
- 🗸 bash
- ✓ mkdir test_ml
- ✓ cd test_ml
- ✓ git clone <u>https://github.com/aymericdamien/TensorFlow-</u> <u>Examples.git</u>
- ✓ cd TensorFlow-Examples
- v python examples/3_NeuralNetworks/neural_network.py





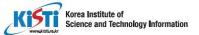
Conclusion

- GPU machine will be arrived on October
- "Singularity" is a very nice tool to setup the machine learning software
- "Singularity" can use the "Docker" images directly
- Don't use "singularity" to make your container at this time. Use "Docker".





감사합니다.





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