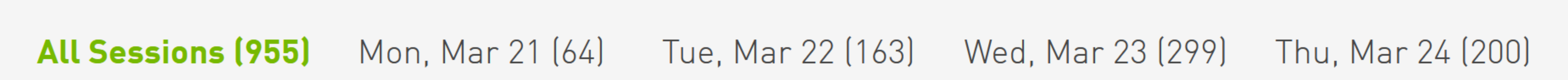
2022 GTC

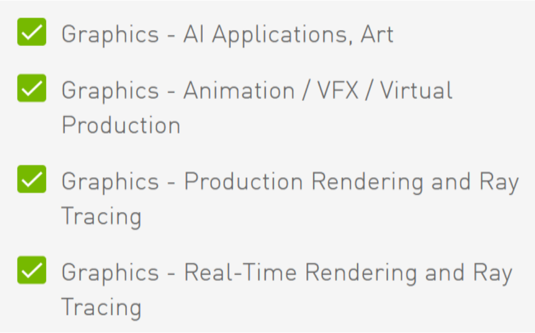
Session slides are all free to download from https://www.nvidia.com/gtc/session-catalog/

GTC 2022

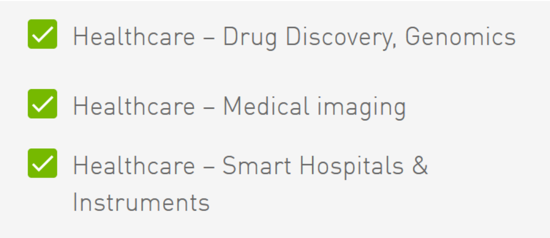


All Sessions (955) Mon, Mar 21 (64) Tue, Mar 22 (163) Wed, Mar 23 (299) Thu, Mar 24 (200)

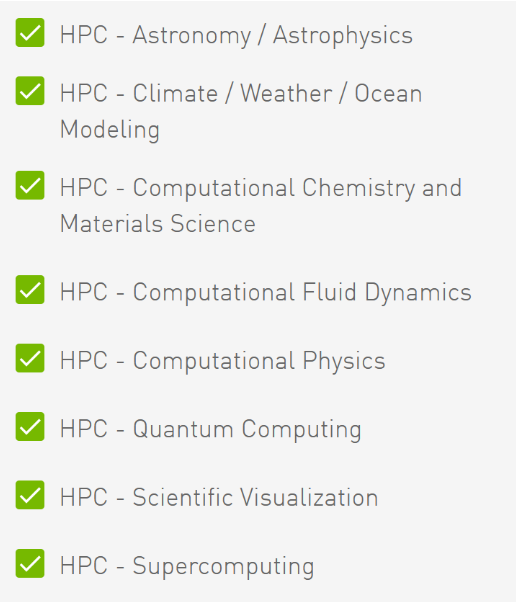
Category	session count
Accelerated computing & Dev Tools	78
Autonomous Machine (Robotics)	50
Autonomous Vehicles	38
Computer Vision	55
Conversation AI/NLP	47
Data Center	81
Graphics	48
Healthcare	69
HPC	84
IoT/5G/Edge	31



- ☑ Graphics - AI Applications, Art
- ☑ Graphics - Animation / VFX / Virtual Production
- ☑ Graphics - Production Rendering and Ray Tracing
- ☑ Graphics - Real-Time Rendering and Ray Tracing



- ☑ Healthcare – Drug Discovery, Genomics
- ☑ Healthcare – Medical imaging
- ☑ Healthcare – Smart Hospitals & Instruments

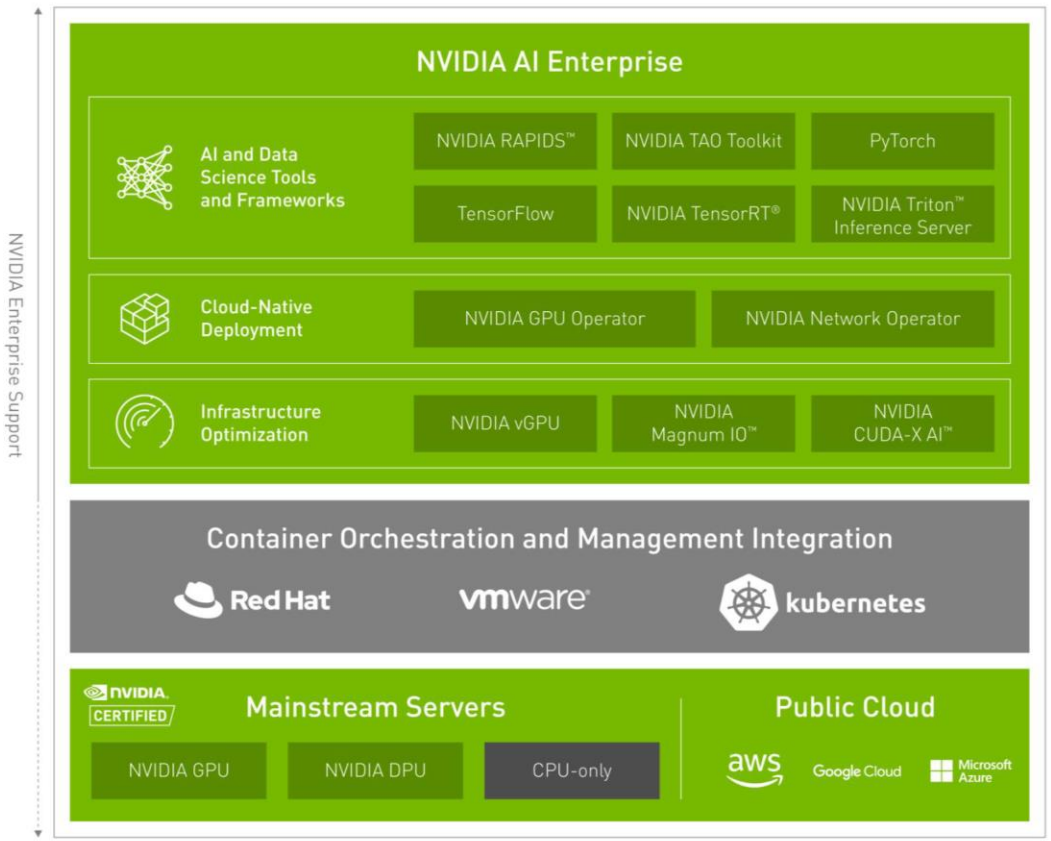


- ☑ HPC - Astronomy / Astrophysics
- ☑ HPC - Climate / Weather / Ocean Modeling
- ☑ HPC - Computational Chemistry and Materials Science
- ☑ HPC - Computational Fluid Dynamics
- ☑ HPC - Computational Physics
- ☑ HPC - Quantum Computing
- ☑ HPC - Scientific Visualization
- ☑ HPC - Supercomputing

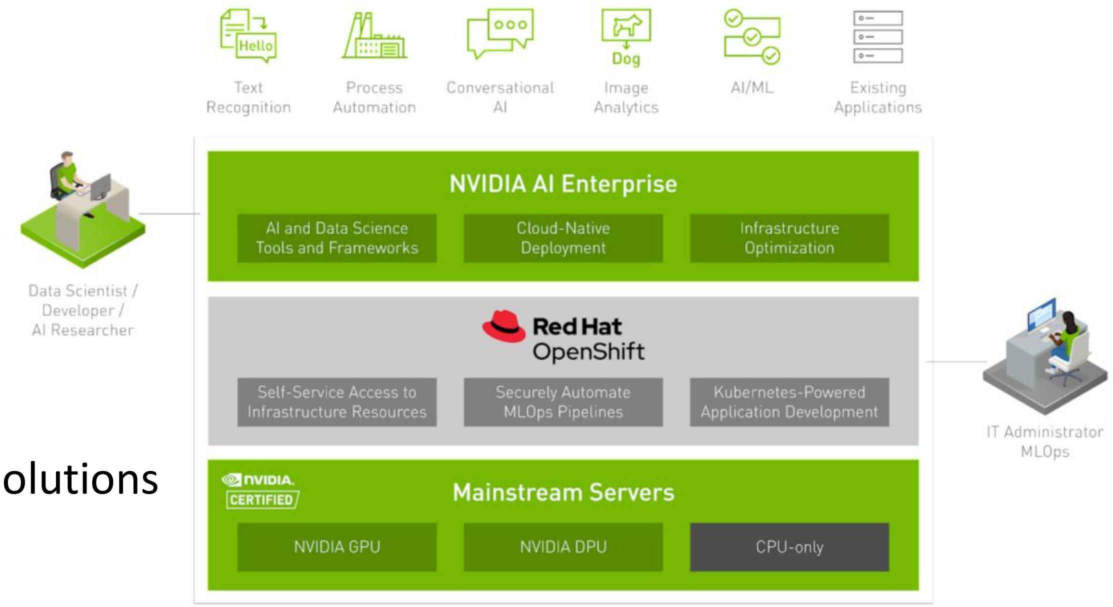
New Products (H/W + S/W)

- 1、**H100 GPU**：采用台积电 4N 工艺，拥有 800 亿个晶体管，实现了首个 GPU 机密计算，相比 A100，FP8 性能提升 6 倍，FP16、TF32、FP64 性能各提升 3 倍。
- 2、**全新 NVLink Switch 系统**：高度可扩展，支持 256 块 H100 GPU 互联。
- 3、**融合加速器 H100 CNX**：耦合 H100 GPU 与 ConnectX-7 和以太网智能网卡，可为 I / O 密集型应用提供更强劲的性能。
- 4、**DGX H100**：配备 8 块 H100 GPU，总计有 6400 亿个晶体管，在全新的 FP8 精度下 AI 性能比上一代高 6 倍，可提供 900GB / s 的带宽。
- 5、**DGX SuperPOD**：最多由 32 个 DGX H100 组成，AI 算力可达 1EFLOPS。
- 6、**Eos 超级计算机**：全球运行速度最快的 AI 超级计算机，配备 576 台 DGX H100 系统，FP8 算力达到 18EFLOPS，FP64 算力达到 275PFLOPS。
- 7、**Grace CPU 超级芯片**：由两个 CPU 芯片组成，采用最新 Armv9 架构，拥有 144 个 CPU 核心和 1TB / s 的内存带宽，将于 2023 年上半年供货。
- 8、**为定制芯片集成开放 NVLink**：采用先进封装技术，与英伟达芯片上的 PCIe Gen 5 相比，能源效率高 25 倍，面积效率高 90 倍。英伟达还将支持通用小芯片互连传输通道 UCIe 标准。
- 9、**CUDA-X**：60 多个针对 CUDA-X 的一系列库、工具和技术的更新。
- 10、**Riva 2.0**：对话式 AI 服务 Riva 全面发行，2.0 版本支持识别 7 种语言，可将神经文本转换为不同性别发声的语音。
- 11、**Merlin 1.0**：可帮助企业快速构建、部署和扩展先进的 AI 推荐系统。
- 12、**Sionna**：一款用于 6G 通信研究的 AI 框架。
- 13、**OVX 与 OVX SuperPod**：面向工业数字孪生的数据中心级服务器和超级集群。
- 14、**Spectrum-4**：全球首个 400Gbps 端到端网络平台，交换吞吐量比前几代产品高出 4 倍，达到 51.2Tbps。
- 15、**Omniverse Cloud**：支持协作者们随时随地实现远程实时协同工作。
- 16、**DRIVE Hyperion 9**：汽车参考设计，拥有 14 个摄像头、9 个雷达、3 个激光雷达和 20 个超声传感器，总体传感器数量是上一代的两倍。
- 17、**DRIVE Map**：多模态地图引擎，包含摄像头、激光雷达和雷达的数据，同时兼顾安全性。
- 18、**Clara Holoscan MGX**：可供医疗设备行业在边缘开发和部署实时 AI 应用的计算平台，AI 算力可达每秒 254~610 万亿次运算。
- 19、**Isaac for AMR**：提供自主移动机器人系统参考设计。
- 20、**Jetson AGX Orin 开发者套件**：在边缘实现服务器级的 AI 性能。

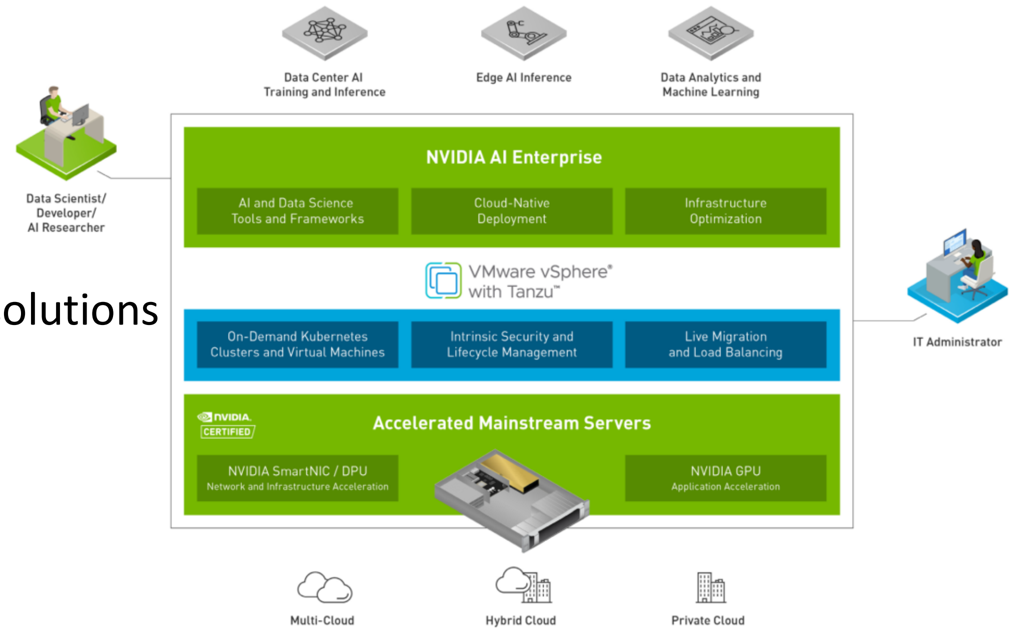
NVIDIA AI ENTERPRISE SOFTWARE SUITE



Redhat solutions



VMware solutions


Data Center AI Training and Inference
Edge AI Inference
Data Analytics and Machine Learning
Data Scientist/ Developer/ AI Researcher
NVIDIA AI Enterprise
AI and Data Science Tools and Frameworks
Cloud-Native Deployment
Infrastructure Optimization
VMware vSphere® with Tanzu™
On-Demand Kubernetes Clusters and Virtual Machines
Intrinsic Security and Lifecycle Management
Live Migration and Load Balancing
IT Administrator
NVIDIA CERTIFIED
Accelerated Mainstream Servers
NVIDIA SmartNIC / DPU
Network and Infrastructure Acceleration
NVIDIA GPU
Application Acceleration
Multi-Cloud
Hybrid Cloud
Private Cloud

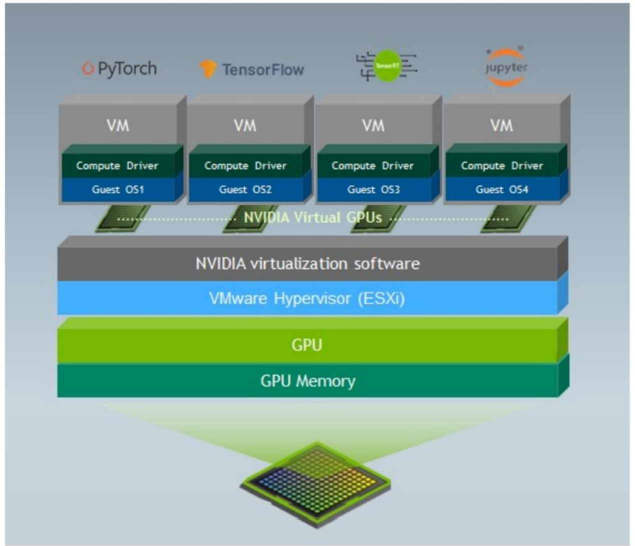
S41838: Tuning Virtualized GPUs for Optimal Performance on ML/AI Workloads

vGPU vs. MIG with vGPU with A100

vGPU

- Allow up to **10 VMs** with vGPU per GPU
- Memory is equally partitioned among vGPUs
- Compute is shared based on time slicing (Best Effort, Fixed Share, Equal Share)

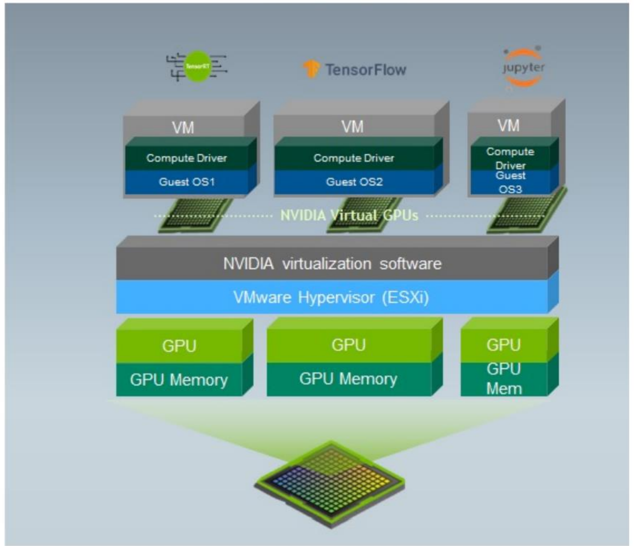
vGPU Only



MIG with vGPU

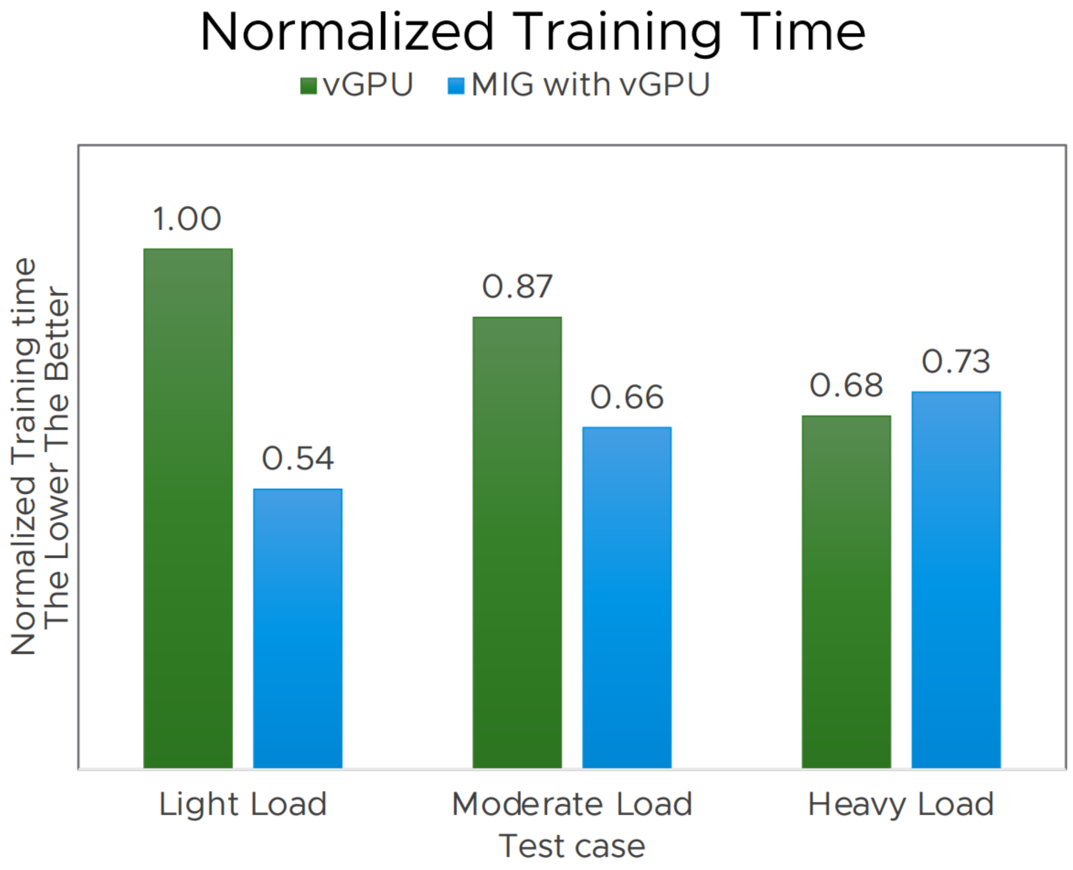
- Allow up to **7 VMs** per GPU
- Memory & compute are partitioned among vGPUs as below

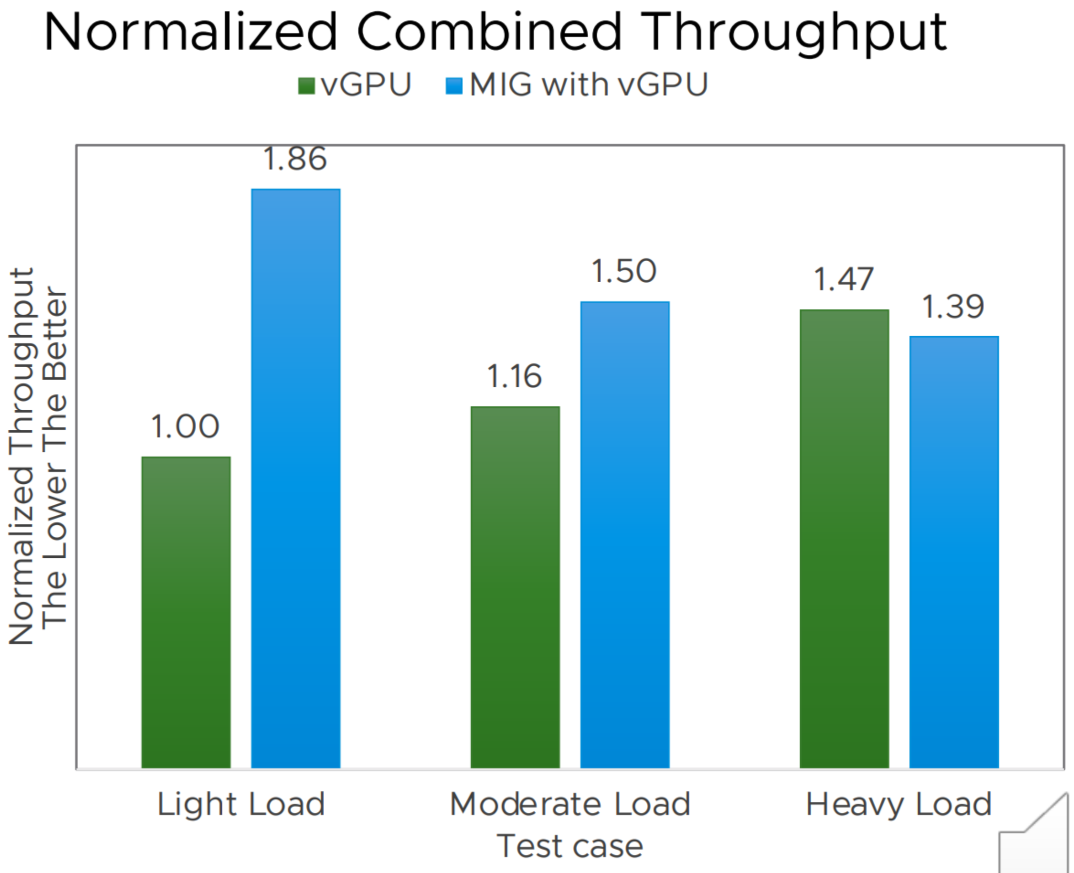
MIG-vGPU



vGPU vs. MIG with vGPU: Sizing ML Training Workload

- Light & moderate load → MIG better
- Heavy load → vGPU lightly better





vmware NVIDIA

Scale and Accelerate the Distributed Model Training in Kubernetes Cluster [S42498]

In order to orchestrate deep learning workloads that scale across multiple GPUs and nodes, Kubernetes offers a compelling solution. With Kubernetes and Kubeflow PyTorch, we can easily schedule and track a distributed training job on single-GPU multi-node, multi-GPU single-node, and multi-GPU multi-nodes in a shared GPU resource pool. To accelerate deep learning training at Zoom, we enable RDMA, RoCE to bypass the CPU kernel and offload the TCP/IP protocol. We apply this technology in Kubernetes with SRIOV by NVIDIA Network Operator in a heterogenous GPUs cluster with four GPU servers and eight GPU servers. By combining NVIDIA NCCL, Apex, and PyTorch PowerSGD, we can reach a near-linear performance increase as the GPU number and worker node increases.

Jack Jin, Lead Machine Learning Infra Engineer, Zoom Video

Kaixing Wu, Machine Learning Engineer, Zoom

☆ Nvidia Network Operator

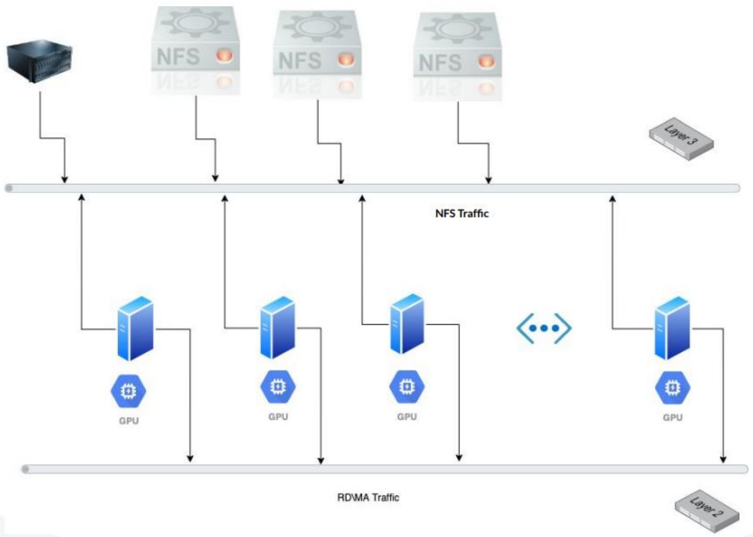
https://github.com/Mellanox/network-operator/tree/master/deployment/network-operator

- The **NVIDIA Network Operator** loads the required drivers, libraries, device plugins, and CNIs on any cluster node with an network interface.
  - sriovNetworkOperator.
  - Nfd
  - nvPeerDriver
  - secondaryNetwork
  - cniPlugins
  - Multus
  - ipamPlugin

- The NVIDIA Network Operator uses Kubernetes CRD and the Operator Framework to provision the host software needed for enabling accelerated networking.

Install with helm

Networking



RDMA capable NIC

Kubernetes SR-IOV

The **Single Root I/O Virtualization** (SR-IOV) can segment a compliant network device on the host node as a physical function (PF), into multiple virtual functions (VFs).

Allow to use RDMA-enabled VF as a normal network device.

- ➢ Network configuration daemon
- ➢ Network device plug-in
- ➢ CNI plug-in

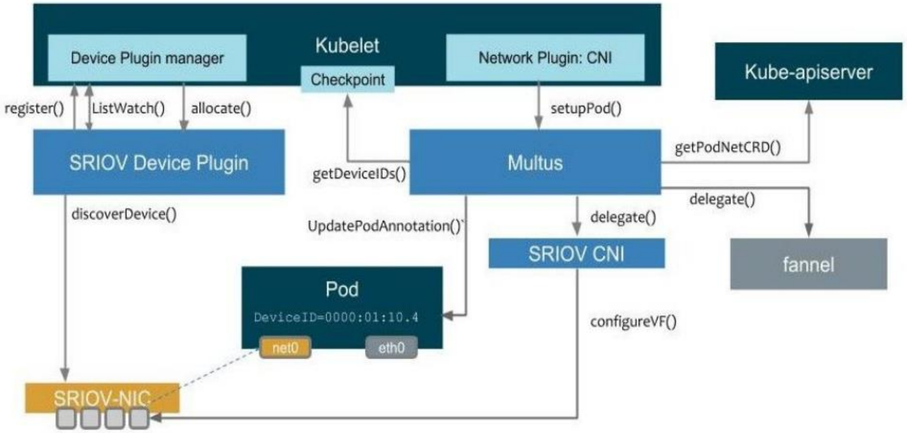
Configuration:

- SR-IOV network device.

Creating SR-IOV network node policy with node selector

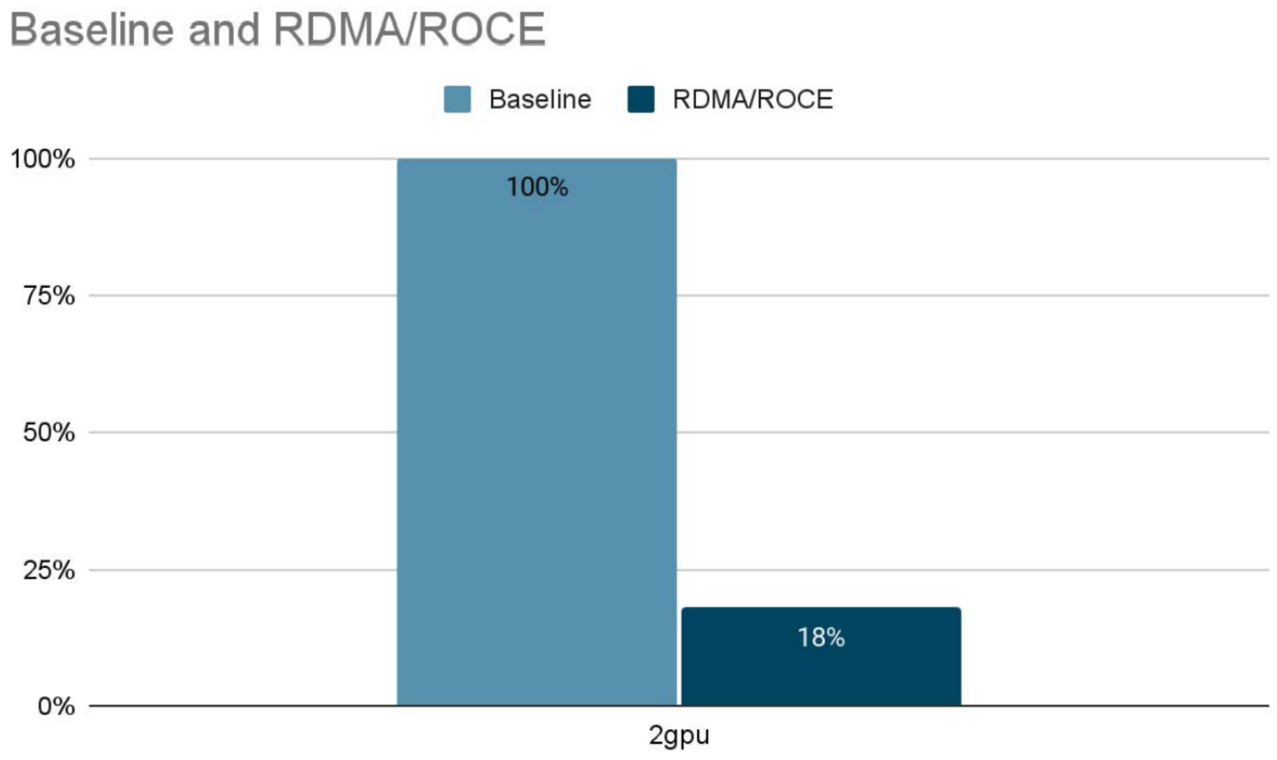
- SR-IOV Ethernet network attachment.

Creating ethernet network device by defining an SriovNetwork object.



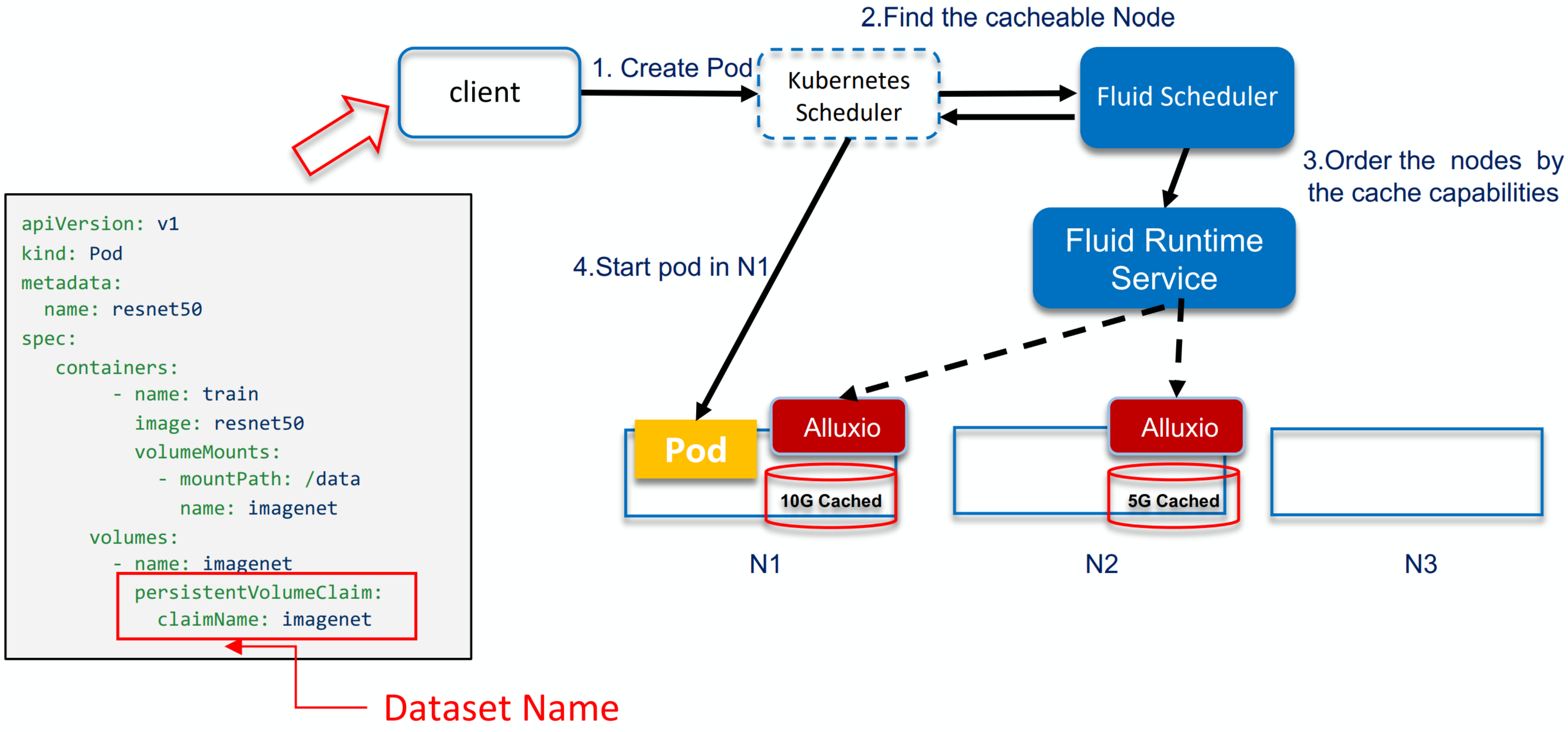
Scale and Accelerate the Distributed Model Training in Kubernetes Cluster [S42498]

Task 2: Hardware update to enable faster multi-node communication. With RDMA/ROCE enabled, the multi-node 2gpu training is around 5x faster.



Fluid: build data orchestration in K8s, kubecon 2021

- https://www.youtube.com/watch?v=Pjt8v4GYvRQ



```
apiVersion: v1
kind: Pod
metadata:
  name: resnet50
spec:
   containers:
        - name: train
          image: resnet50
          volumeMounts:
            - mountPath: /data
              name: imagenet
      volumes:
        - name: imagenet
          persistentVolumeClaim:
            claimName: imagenet
```