PERFORMANCE ANALYSIS OF CLOUD COMPUTING PLATFORMS

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December 2016

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# OUTLINE

- INTRODUCTION

- RESEARCH OBJECTIVES

- METHODOLOGY

- COMPUTING SERVICE DIAGNOSIS

- NETWORKING SERVICE DIAGNOSIS

- STORAGE SERVICE DIAGNOSIS

- MULTI LAYER ANALYSIS

- FUTURE WORK

INTRODUCTION

➢ Complexity of cloud services
➢ Consumers experiment some services latencies
➢ Where to start troubleshooting ?
➢ Complete view of the cloud environment
➢ Correlate information from different nodes

Application Layer

Performance degradation → Virtualization Layer
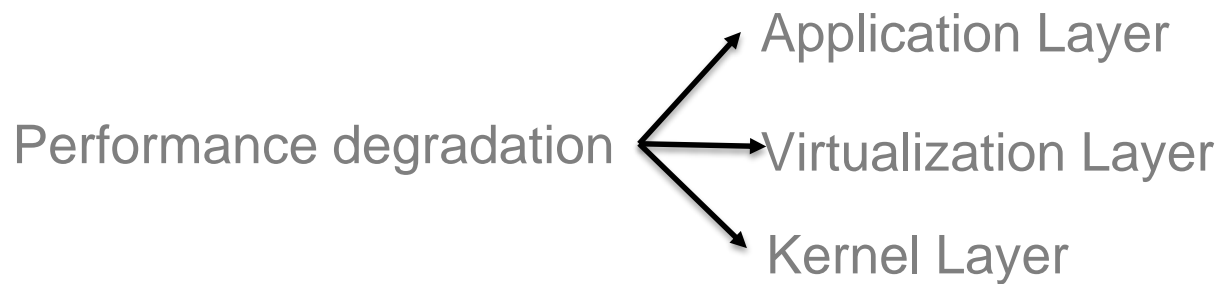
Kernel Layer

Objectives

➢ Multi layer Analysis of cloud infrastructure

Services and virtual resources (application, virtualization, kernel layer)

➢ Show OpenStack service efficiency

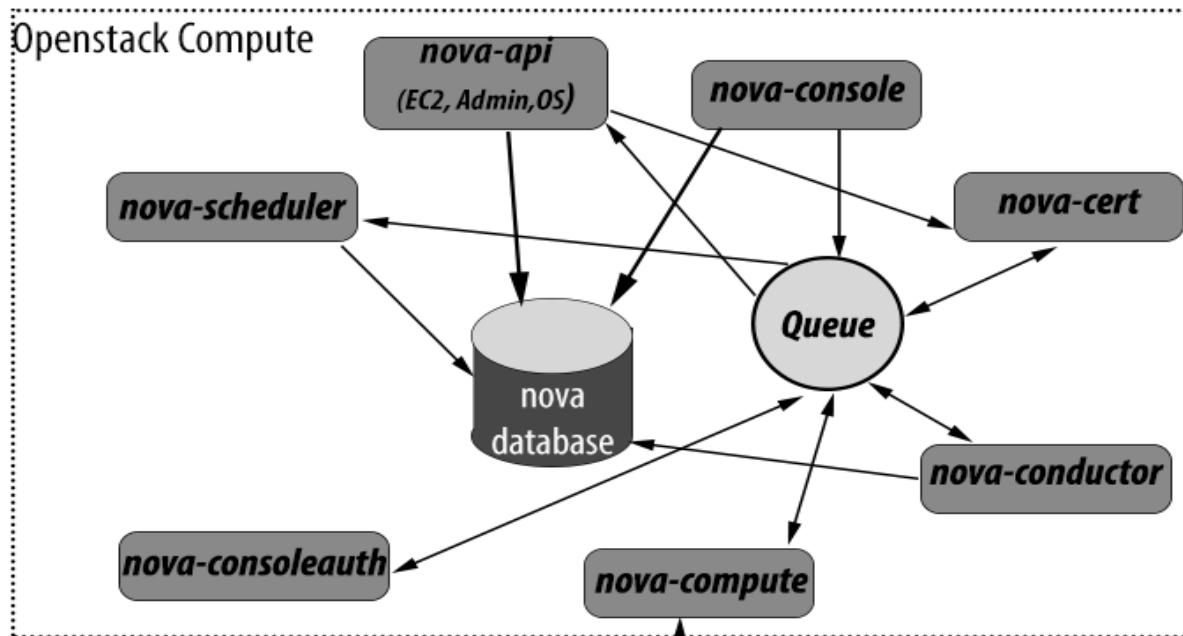show interaction and service bottleneck

➢ Correlate cloud nodes information

Understand execution failures

➢ 1st Method

Survey OpenStack services interaction through RabbitMQ
This method is not efficient.

➢ 2nd Method

OpenStack services instrumentation
OpenStack services tracing with LTTng

TYPE OF SERVICES

Cloud Computing refers to three kind of services
➢ Computing services
Provide virtual machine to consumers
➢ Storage services
Persistent storage for virtual machines
➢ Networking services
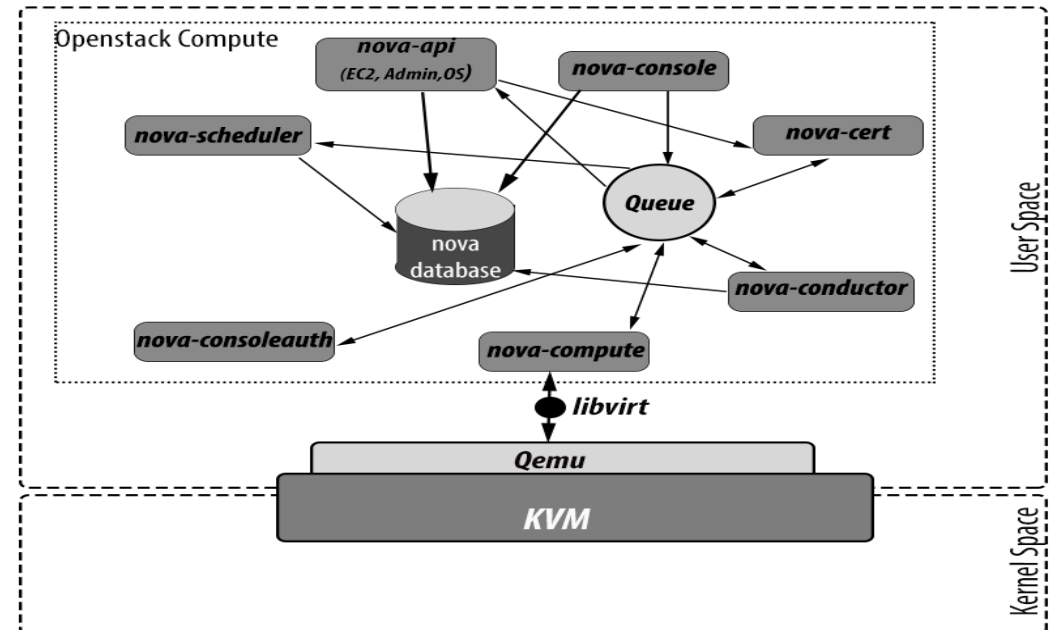Deploy application for virtual machines communication

COMPUTING SERVICE DIAGNOSIS

- Provide virtual machines
- shared computer processing resources

Computing Service Layers

Layers	Features
Application	Nova
Virtualization	QEMU/KVM
Kernel	Host Kernel

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Application Layer Diagnosis

OpenStack Nova Instrumentation

- o Instrumentation is based on Nova logging activities
- o LTTng-UST with python binding to collect logs
- o Write log in JSON format to retrieve instance attributes
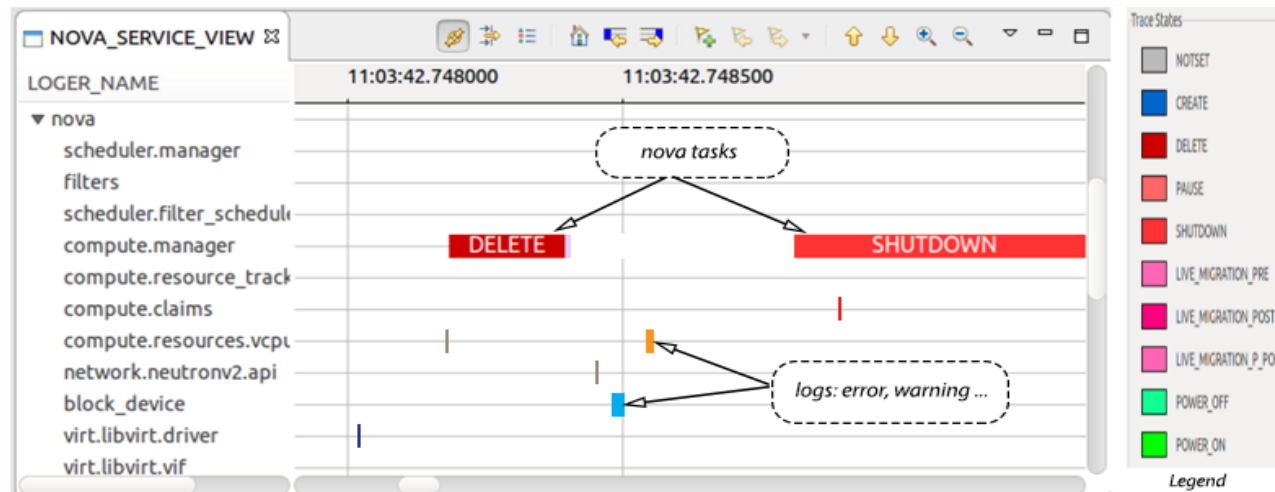
Log.Trace(*trace_nova*(event_type, instance, message))

message output in JSON

```
{
    "EVENT": {
        "event_type": event_type
        "vm_name": instance.name
        "state": instance.state
        ....
        "host": instance.hostname
        "request_id": instance.context.req_id
        "msg": message
    }
}
```
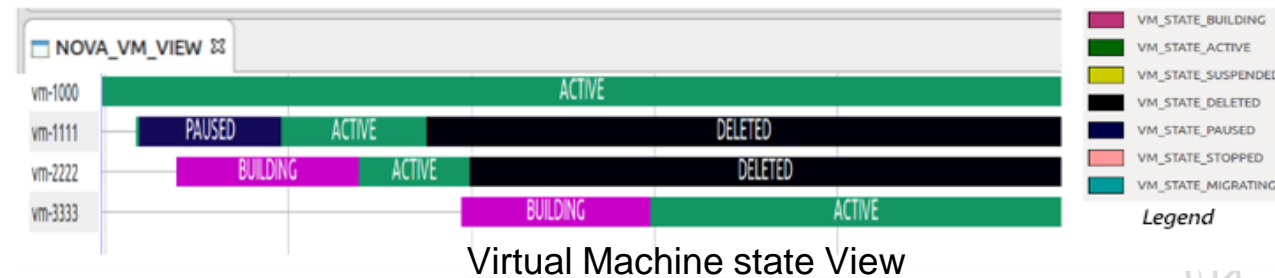
Application Layer Diagnosis

OpenStack Nova Trace analysis

- VM state investigation
- Service performance analysis
- Survey request flow

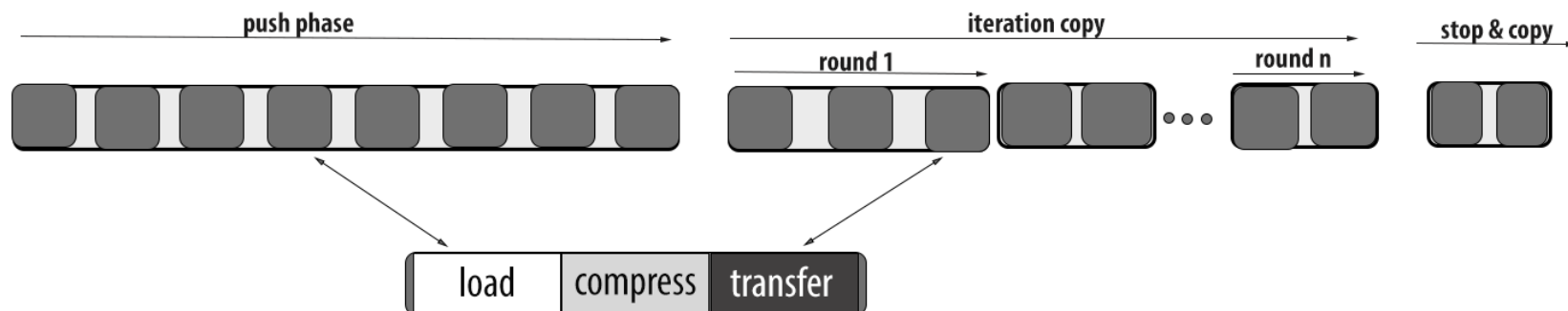Nova Service View

Virtual Machine state View

Virtualization Layer Diagnosis

➤ QEMU Instrumentation

Already instrumented!

➤ QEMU Trace analysis

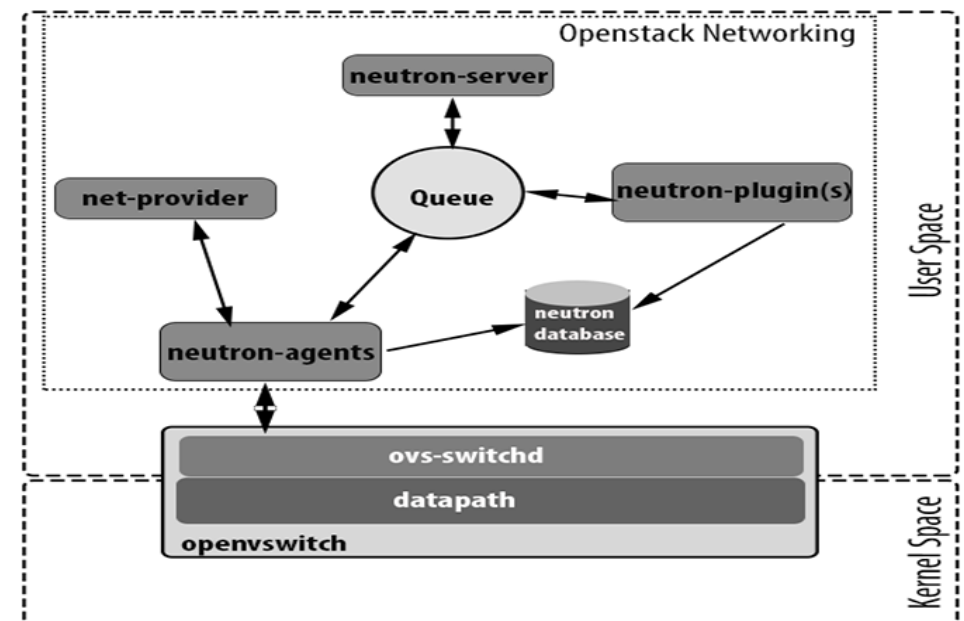*Live migration stage: precopy, iteration copy, stop and copy.*

NETWORKING SERVICE DIAGNOSIS

- Virtual machines communication
- Responsible of virtual network, routers... creation

Networking Service Layers

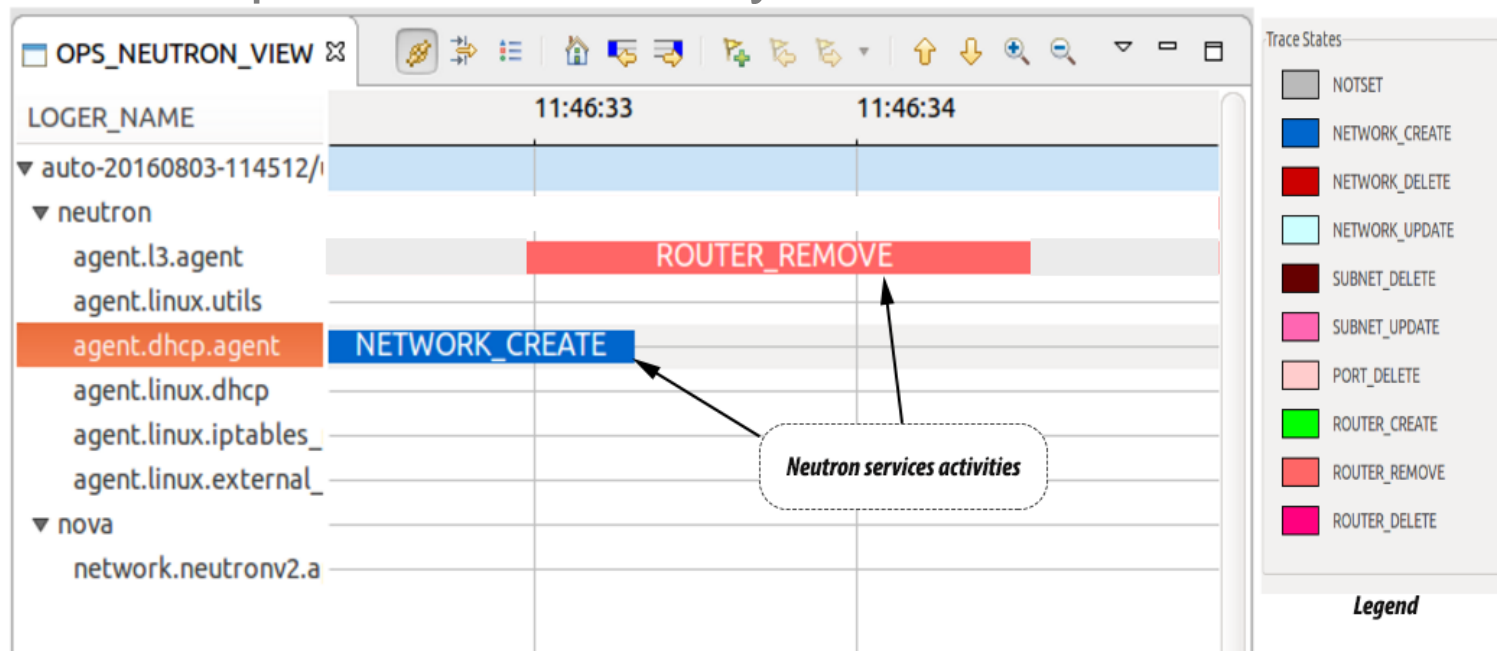| Layers	Features
Application	Neutron
Virtualization	Open vSwitch
Kernel	Host Kernel

Application Layer Diagnosis

➢ OpenStack Neutron Instrumentation

Instrumented with as Nova with Log in JSON format

➢ OpenStack Neutron Trace Analysis
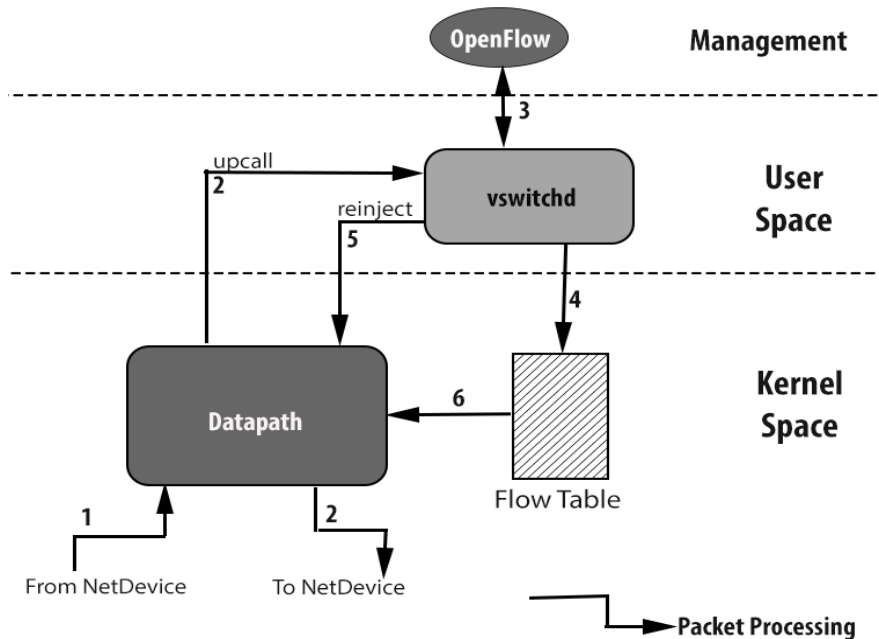
Survey request flow
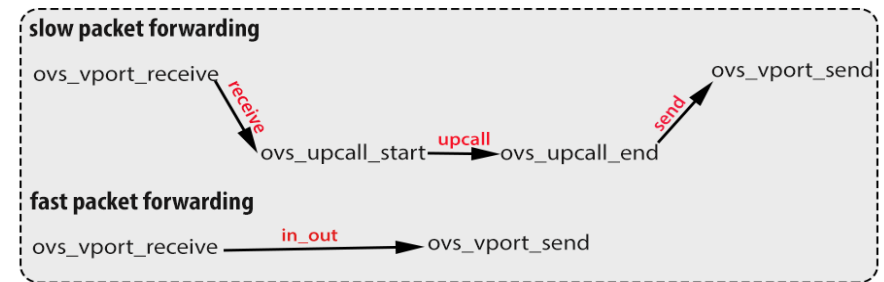
Service performance analysis

Virtualization Layer Diagnosis

Open vSwitch Instrumentation

- Dynamic instrumentation based on kprobe
- Use LTTng addons to instrument <u>datapath</u> functions
- Tagging Packet tail room

Open vSwitch Packet Processing

Packet forwarding events

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Virtualization Layer Diagnosis

Open vSwitch Trace Analysis

➤ Packet switching performance

Packet latency through OvS components
Frequency of network topology configuration

➤ OvS components interaction

Datapath/ovs-vswitchd communication
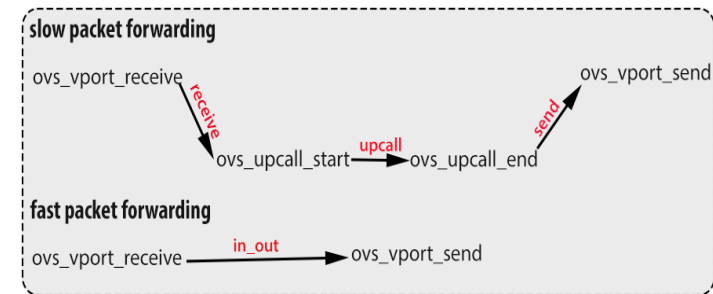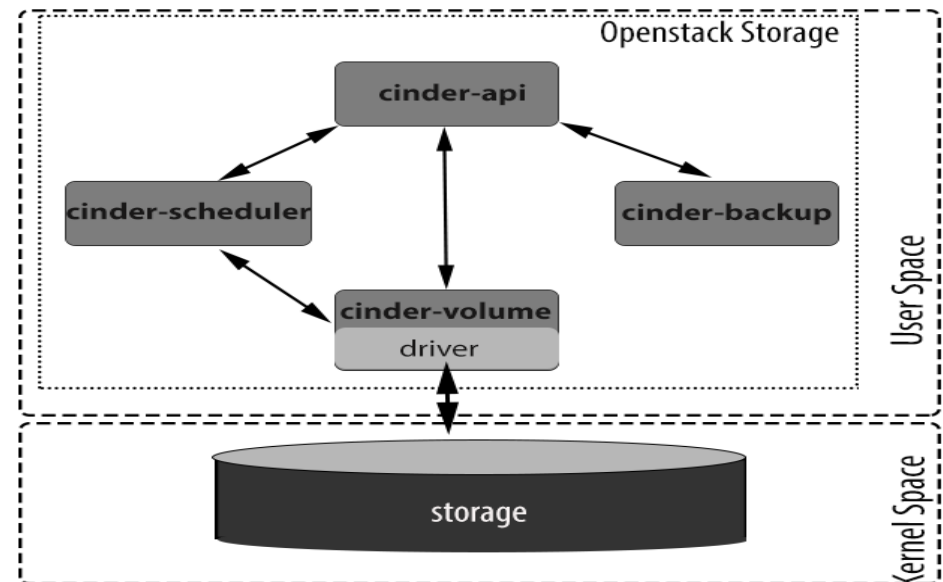

Packet forwarding events
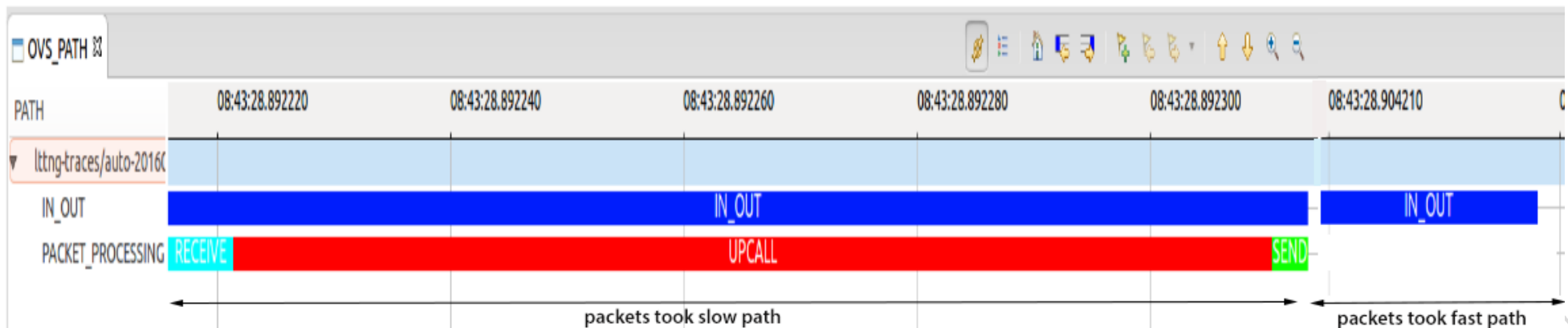
Open vSwitch View

Storage Service Diagnosis

- Virtualize storage devices
- Provide storage resources to consumers
- Persistent storage to virtual machines

Storage Service Layers

Layers	Features
Application	Cinder
Virtualization	-
Kernel	Host Kernel

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Application Layer Diagnosis

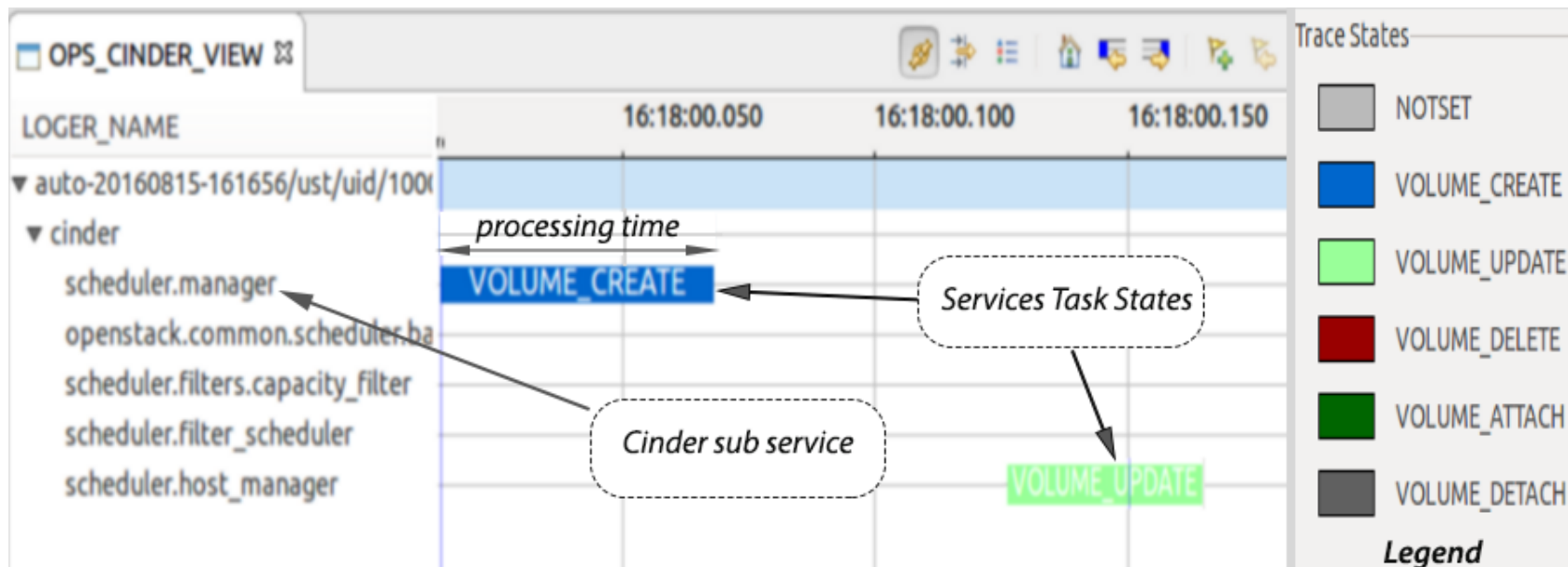➢ OpenStack Cinder Instrumentation

Instrumented with as Nova with Log in JSON format

➢ OpenStack Cinder Trace Analysis

Survey request flow
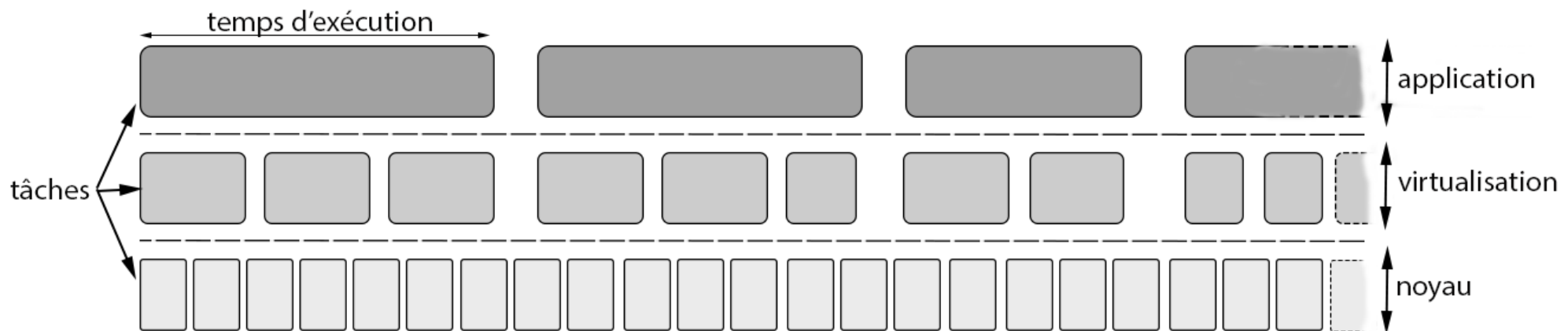
Performance of Cinder operations

Link virtual volume to physical disk

Cinder View

MULTI-LAYER ANALYSIS

➢ Link Instances data from the three layers

➢ For each operation from the Application layer,
find sub-operation in the Virtualization and the Kernel layer

Live Migration

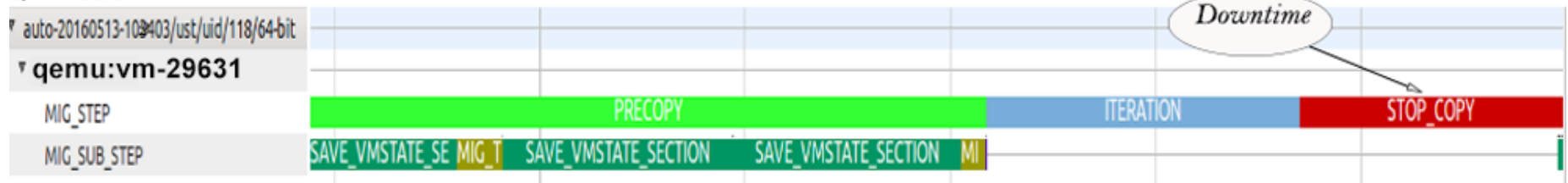## Normal case: live migration succeed

vm-29631 live migration

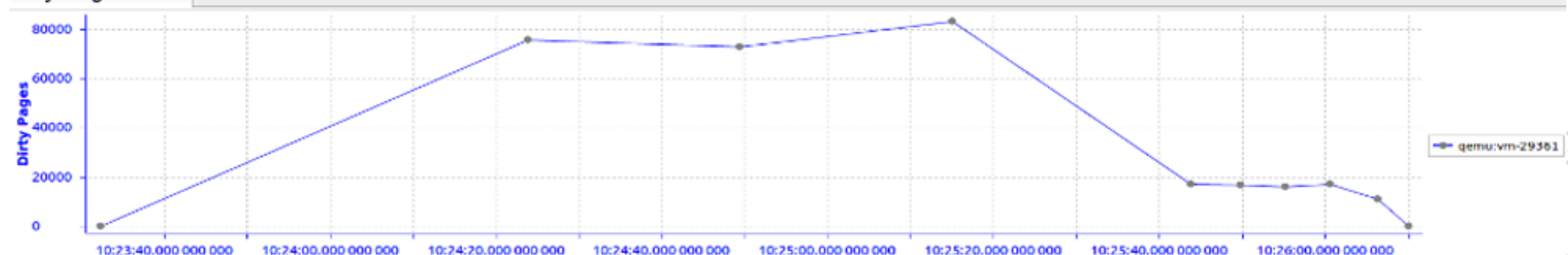Stages of VM migration (precopy, iteration and stop&copy)

Downtime=stop&copy

Round and sub-round for each stage
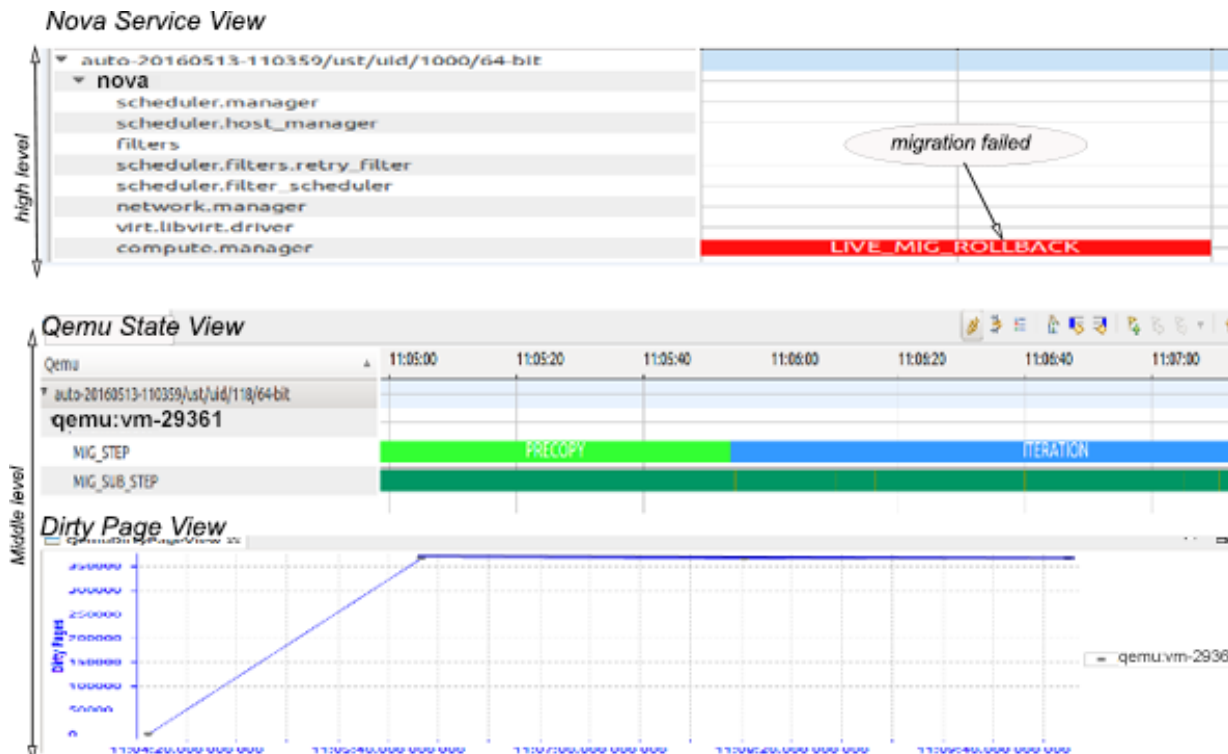
Dirty page curve converge to 0=migration succeed.

Live Migration

Abnormal case: live migration fail

- Live migration rollback; stop&copy stage is missing
- Dirty page view does not converge to 0
- vm-29361 has a high workload
- Qemu cannot transfer quickly the memory

FUTURE WORK

➢ OpenStack service diagnosis

associate Nova, Neutron, Cinder interfaces in a single utility

➢ OvS diagnosis

use packet source and destination address to locate VM

QUESTIONS

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