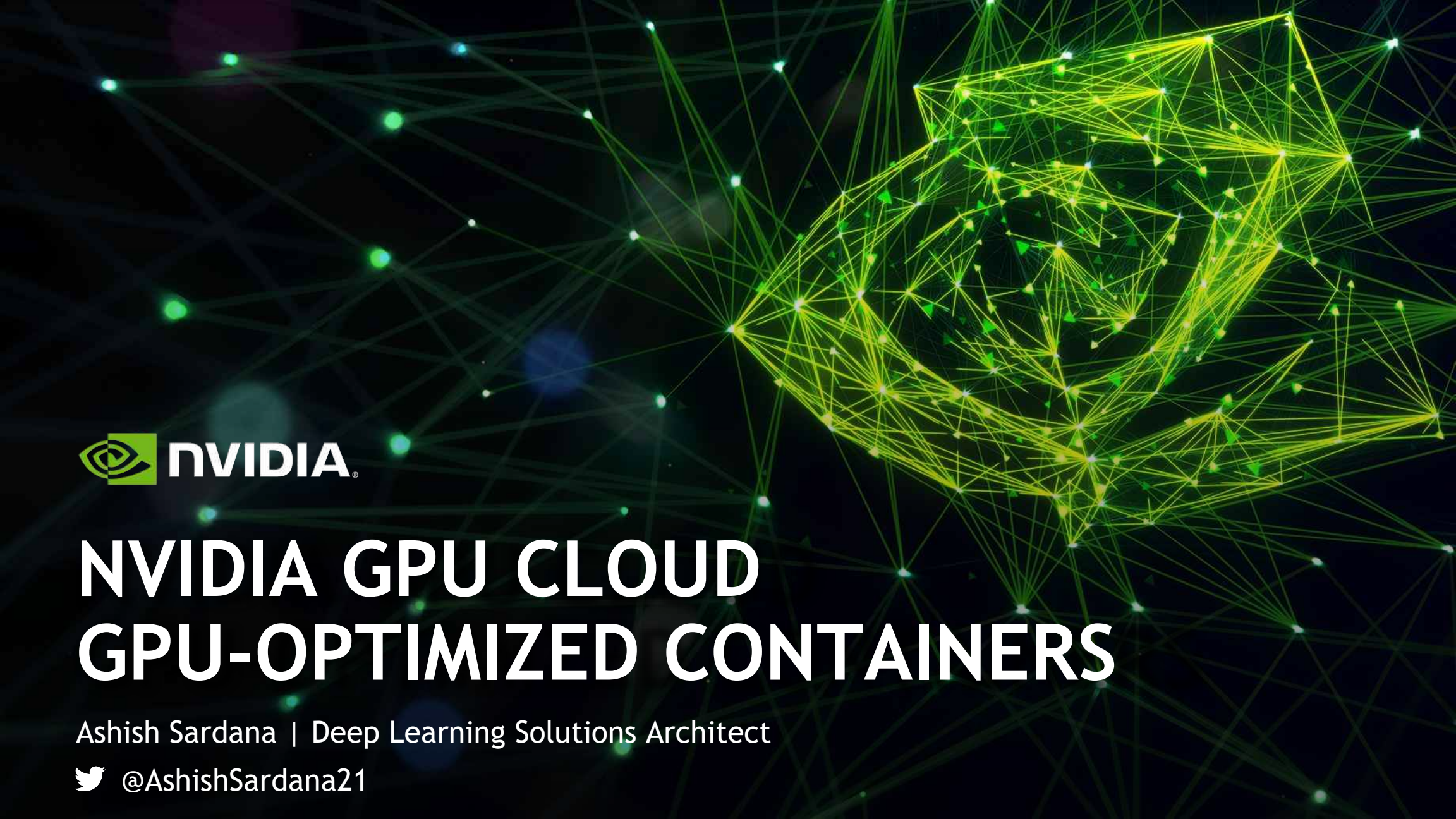


NVIDIA GPU CLOUD
GPU-OPTIMIZED CONTAINERS

Ashish Sardana | Deep Learning Solutions Architect

@AshishSardana21

PREREQUISITE & GOAL

- Familiar with GPU DL
- Some understanding of deep learning frameworks – TF and pyTorch mainly
- Have an understanding of common models like ResNet, AlexNet, VGG and Inception
- Can follow terminal exercises and commands

- When in doubt go to https://ngc.nvidia.com/

- Capture the value of GPU optimized containers
- Fast-track your GPU DL development using NGC
- Prevent you from becoming a system admin

HOW DO YOU SETUP YOUR ENVS TODAY?

python virtualenvs

```
$sudo apt-get install python-pip python-dev python-virtualenv

$virtualenv --system-site-packages tensorflow

$source ~/tensorflow/bin/activate  bash

$source ~/tensorflow/bin/activate.csh

(tensorflow)$ pip install --upgrade tensorflow-gpu

(tensorflow)$ pip install myOtherLibsAndPkgs
```

HOW DO YOU SETUP YOUR ENVS TODAY?

The conda way to getting TF-gpu running

```
$conda create -n tensorflow python=3.5

$source activate tensorflow

$conda install pandas matplotlib jupyter notebook scipy scikit-learn nb_conda
nltk spyder

$conda install -c conda-forge tensorflow keras

$pip install gym

.

$manyMoreLibsAndPkgs
```

$conda list --envs

What gives?

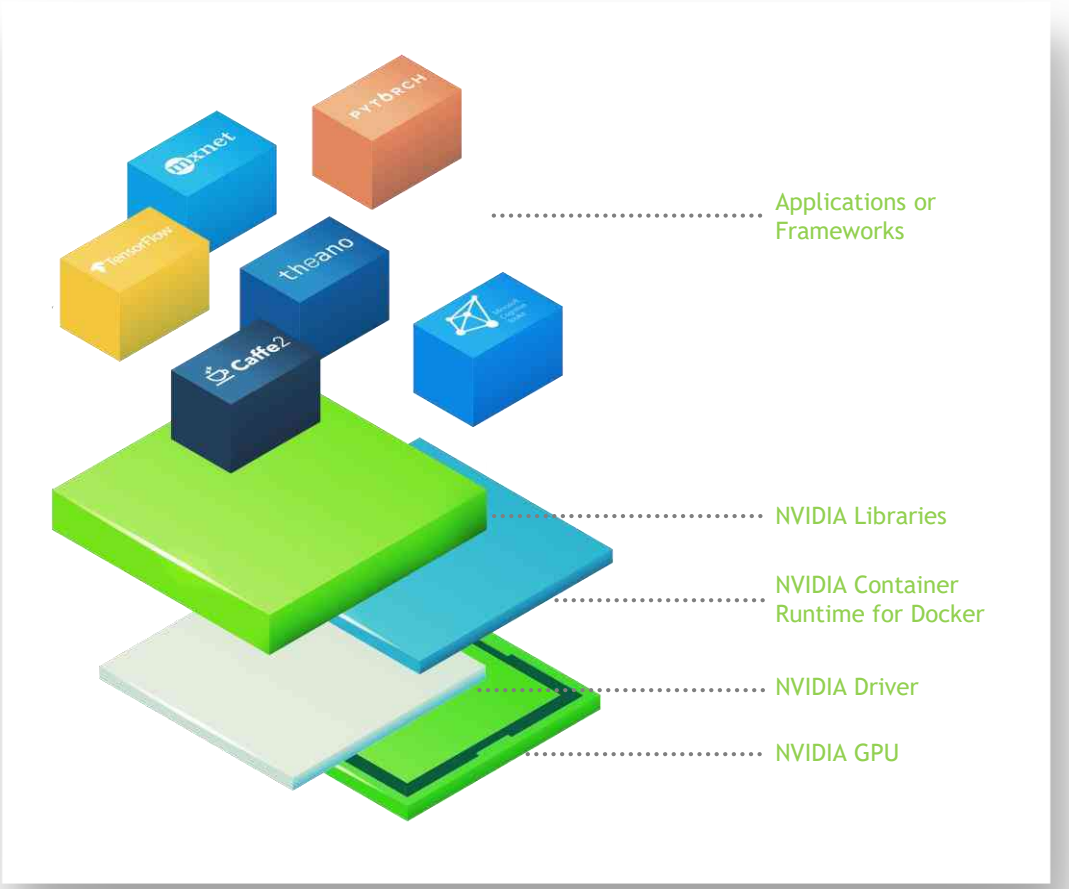
- Large collection of envs and highly fragmented by versions and features of frameworks
- Unable to cope with framework rel-cycles and newer pre-trained models/papers
- Exploding home directory and need to do have LDAP management
- The fear of `$sudo apt-get update`
- Data scientists becoming pro-bono FTE system admins!

CHALLENGES WITH COMPLEX SOFTWARE

Current DIY GPU-accelerated AI and HPC deployments are **complex** and **time consuming** to build, test and maintain

Development of software frameworks by the community is moving **very fast**

Requires high level of **expertise** to manage driver, library, framework dependencies



NVIDIA GPU CLOUD (NGC)

Simple Access to GPU-Accelerated Software

Discover 35 GPU-Accelerated Containers
Deep learning, HPC applications, HPC visualization tools, and partner applications

Innovate in Minutes, Not Weeks
Pre-configured, ready-to-run

Run Anywhere
The top cloud providers, NVIDIA DGX Systems, and PCs and workstations with NVIDIA Volta or Pascal™ architecture GPUs

GPU-ACCELERATED CONTAINERS

Innovation for Every Industry

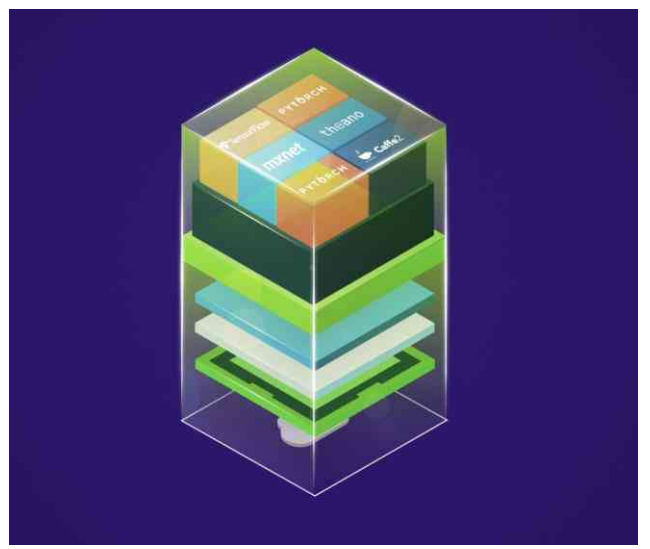
Quickly tap into the power of NVIDIA AI, from automotive, to healthcare, to fintech, and more

Say Goodbye to DIY

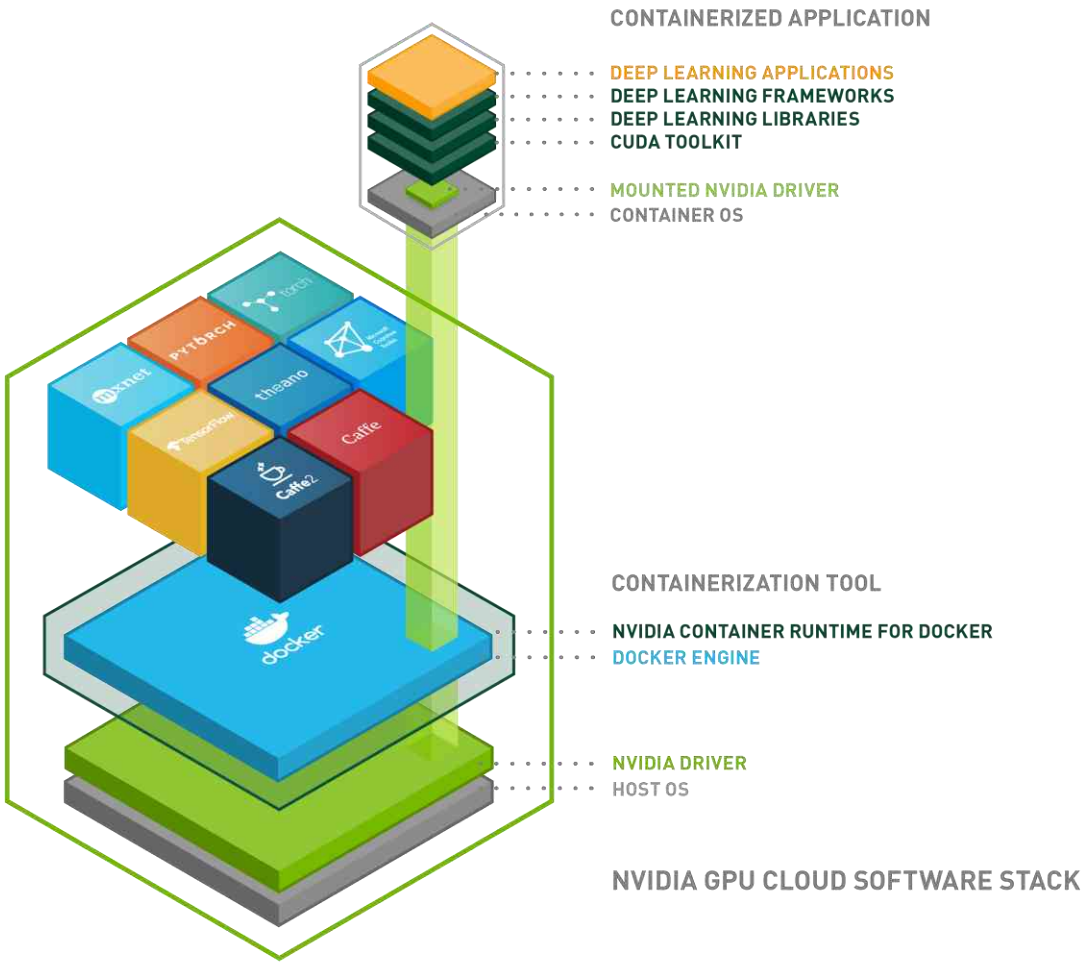
GPU-accelerated software is optimized and pre-configured in ready-to-run containers

Stay Up To Date

Monthly updates to supported deep learning containers



NVIDIA GPU Cloud integrates GPU-optimized software, runtimes, libraries, and OS into a ready-to-run container, available at no charge



WHY CONTAINERS?

Benefits of Containers:

Simplify deployment of GPU-accelerated software, eliminating time-consuming software integration work

Isolate individual deep learning frameworks and applications

Share, collaborate, and test applications across different environments

GPU-ACCELERATED CONTAINERS

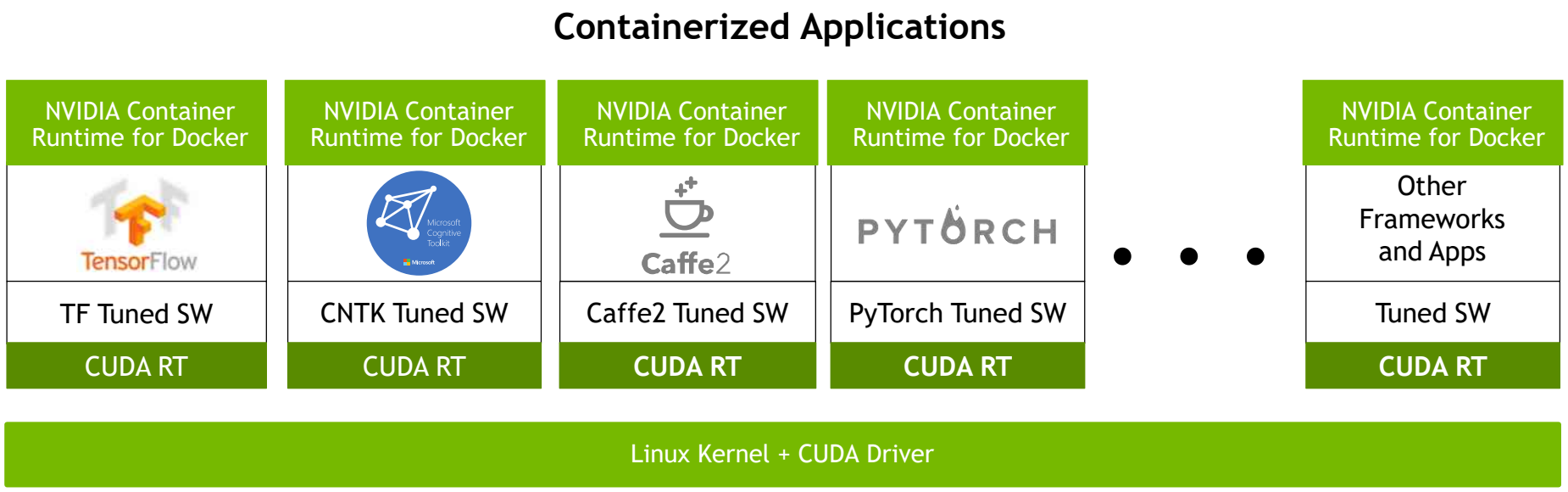
10 at Launch, 35 Today

Deep Learning	HPC	HPC Visualization	NVIDIA/K8s	Partners
caffe	bigdft	index	Kubernetes on NVIDIA GPUs	chainer
caffe2	candle	paraview-holodeck		h20ai-driverless
cntk	chroma	paraview-index		kinetica
cuda	gamess	paraview-optix		mapd
digits	gromacs			Paddlepaddle
inferenceserver	lammps			MATLAB
mxnet	lattice-microbes			
pytorch	milc			
tensorflow	namd			
tensorrt	pgi			
theano	picongpu			
torch	relion			
	vmd			

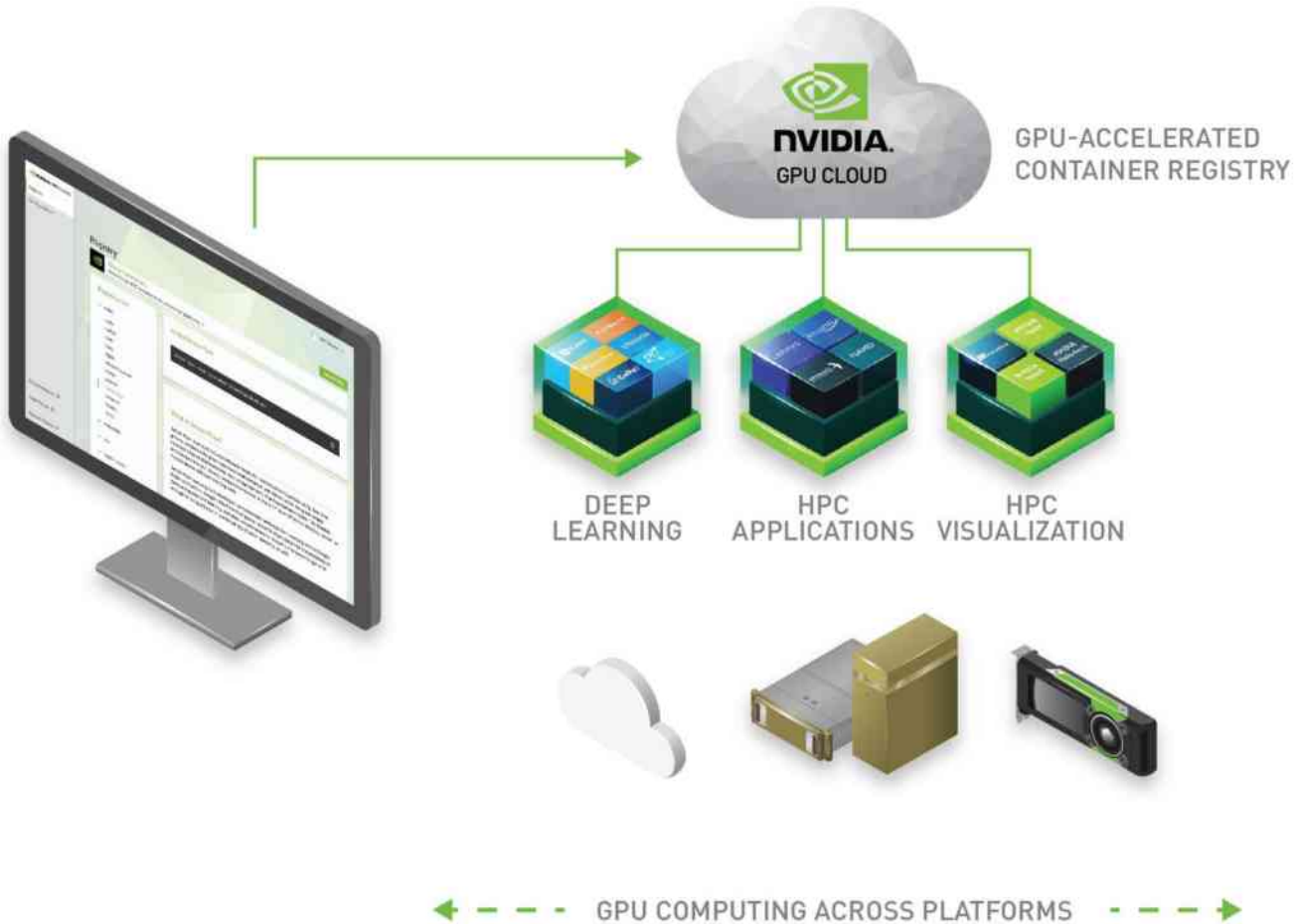
NVIDIA GPU CLOUD

ALWAYS OPTIMIZED AND UP-TO-DATE

NGC Deep Learning Containers are Tuned and Optimized Monthly to Deliver Maximum Performance on NVIDIA GPUs



A CONSISTENT, HYBRID CLOUD EXPERIENCE ACROSS COMPUTE PLATFORMS



NGC CONTAINERS ON NVIDIA GPUs IN THE CLOUD

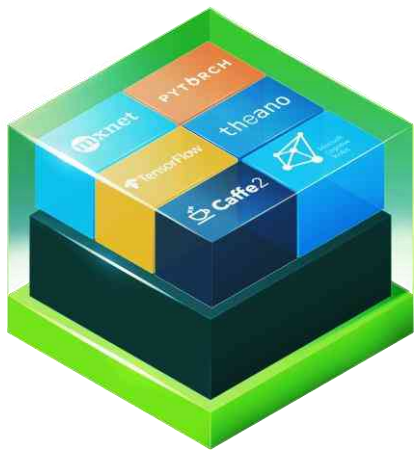
NGC Containers on the Top Cloud Service Providers

aws

Google Cloud

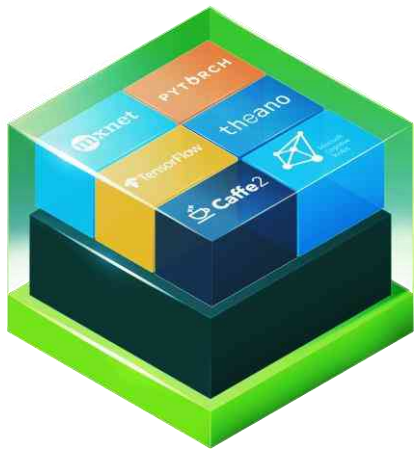
Azure

ORACLE
Cloud Infrastructure



WORK AT SCALE ON AI SUPERCOMPUTERS

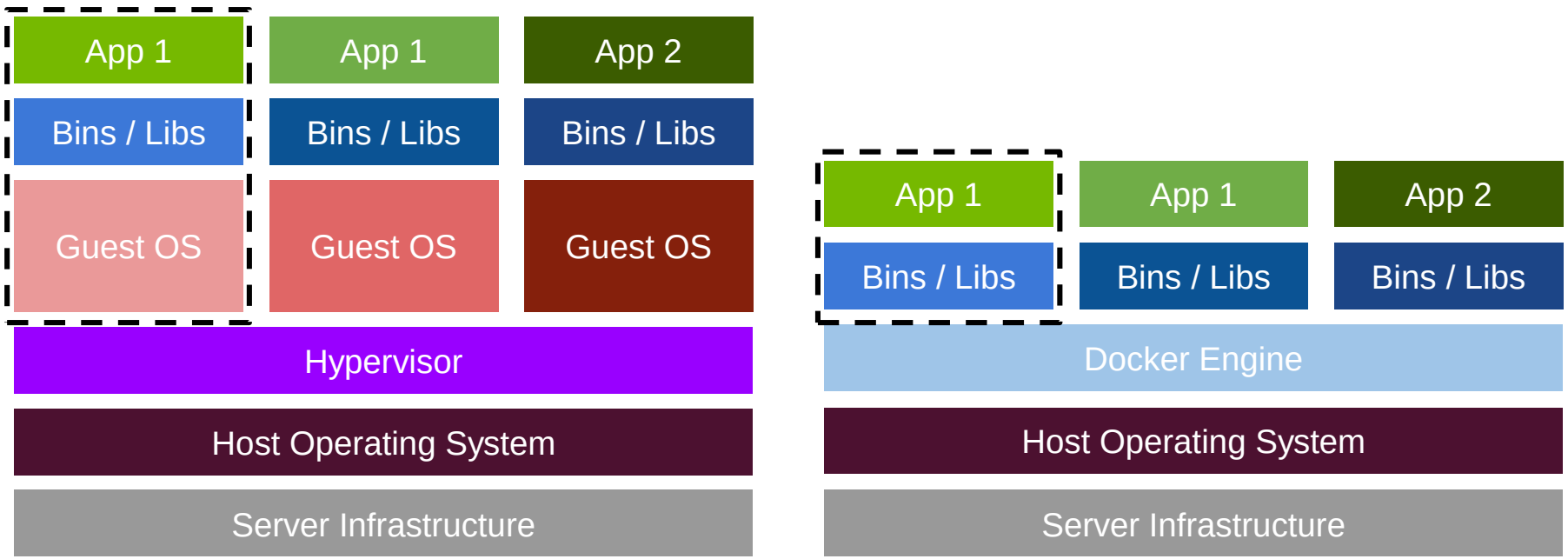
NGC Containers Run on NVIDIA DGX Systems



What is this container thing you speak of?

Virtual Machine vs. Container

Not so similar



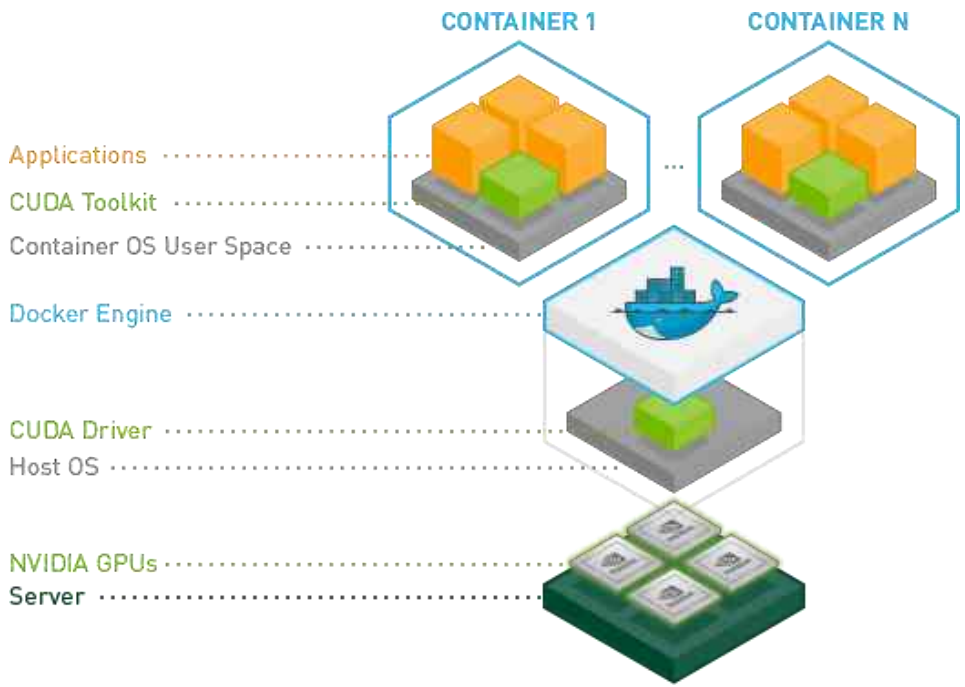
Virtual Machines

Containers

NVIDIA container runtime

https://github.com/NVIDIA/nvidia-docker

- Colloqually called “nvidia-docker”
- Docker containers are hardware-agnostic and platform-agnostic
- NVIDIA GPUs are specialized hardware that require the NVIDIA driver
- Docker does not natively support NVIDIA GPUs with containers
- NVIDIA Container Runtime makes the images agnostic of the NVIDIA driver



Docker Terms

Definitions

Image
Docker images are the basis of containers. An Image is an ordered collection of root filesystem changes and the corresponding execution parameters for use within a container runtime. An image typically contains a union of layered filesystems stacked on top of each other. An image does not have state and it never changes.

Container
A container is a runtime instance of a docker image.
A Docker container consists of

- A Docker image
- Execution environment
- A standard set of instructions

https://docs.docker.com/engine/reference/glossary/

Managing Images and Containers

Common Commands

List Images:

```
docker images
```

Remove an Image:

```
docker rmi imageID
```

```
docker rmi tensorRT
```

List Containers:

```
docker ps -a
```

Stop a running Container:

```
docker stop containerID
```

Remove a Container:

```
docker rm containerID
```

Note: imageID and containerID can be either a hash or a name

Running Containers

docker run and option

`docker run` Options

- ➔ `--runtime=nvidia` enable GPU capabilities
- ➔ `--rm` remove the container after it exits
- ➔ `-i -t` or `-it` interactive, and connect a "tty"
- ➔ `-d --detach` run in the background
- ➔ `--name` give the container a name
- ➔ `-p 8080:80` port map from host to container
- ➔ `-v ~/data:/data` map storage volume from host to container (bind mount) i.e. bind the `~data` directory in your home directory to `/data` in the container

Starts Tensorflow with ports, volumes, and console (All 1 line):

```
docker run
    --runtime=nvidia
    --rm -it
    --name MyCoolContainer
    -p 8888:80
    -v ~/data:/data
    nvcr.io/nvidia/tensorflow:18.01-py2
    examples/nvcnn.py
```

Terminal Time!

TERMINAL TIME

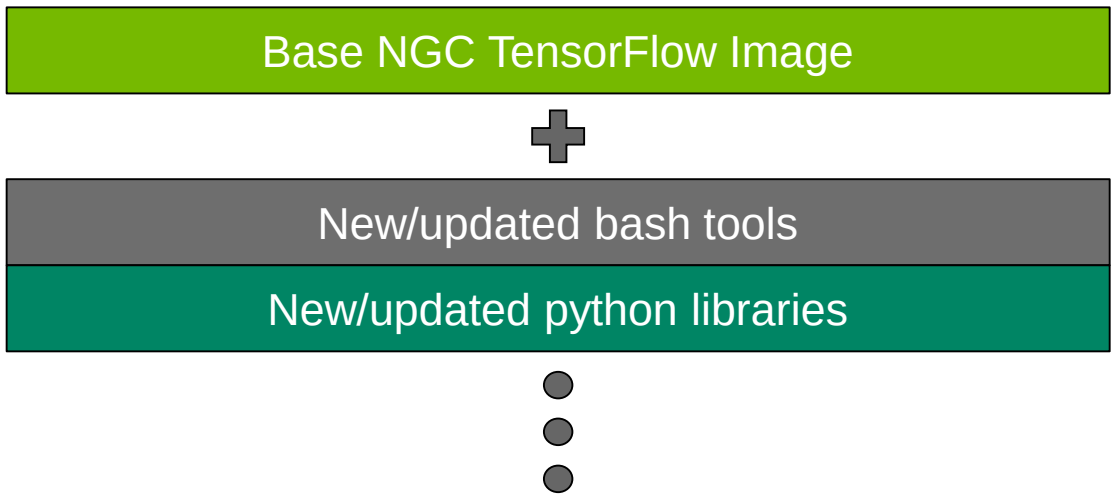
So this is the plan…

- Login in to NGC
- Understand the logistics of NGC Web UI
- Spin-up and instance on Cloud and On-prem (DGX)
- Go from spin-up to running models under 5 mins!
- Some interesting next steps

Extending NGC Images

Extending NGC Images

Layers layers layers



- Dockerfile allows for building custom images
  - `docker build` command creates new image from set of instructions

Extending NGC Images

A Dockerfile is a script that contains instructions to custom configure a container from a base image

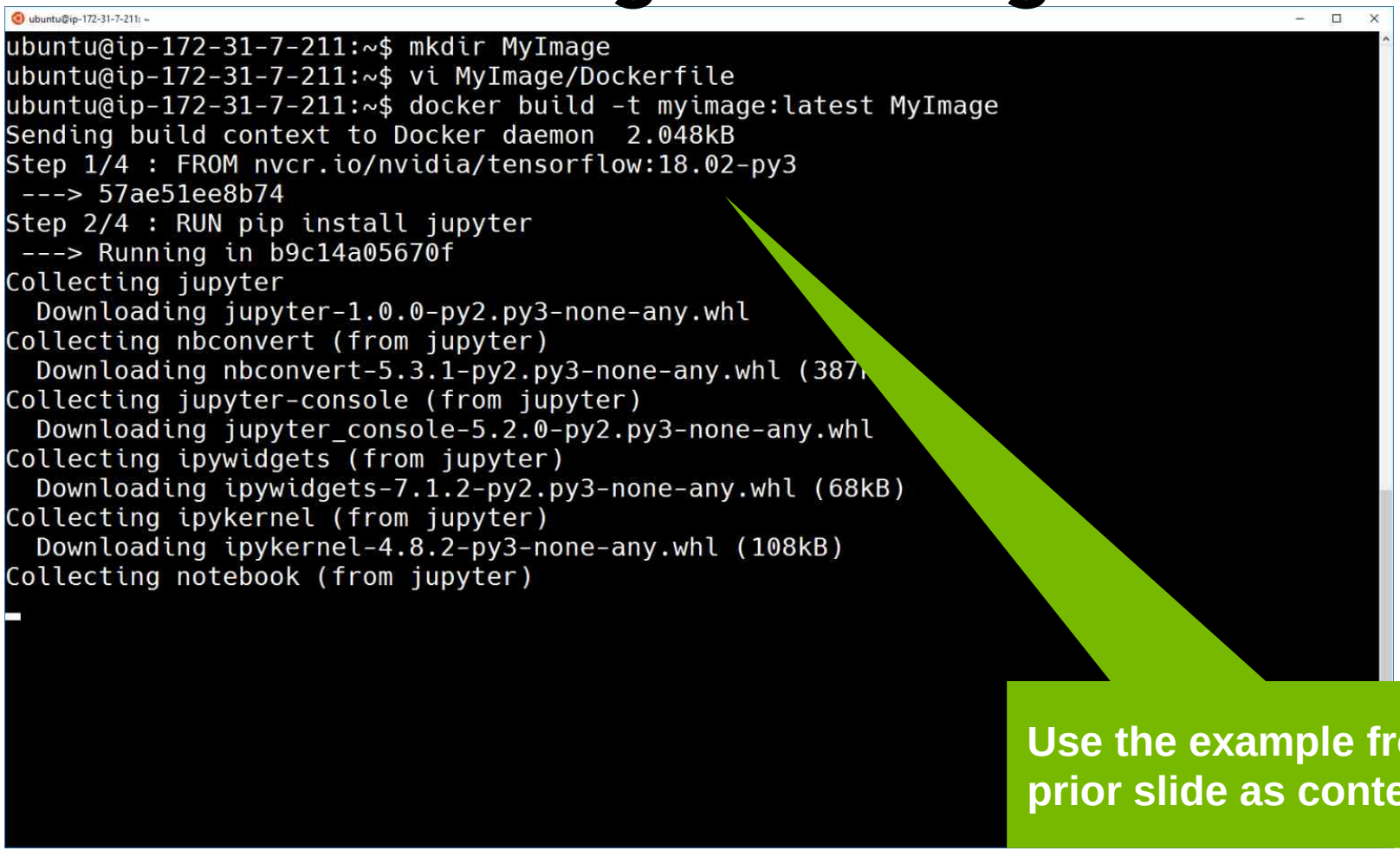
Here are some common commands:

- FROM is Mandatory as the first instruction. It denotes the base image to be built from. Use a tag to specify the image.
- RUN = Creates a new layer with the output of the specified commands.
- WORKDIR = Directory the command will start it
- CMD = Default command executed when Docker container is started. Use only one CMD instruction in a Dockerfile.

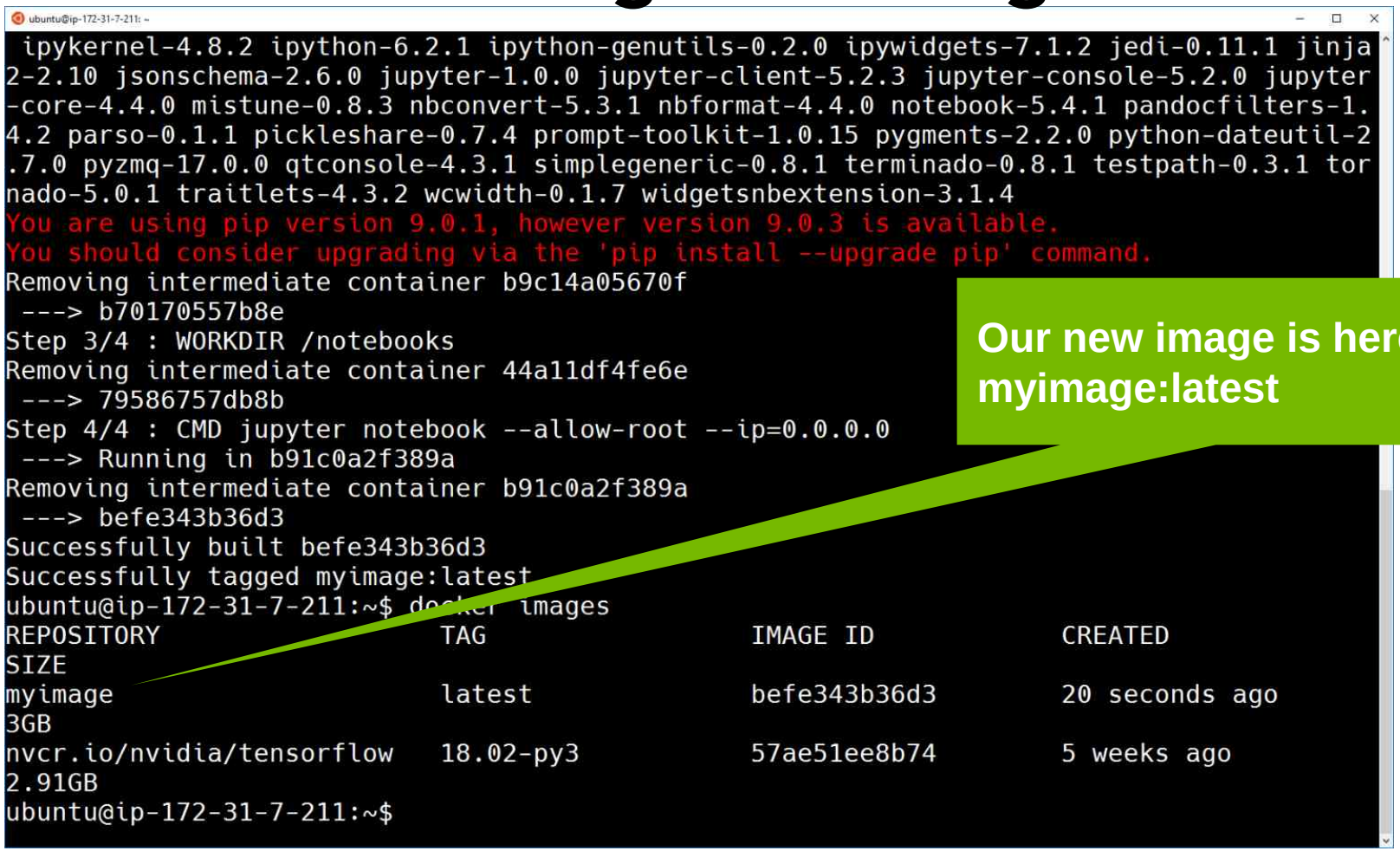
```
1  FROM nvcr.io/nvidia/tensorflow:18.02-py3
2
3  RUN pip install jupyter
4
5  WORKDIR /notebooks
6
7  CMD jupyter notebook --allow-root --ip=0.0.0.0
```

Best practices for writing Dockerfiles

Extending NGC Images



Extending NGC Images



Where do we go from here?

GET STARTED TODAY WITH NGC

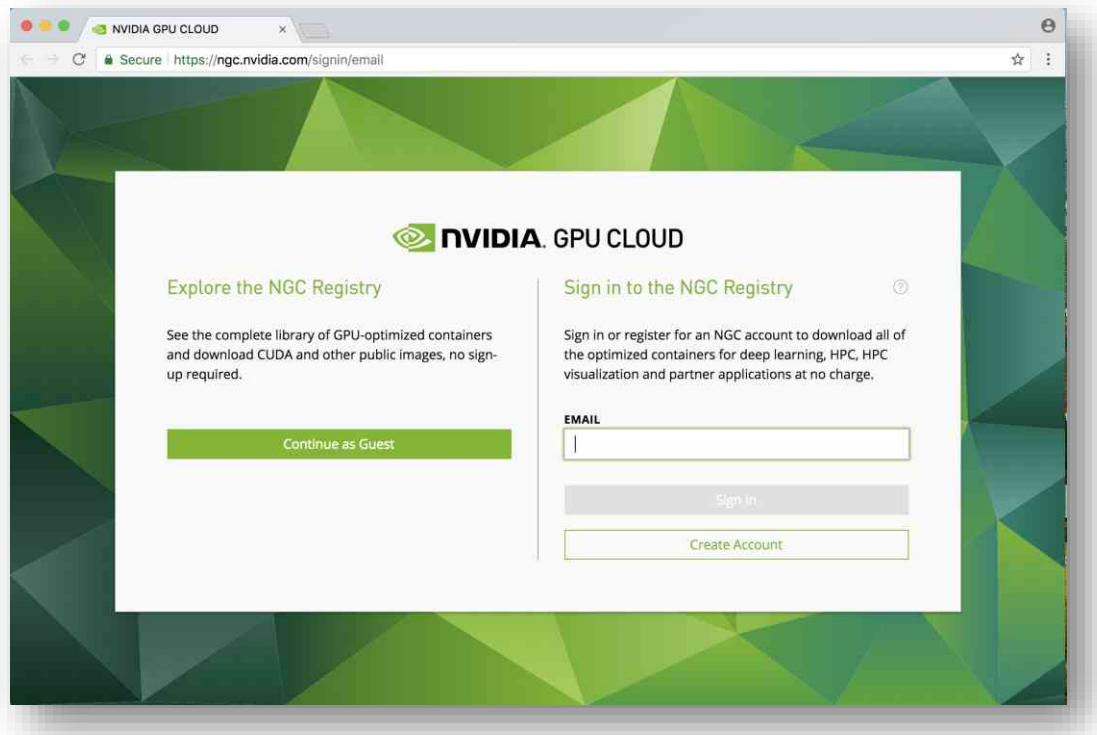
Sign Up and pull containers

To learn more about all of the GPU-accelerated software from NGC, visit:

nvidia.com/ngc

To sign up or explore NGC, visit:

ngc.nvidia.com




NVIDIA