High Performance Storage : A Cloud Story
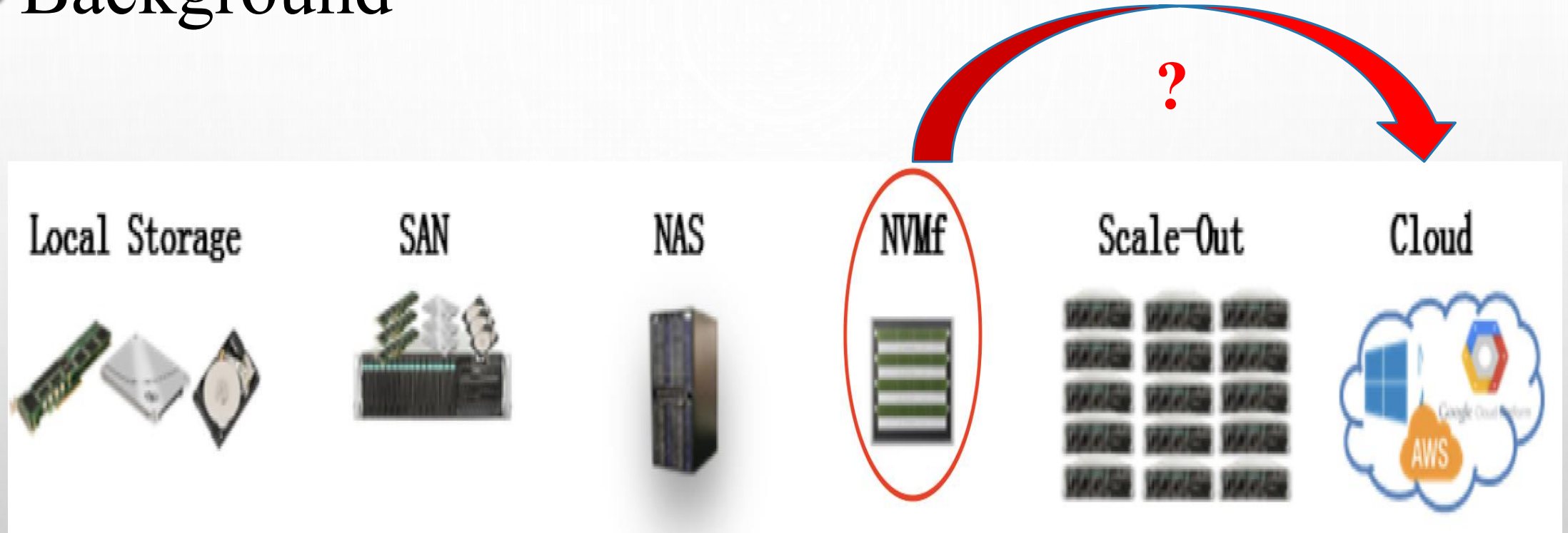
Luwei He
Standard Engineer, Huawei

Outline

- Background
- Cloud Storage Core Technologies
- Proposed Design
- Conclusion

Background

More and more applications rely on high performance storage

Outline

- Background
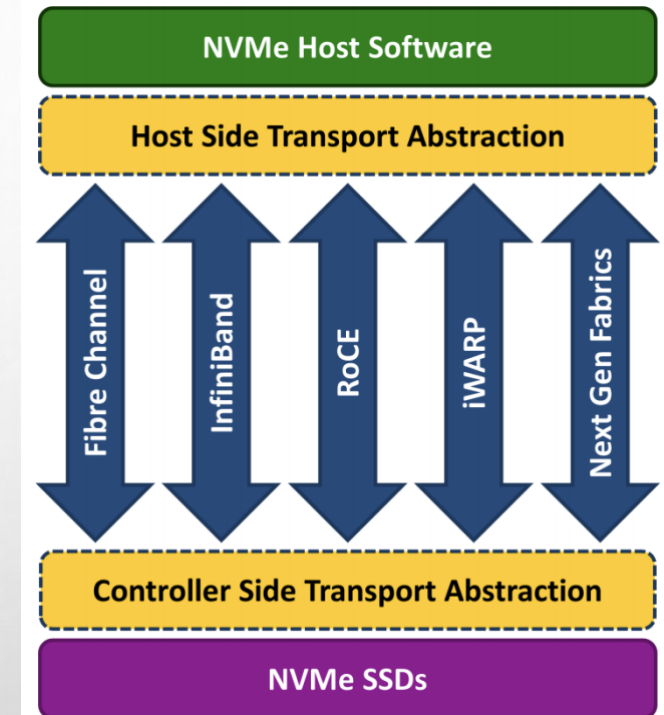- Cloud Storage Core Technologies
  - NVMf
  - SPDK
  - Cyborg
  - OpenSDS
- Proposed Design
- Conclusion

Cloud Storage Core Technologies——NVMf

NVMe over Fabrics

- a technology specification
- transfer data between a host computer and a target SSD over a network
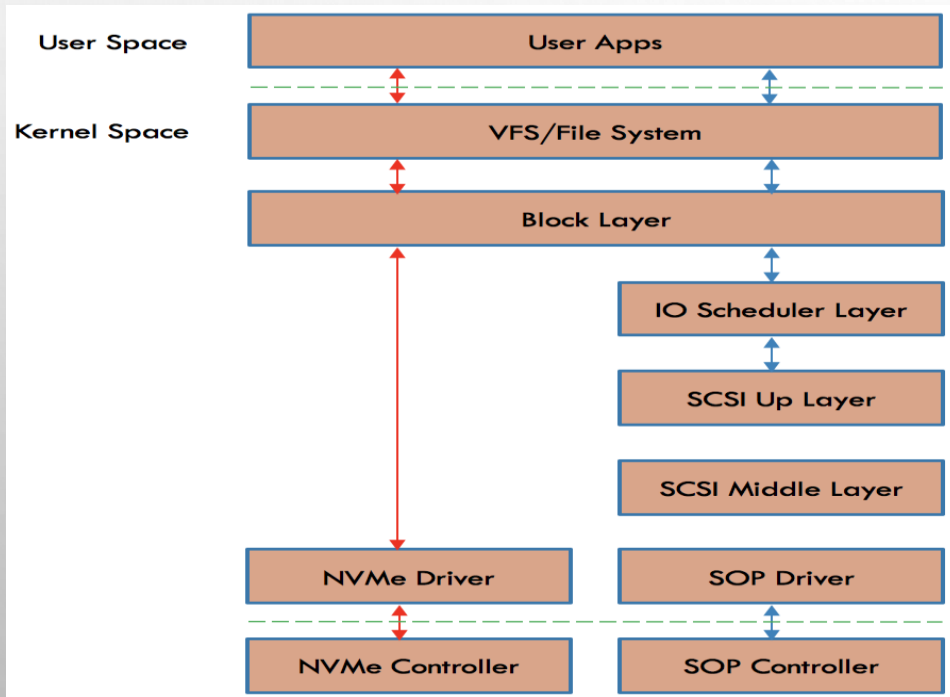- Fibre Channel, Infiniband, RoCE, …
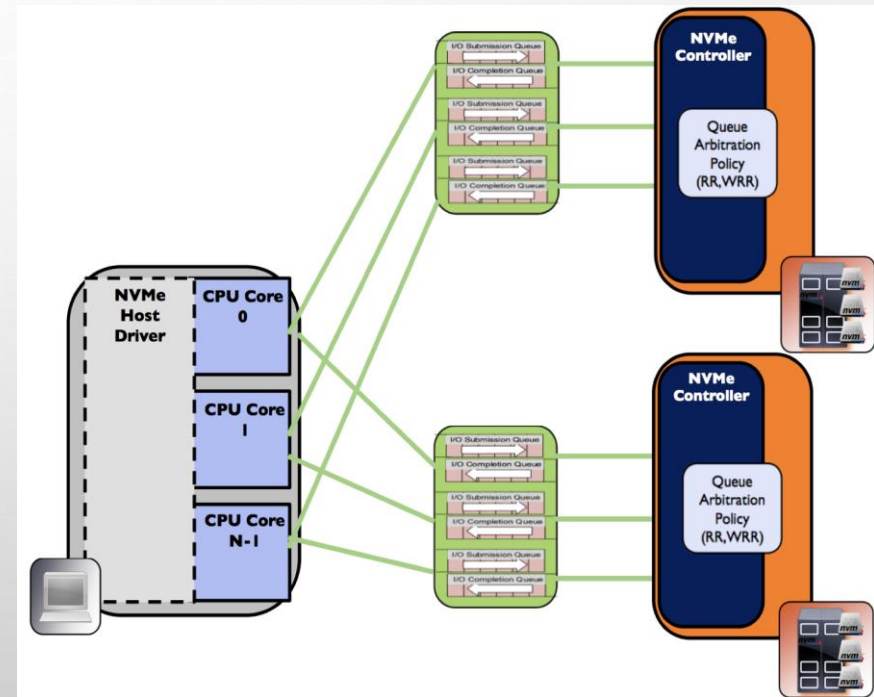
Cloud Storage Core Technologies——NVMi Benefits

➢ low latency
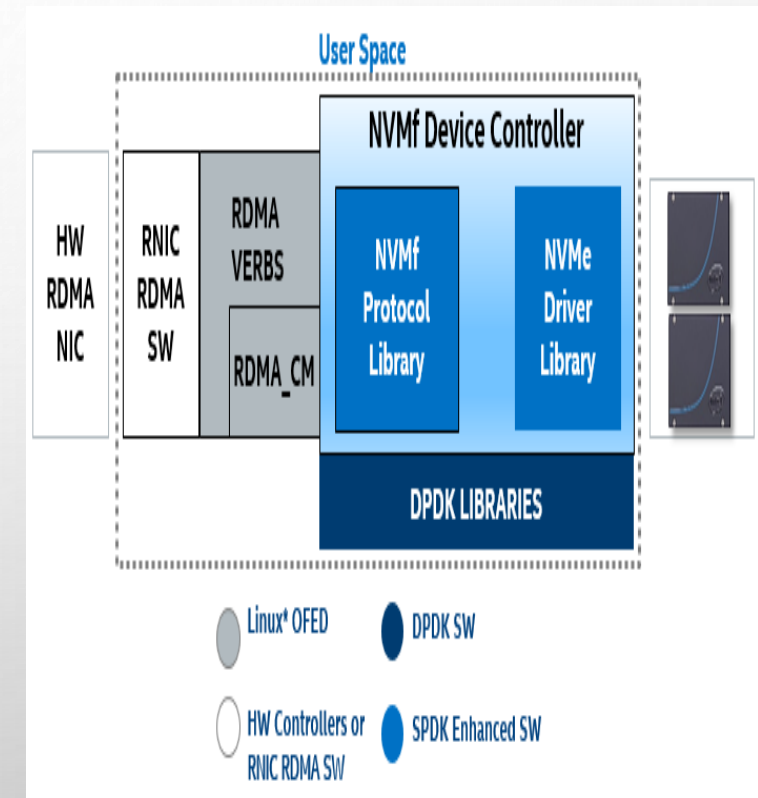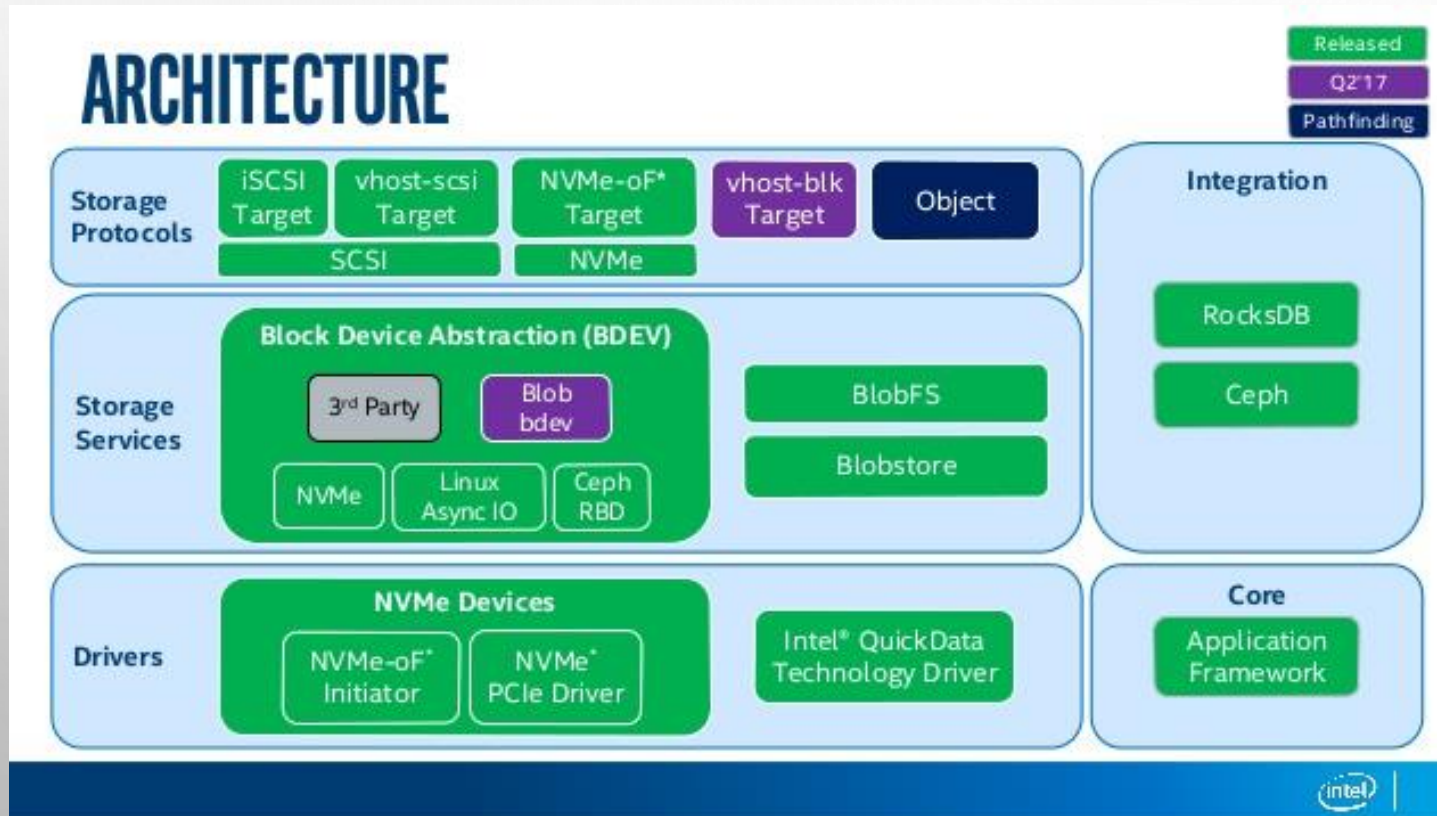➢ high IOPS

high performance

IO path is shorter

Multi-queue, Lockless

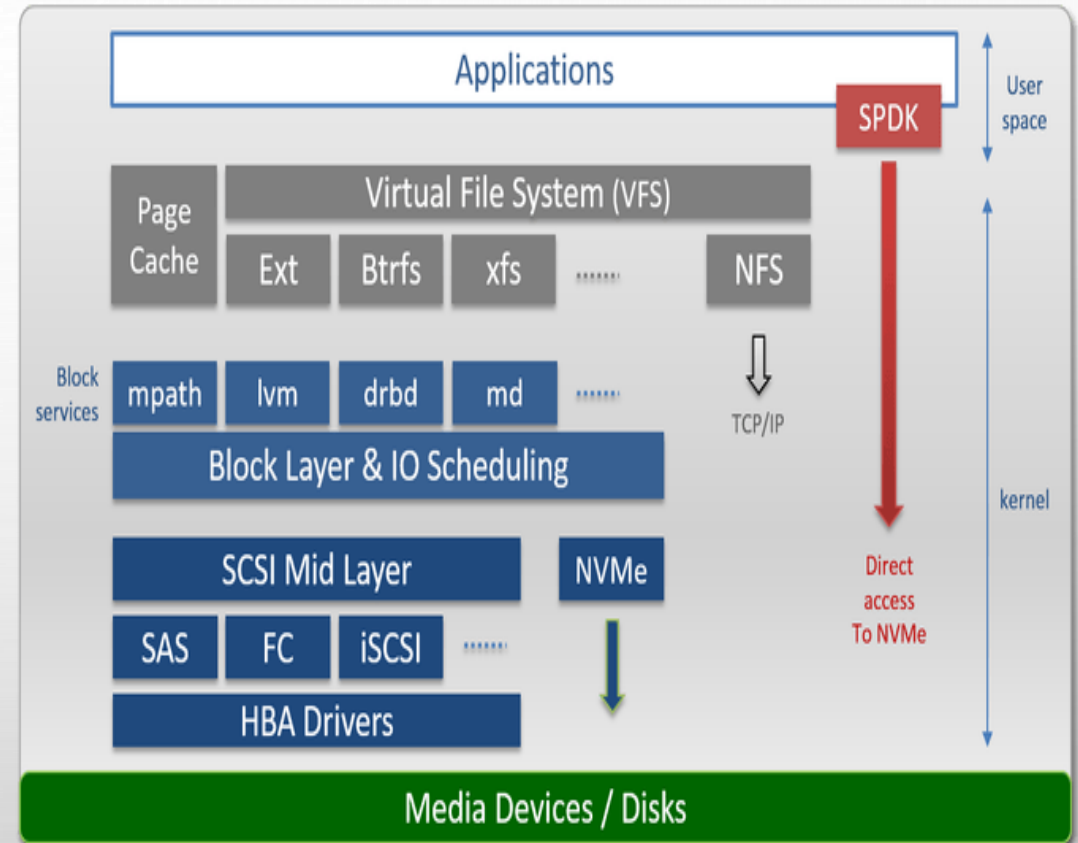# Cloud Storage Core Technologies——SPDK

Storage Performance Development Kit: User Space Driver and Poll-mode

Cloud Storage Core Technologies——SPDK NVMf

➢ Moving the NVMe drivers into user space, which avoids syscalls and enables zero-copy access from the application.

➢ Polling hardware for completions instead of relying on interrupts, which lowers latency.

➢ Avoiding all locks in the I/O path, instead relying on message passing.

Cloud Storage Core Technologies——OpenStack Cyborg

Cyborg aims to provide a management framework for dedicated devices (e.g. FPGA, GPU) as well as various accelerators (e.g DPDK, SPDK) in OpenStack.
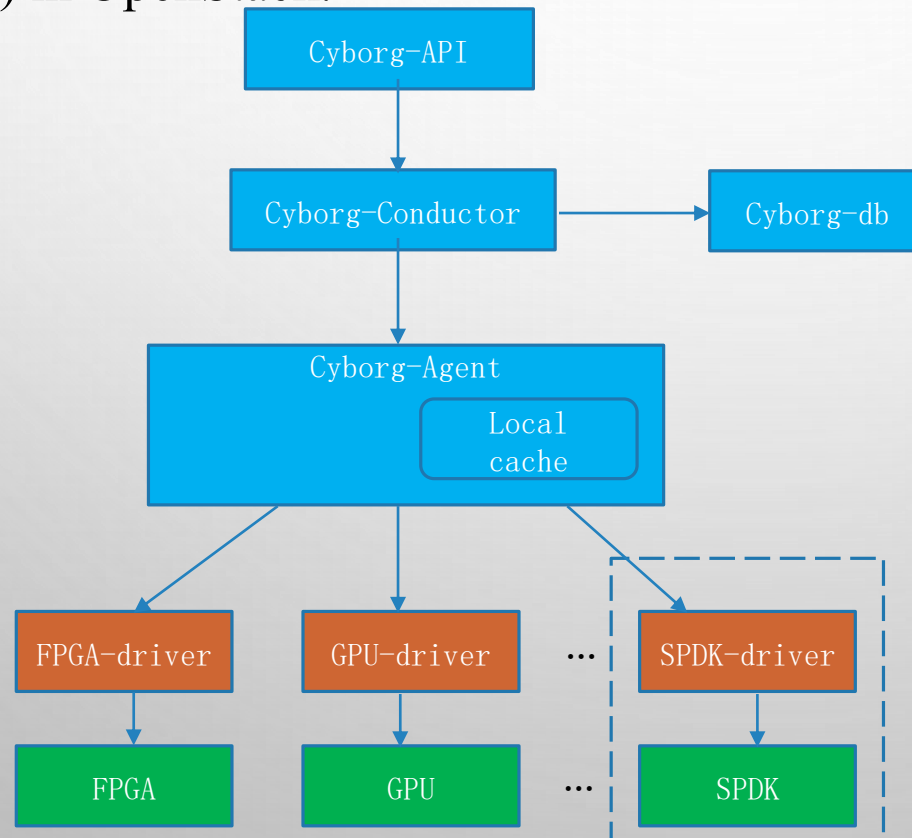

'server': 'nvmf_tgt',
'bdevs': [{"num_blocks": 131072,
        "name": "nvme0n1",
        "block_size": 512
        }],
'subsystems': [{
"nqn": "nqn.2016-06.io.spdk:cnode1",
"subtype": "NVMe",
"listen_addresses": [
{
"trtype": "RDMA",
"adrfam": "IPv4",
"traddr": "192.168.0.123",
"trsvcid": "4420"
}],
"hosts": [
{"nqn": "nqn.2016-06.io.spdk:host1"}
],
"allow_any_host": false,
"serial_number": "abcdef",
"namespaces": [
{"nsid": 1, "name": "Malloc2"},
{"nsid": 2, "name": "Nvme0n1"}]
}
]
…

Cloud Storage Core Technologies——OpenSDS

- **Unified Plug-in Interface:** for different frameworks
- **Policy-Based Control:** Pooling of storage resources with policy-based control
- **Wide Storage Support:** support for wide range of storage drivers
- **Enterprise Class:** supports various hardwares platforms (x86, ARM, ARM64, PowerPC,..)
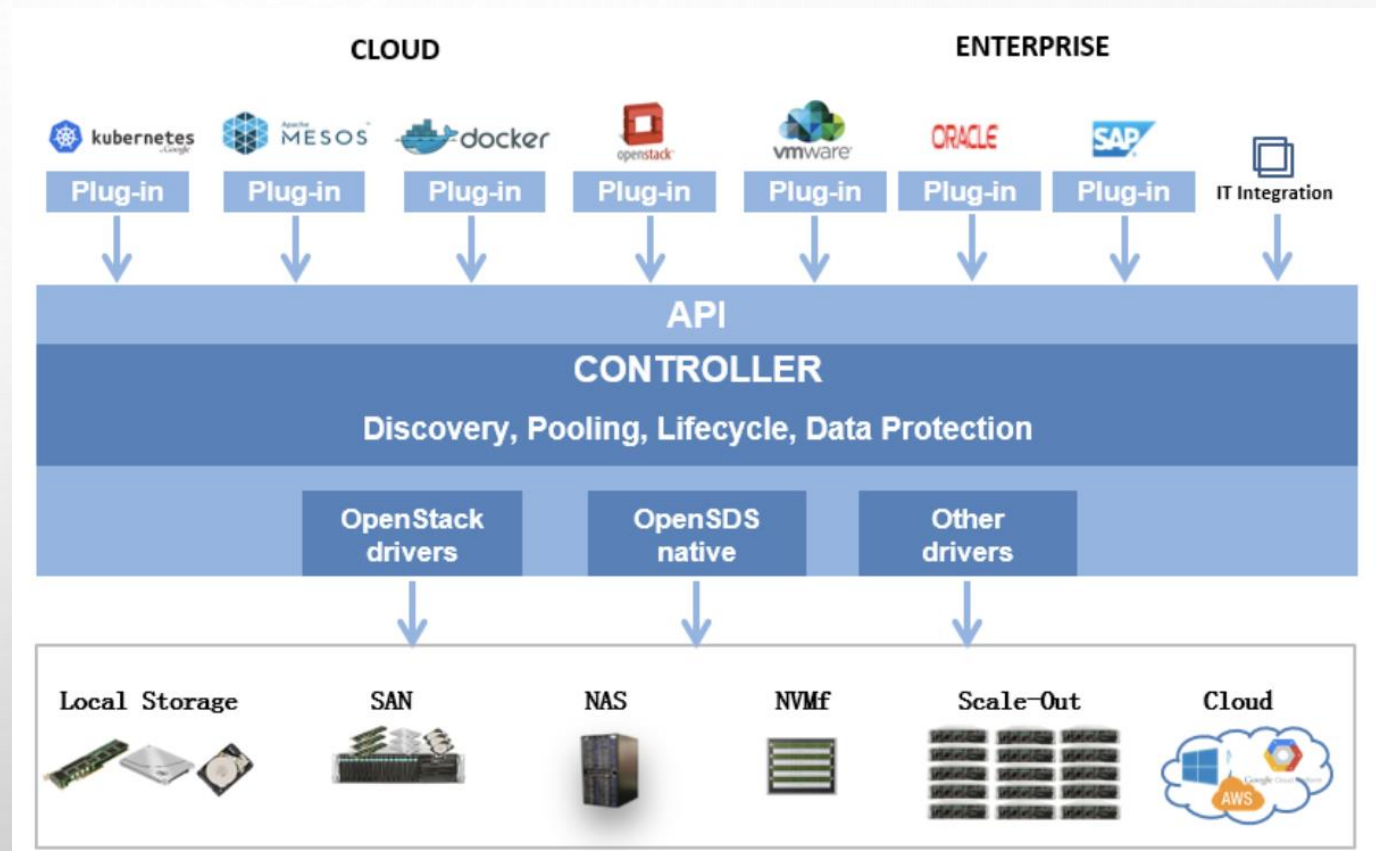
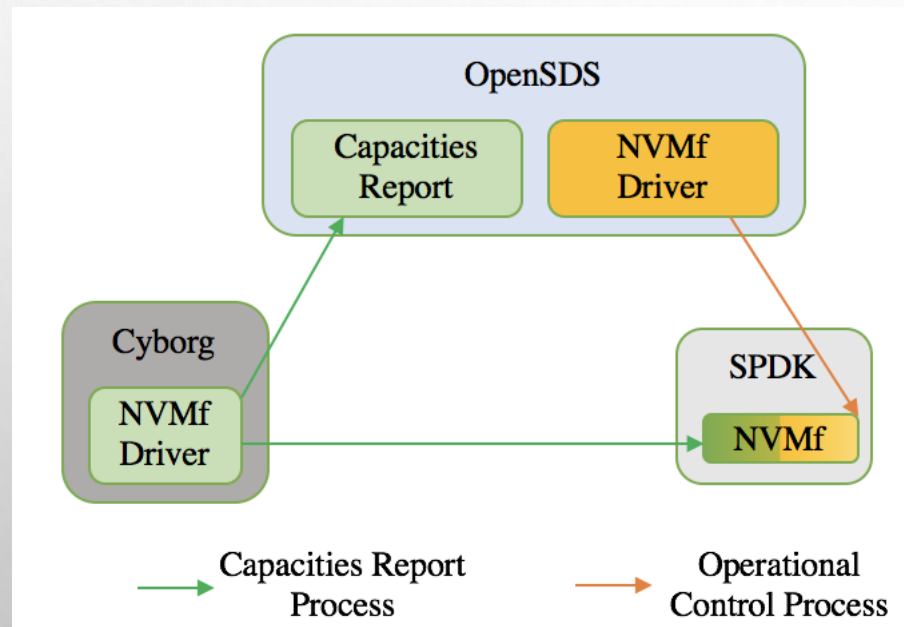# Cloud Storage Core Technologies——OpenSDS Enabled Storage Management
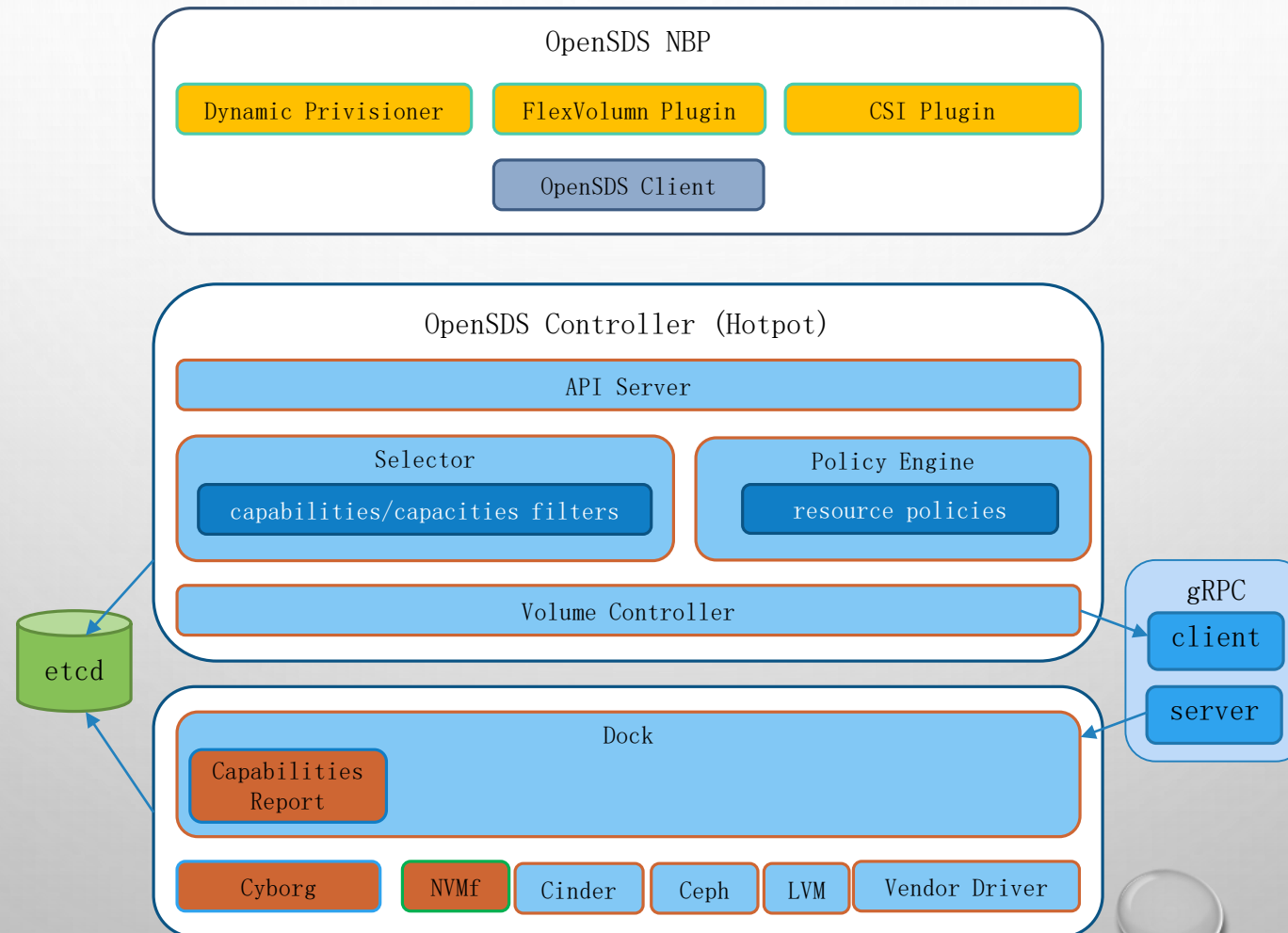
Outline

- Background
- Cloud Storage Core Technologies
- Proposed Design
- Conclusion

Proposed Design: Fine Grained High Performance Storage Management (1)

Capacities Report Process
1. OpenSDS start
2. OpenSDS Dock informs Cybogr to report the abilities of SPDK NVMf_target through 'Capacities Report'
3. Cyborg SPDK driver initialize the huge pages and start NVMf_target server, then get the abilities of accelerator (like subsystem, namespace, port, bdev, …)
4. Cyborg report these abilities to Dock through 'Capacities Report'

Proposed Design: Fine Grained High Performance Storage Management (2)
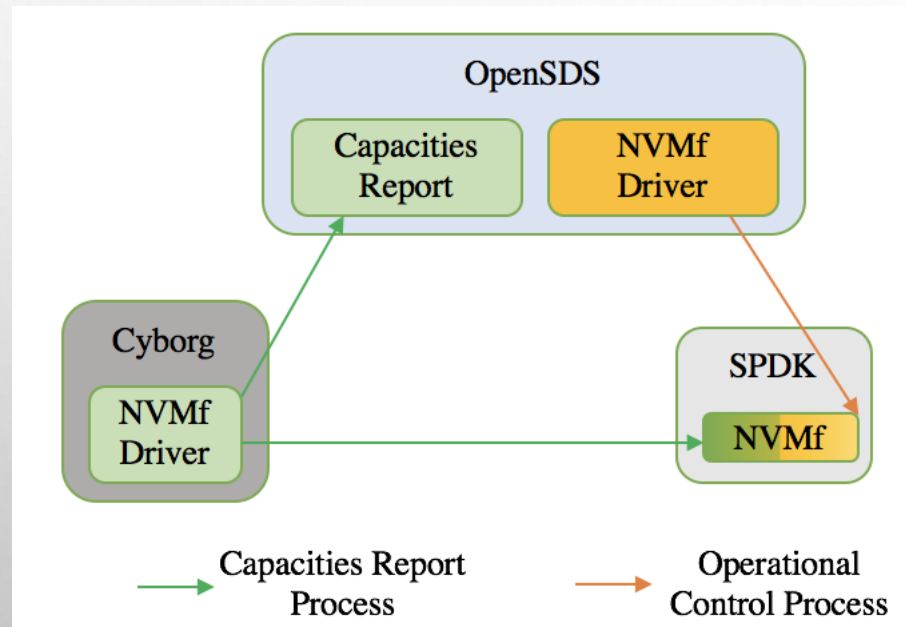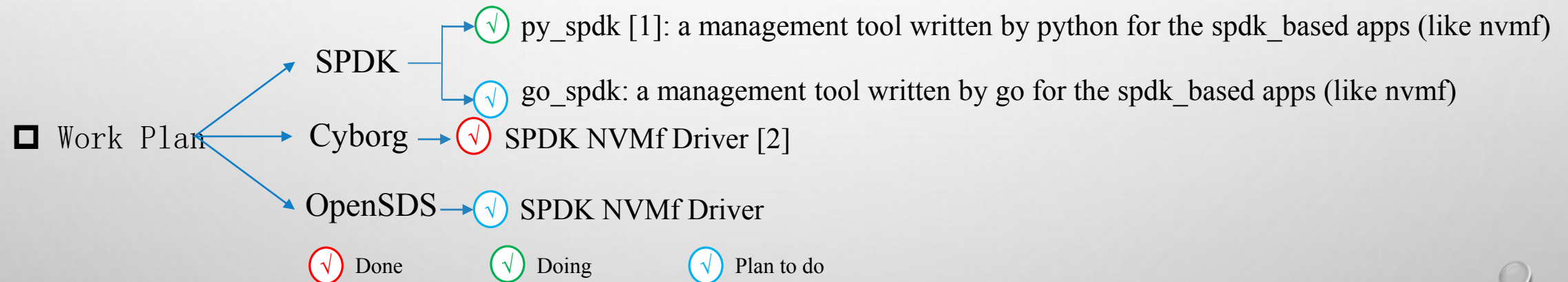

Operational Control Process
1. According to the returned abilities, OpenSDS starts creating the pool which is the basic operating unit of OpenSDS .
2. OpenSDS Dock starts executing specific actions (like add/delete namespace) through nvmf driver.

Outline

Conclusion

❑ Provide NVMf high performance storage backend for cloud computing:
  • SPDK implements the user space NVMf
  • Cyborg reports the abilities of NVMf to OpenSDS
  • OpenSDS manages and schedules the NVMf

❑ Work Plan

SPDK
√ py_spdk [1]: a management tool written by python for the spdk_based apps (like nvmf)
√ go_spdk: a management tool written by go for the spdk_based apps (like nvmf)

Cyborg → √ SPDK NVMf Driver [2]

OpenSDS → √ SPDK NVMf Driver

√ Done   √ Doing   √ Plan to do

【1】 https://review.gerrithub.io/#/c/403506/
【2】 https://github.com/openstack/cyborg/tree/master/cyborg/accelerator/drivers/spdk/nvmf

Thank You

Q&A