Enable GPU Virtualization in OpenStack

About Us

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Agenda

- Motivation
- Intel GPU Virtualization Overview
- OpenStack vGPU enhancement
- Future Work

Motivation

Automatic Driving

Video Streaming

Cloud Gaming

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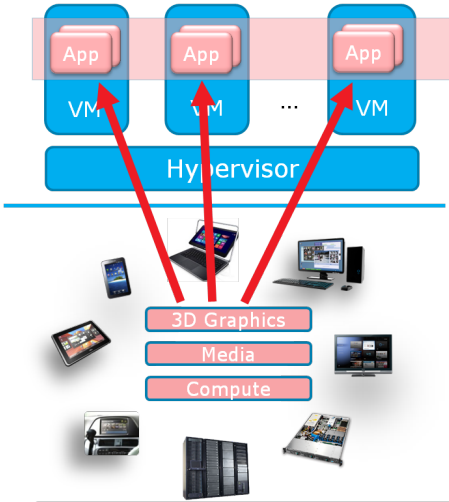
Motivation



GPU Accelerated Tasks

- Computer Aided Design
- Video Playback
- Media Transcoding
- Web Experience
- Office Productivity
- User Interface
- Games
- Weather broadcast
- ...

GPU virtualization becomes a fundamental requirement

Performance → Direct GPU acceleration

Capability → Consistent visual experience

Sharing → Multiple Virtual Machines

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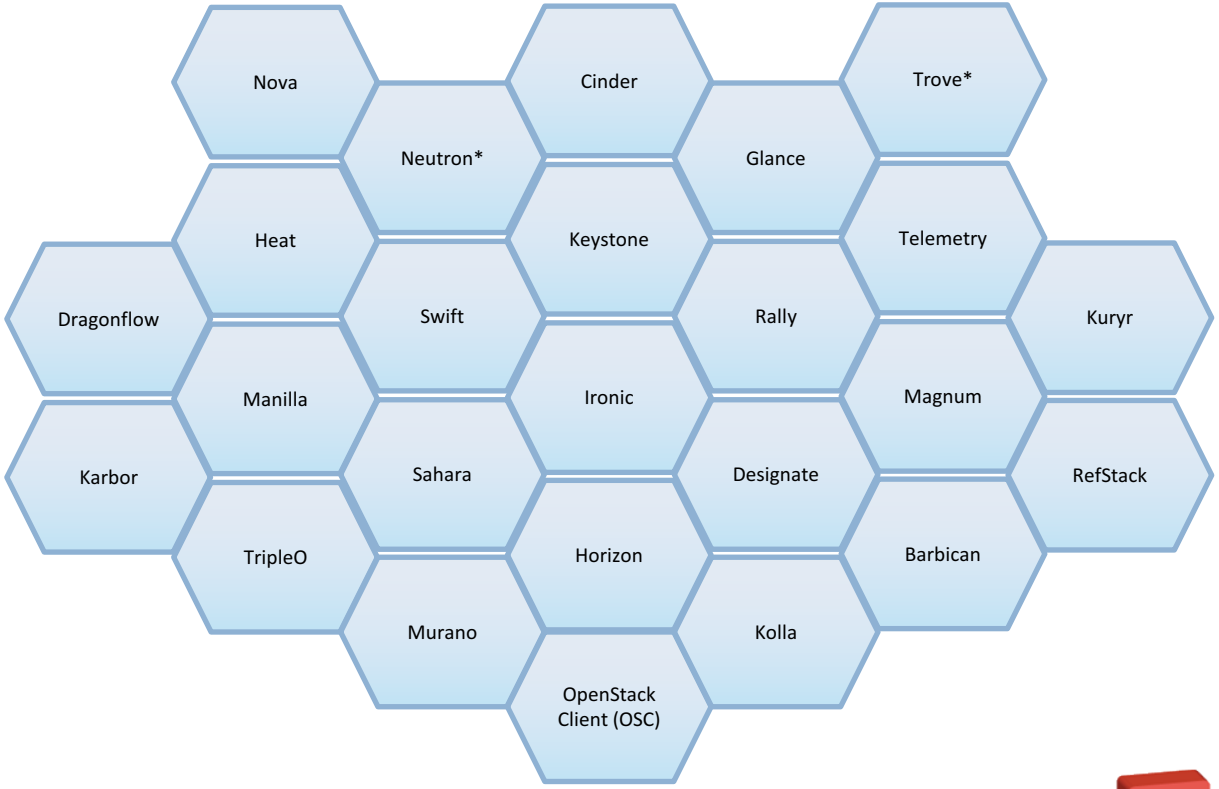
Motivation



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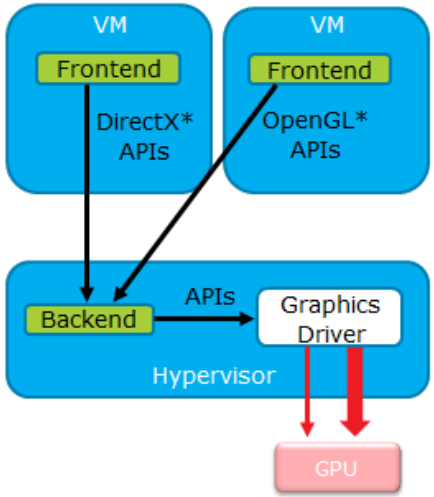
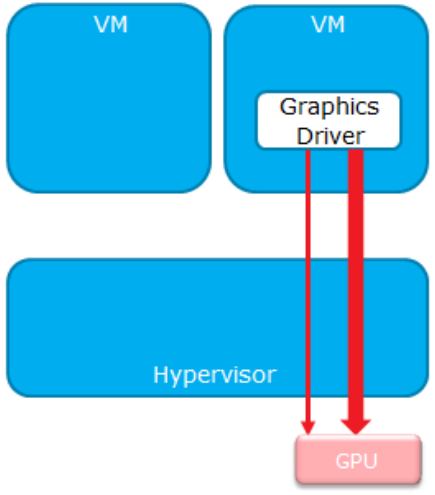
Intel GPU Virtualization Overview

Intel® GVT-s API Forwarding



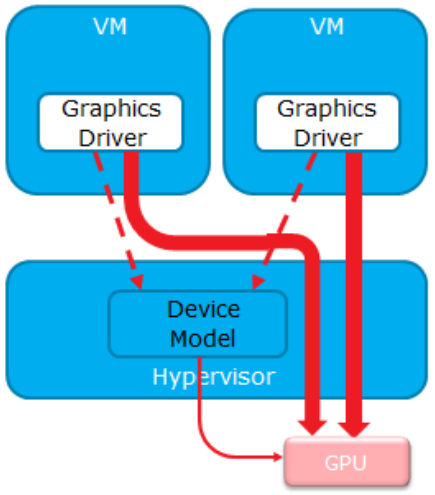
Performance Feature Sharing

Intel® GVT-d Direct Pass-Through



Performance Feature Sharing

Intel® GVT-g Full GPU Virtualization



Performance Feature Sharing

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Benefits of Intel GVT-g Technology

Performance

3D >80%
2D > 70%
Media Decode > 90%
Media Encode > 80%

Features

Running Native Driver
DirectX* 11.1
OpenGL* 4.2
OpenCL* 1.2
MediaSDK 16.2
DirectX* 12

Sharing

Multiple VMs up to 15
Guest OS:

- Ubuntu*
- Windows* 7 x32/x64
- Windows* 8 x32/x64
- Windows* 10 x64

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Implementations of Intel® GVT-g Technology

- Intel® server platform support
  - From Xeon E5v4 platform
- In Linux kernel and hypervisors
  - Intel® GVT-g for Xen – XenGT
  - Intel® GVT-g for KVM – KVMGT

New Cloud Friendly Features

- Live Migration support for virtual GPU devices.
- QoS support in cloud environments.

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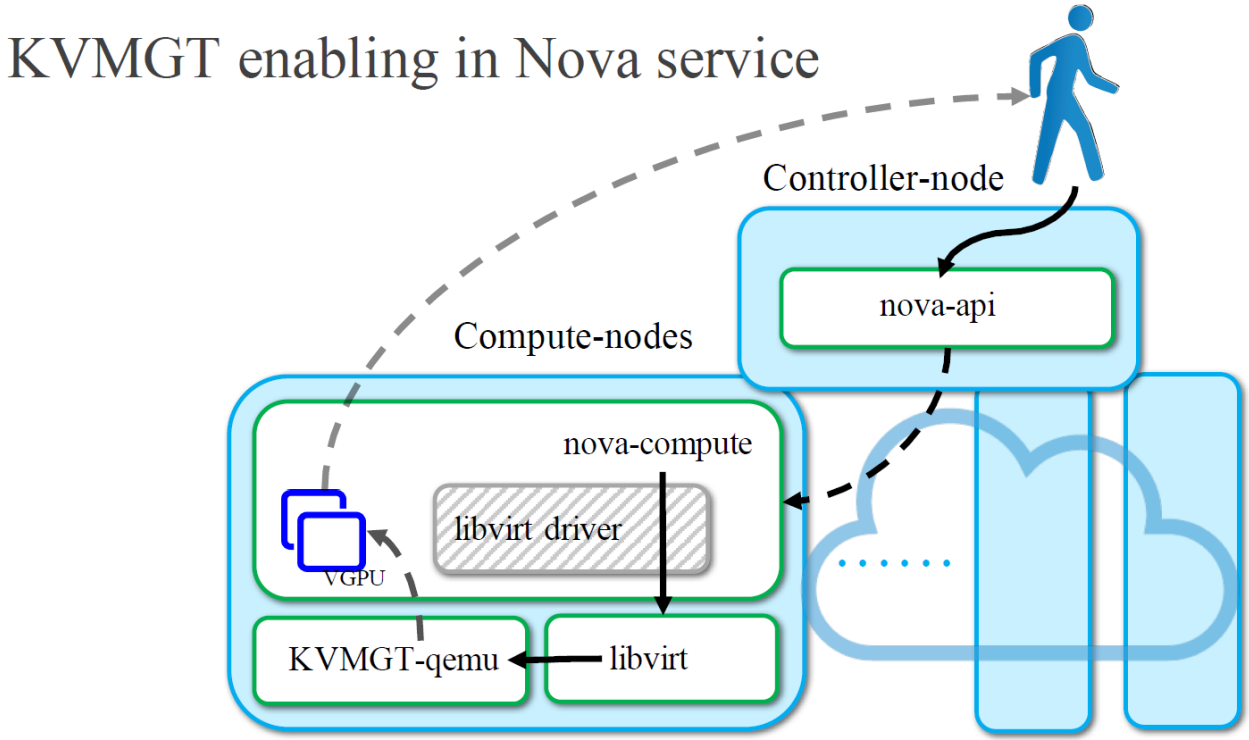
OpenStack vGPU enhancement – Nova Centric (Option 1)



OpenStack vGPU enhancement – Nova Centric (Option 1)

VGPU as PCI devices

- PCI device
  - Address: [Domain:Bus:Slot.Function]
  - Vender ID
  - Product ID
- SRIOV
  - PF,VF vs PGPU,VGPU
- PCI tracker in Nova
  - VID, PID, Domain, Bus
  - Slot, Function, Parent address
  - Whitelist

VGPUs are not real PCI devices

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OpenStack vGPU enhancement – Nova Centric (Option 1)

Add a new kind of resource

• Request with flavor	extra-specs
• Scheduling	new kind of filter and weigher
• Claim check	check and consume GPU resources
• Resource tracking	report available GPU resources
	update compute-node record
• Place the VM	persist instance record with usage
• Rolling upgrade	

Complicated ☹

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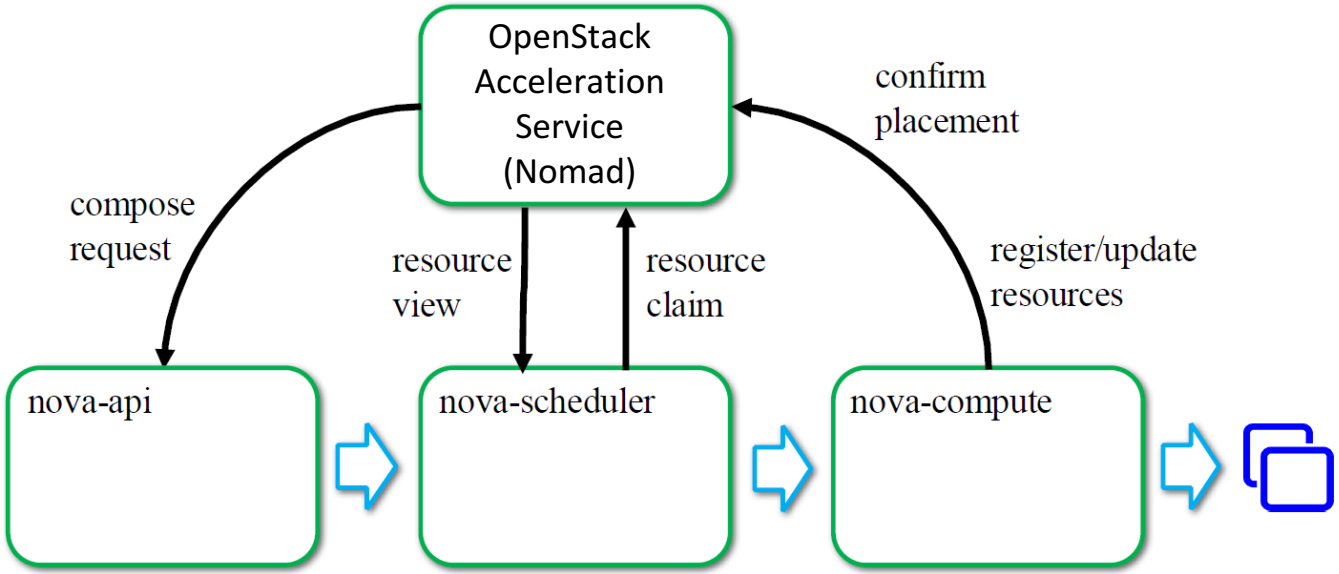
OpenStack vGPU enhancement – Dedicated Service (Option 2)



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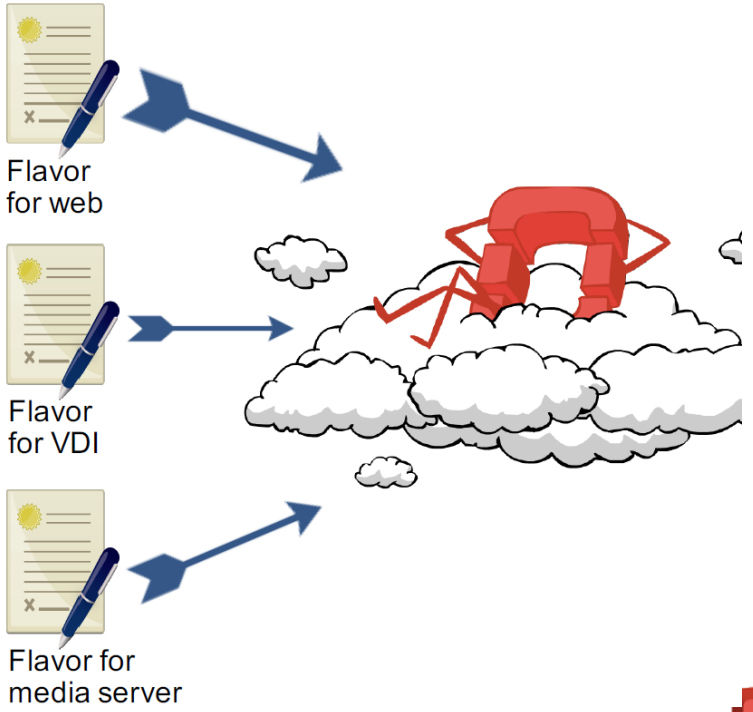
OpenStack vGPU enhancement – Dedicated Service (Option 2)

VGPU as dynamic resources

On demand resource allocation

- Resource pool: low-gm, high-gm, fence
- Resource capabilities
- Configurable flavor:
  - Flexible
  - Descriptive
- Safety



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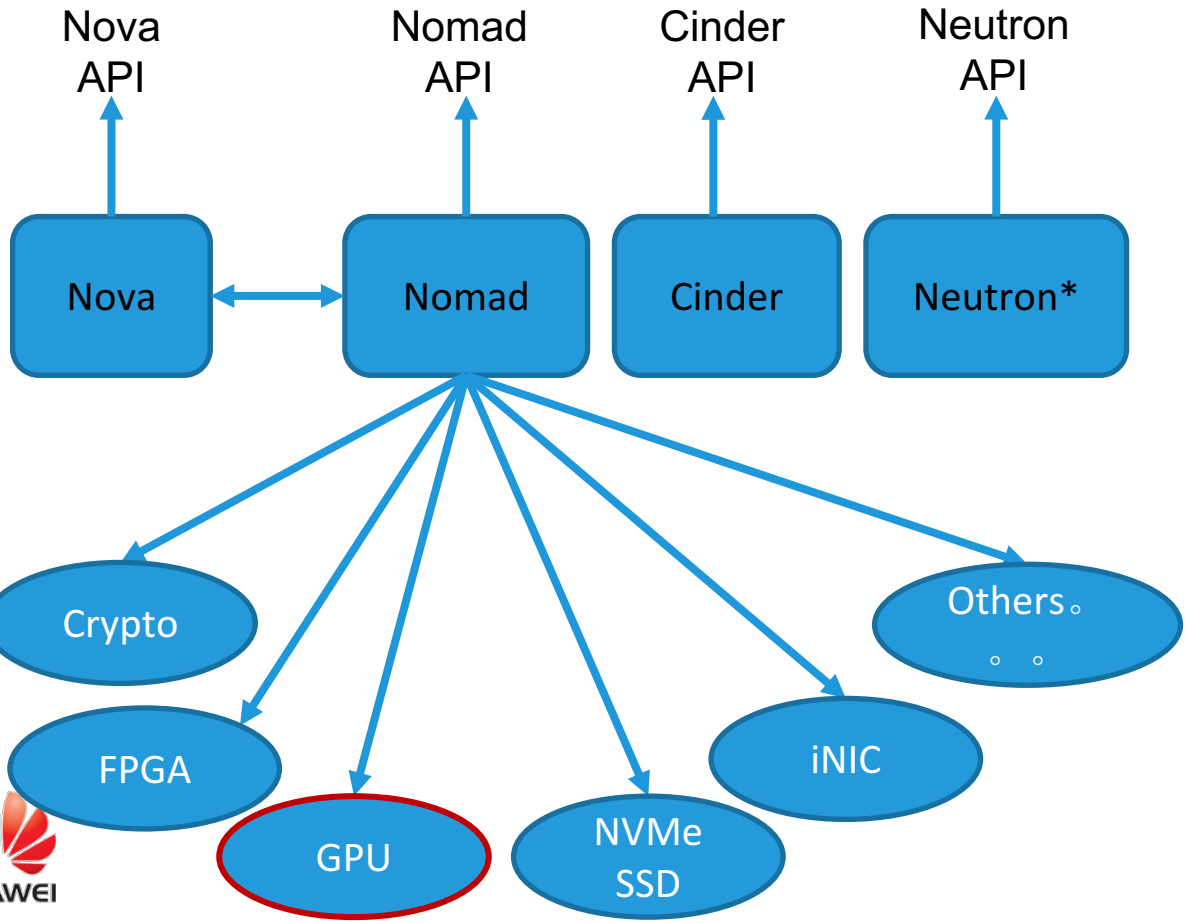
OpenStack vGPU enhancement – Dedicated Service (Option 2)



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Future Work

- Libvirt support
- GPU resources report
- Citrix implementation based on XenGT: https://review.openstack.org/#/c/280099/
- Nomad implementation
- Generic solution for graphic virtualization

Resources Links

- Get KVMGT from 01.org
  - https://01.org/zh/igvt-g/blogs/wangbo85/2016/intel-gvt-g-kvmgt-public-release-q12016
- Libvirt enhancement for KVMGT.
- OpenStack enhancement for KVMGT.

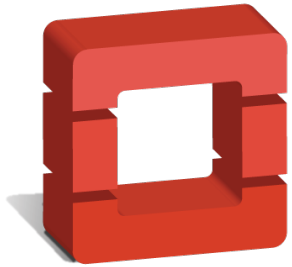
Welcome to Nomad design session on Friday

- Room 130
- Time: Friday, 10:50am

- https://www.openstack.org/summit/barcelona-2016/summit-schedule/events/17242/nomad-work-session

Q&A

THANKS



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