Power Matters.TM

利用PCIE Switch+RDMA技术加速数据中心IO流量

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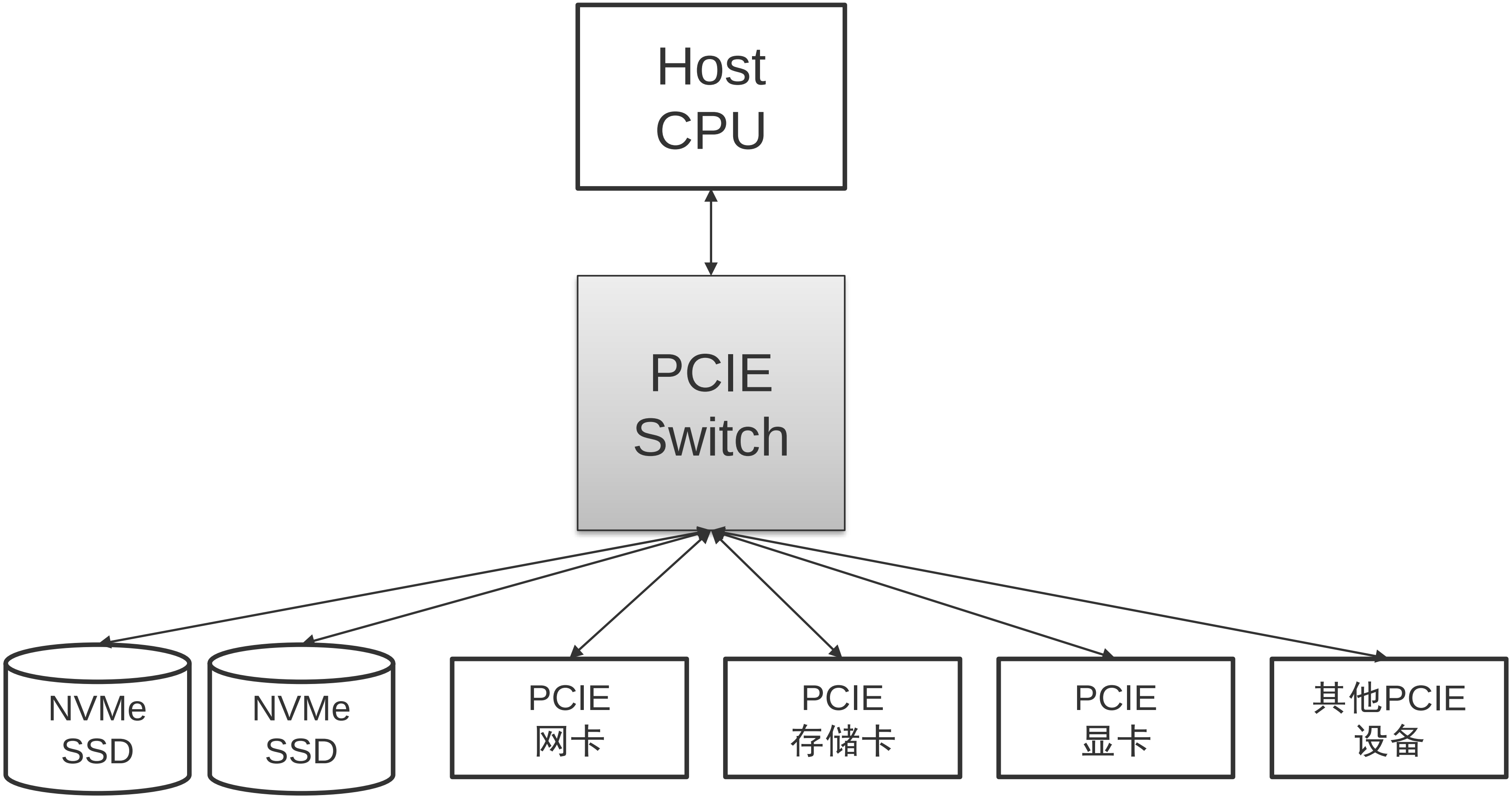
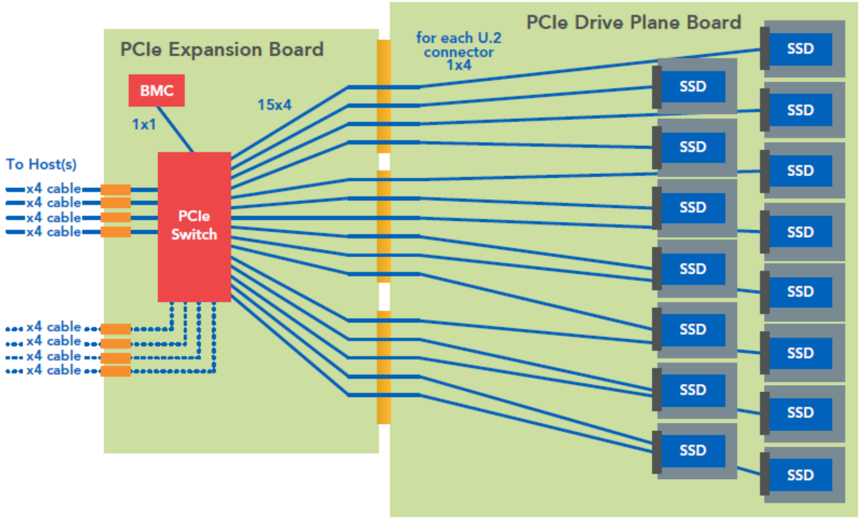
PCIE Switch能做什么——FANOUT

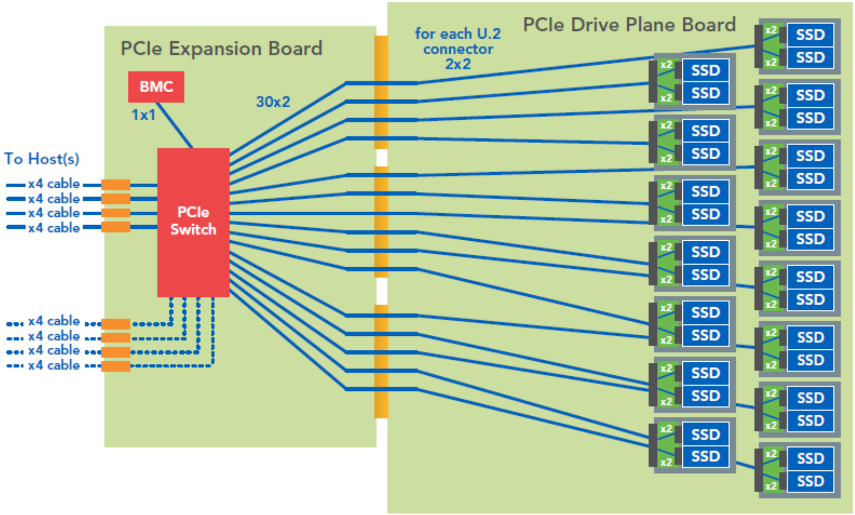


单芯片最大支持48个Port——Microsemi特有

PCIe switch configurations



15 x4 SSDs

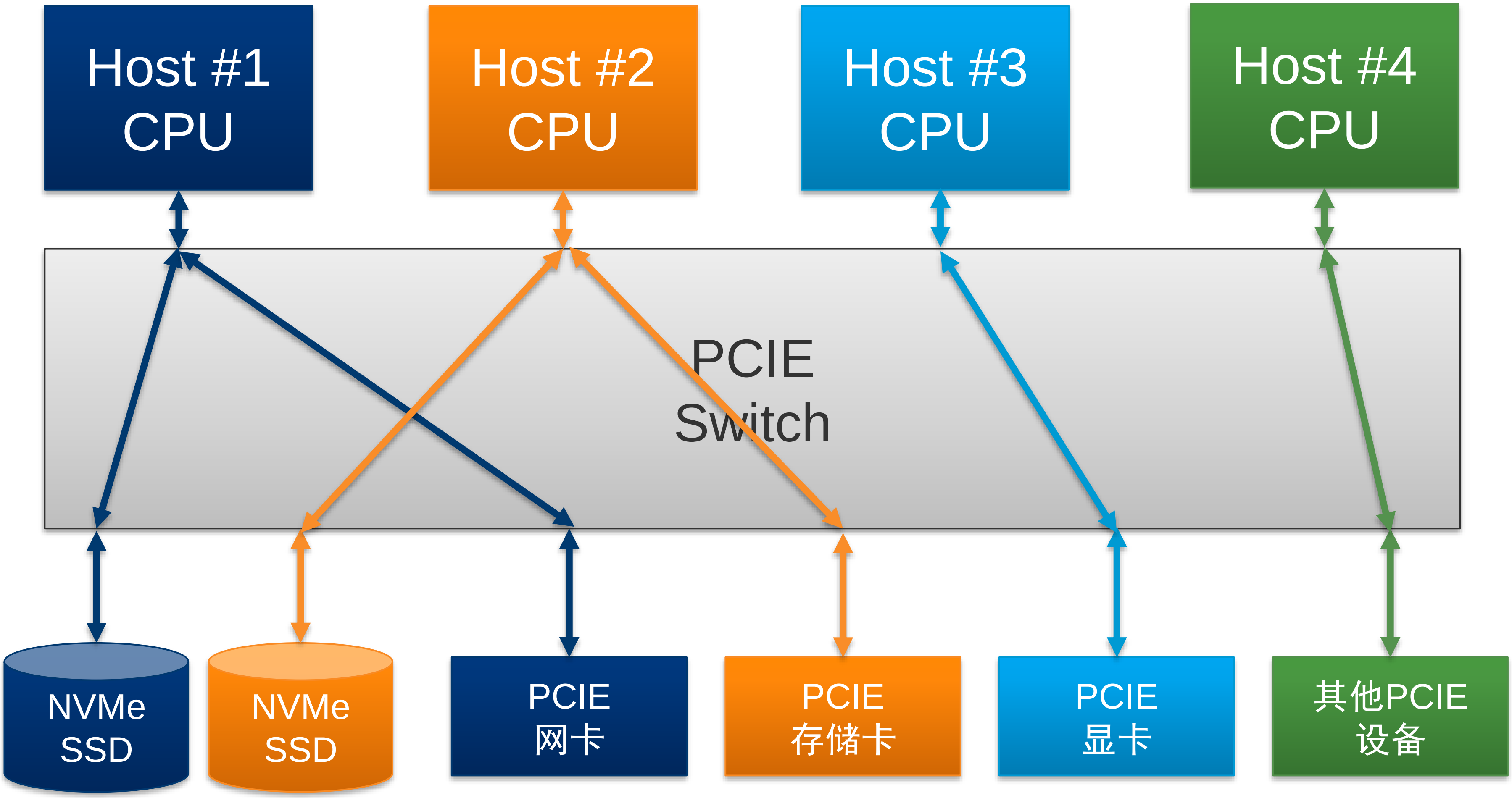


30 x2 SSDs

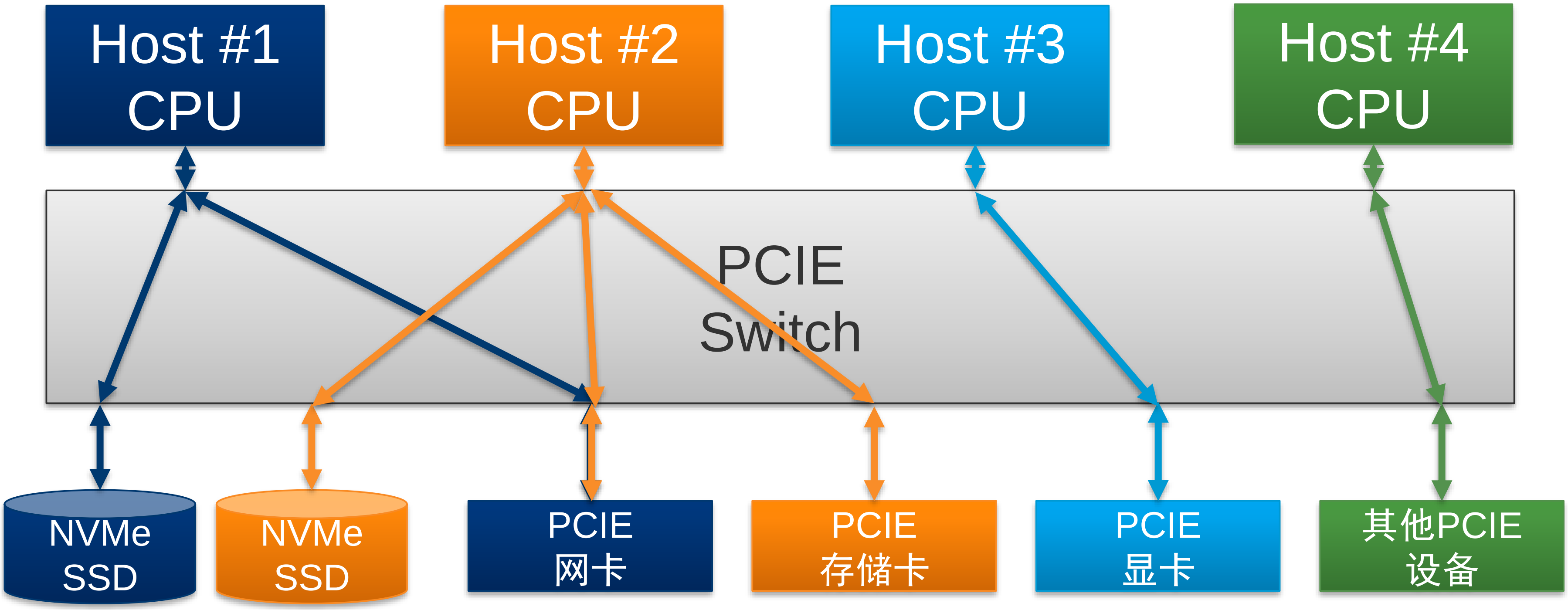
Open Compute (Facebook) Reference Design

http://www.opencompute.org/wiki/Storage *(search for Lightning)*

PCIE Switch能做什么——分区

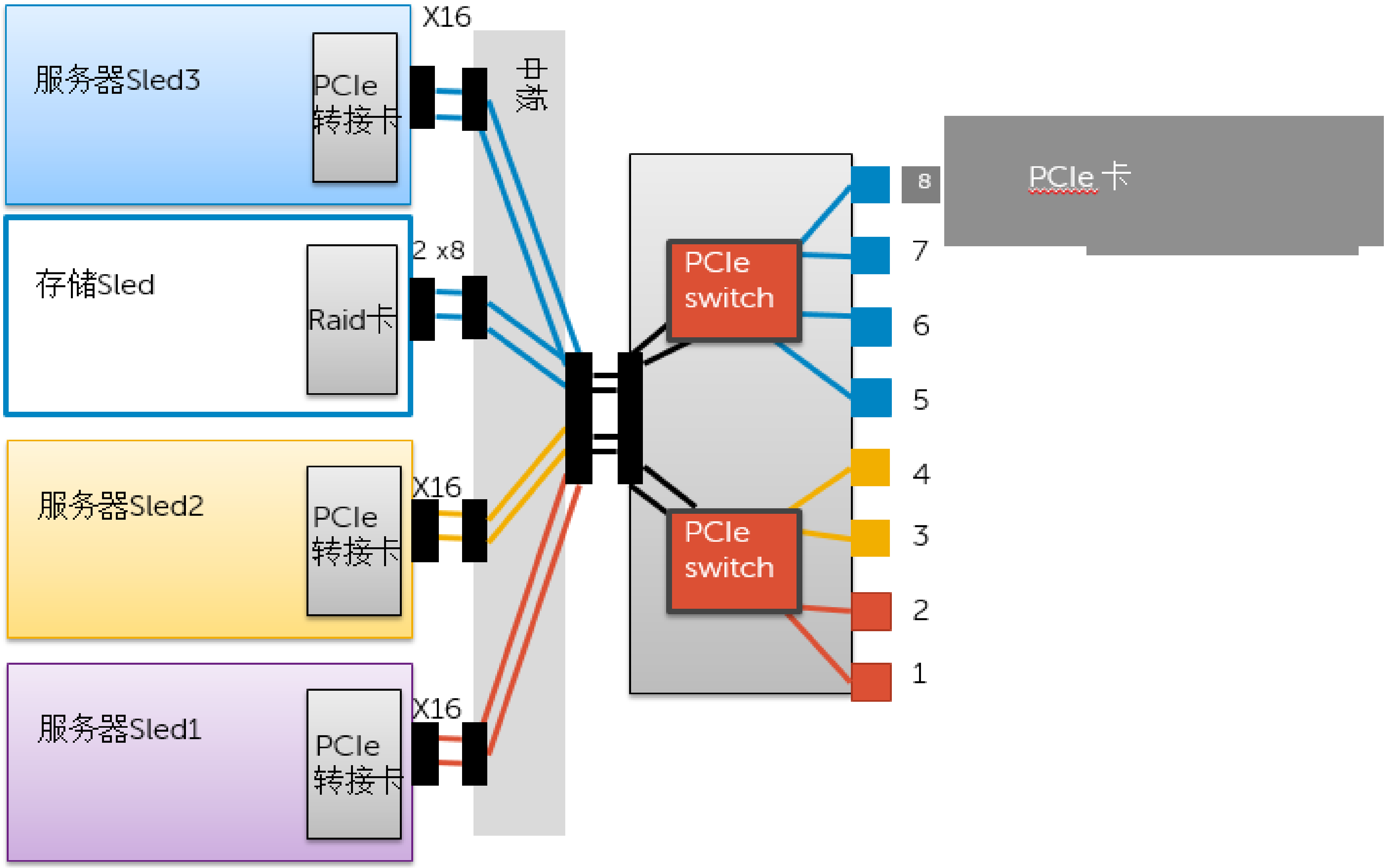


动态分区——Microsemi PCIE Switch特有

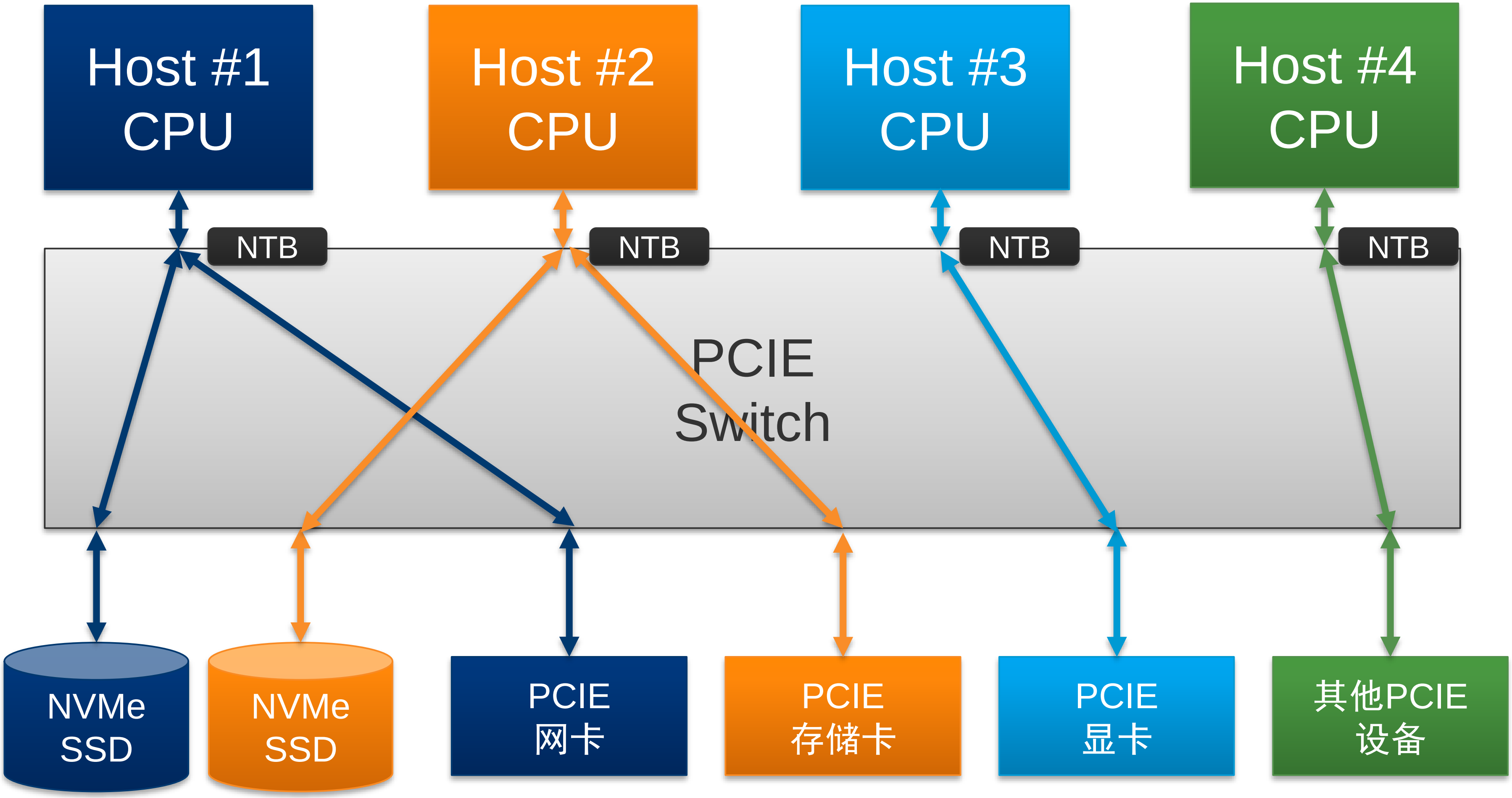


分区的重新配置不需要主机端重启，不中断主机端原有的IO访问。新添加设备动态发现并理解可用。

基于PCIE Switch分区的服务器设计

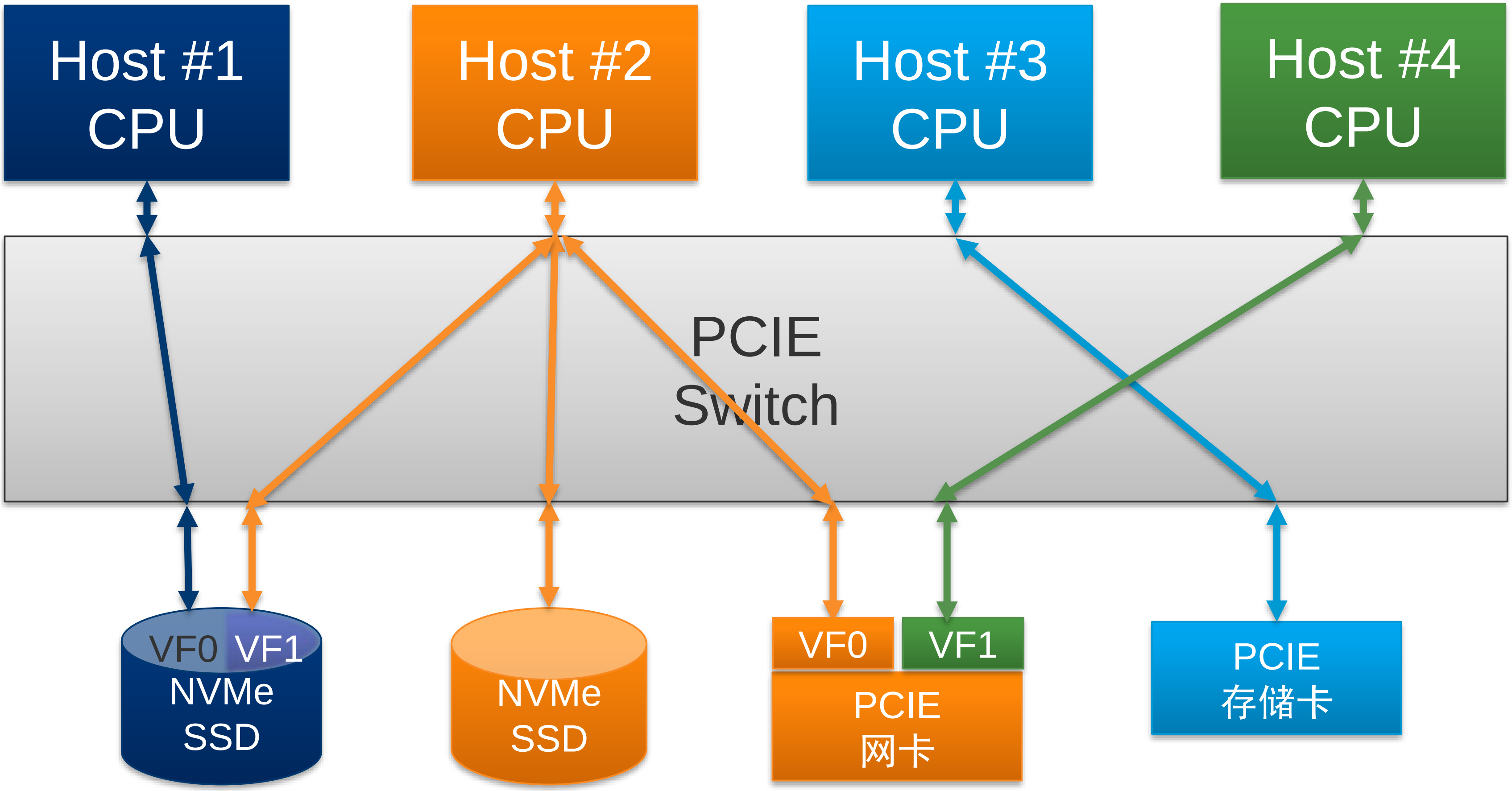


PCIE Switch能做什么——多机互联



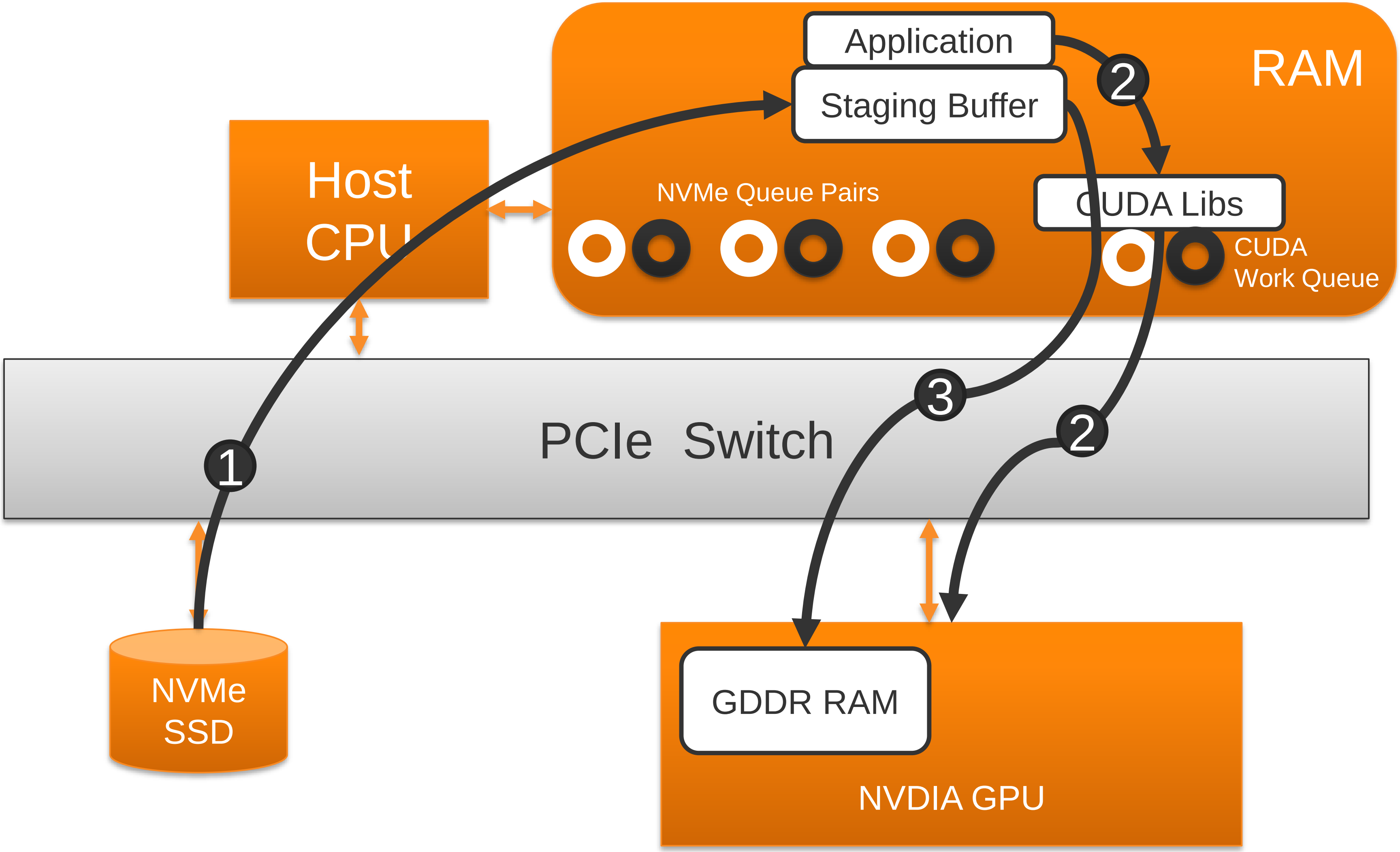
Microsemi PCIE Switch最大支持48台主机互联

PCIE Switch能做什么——共享IO

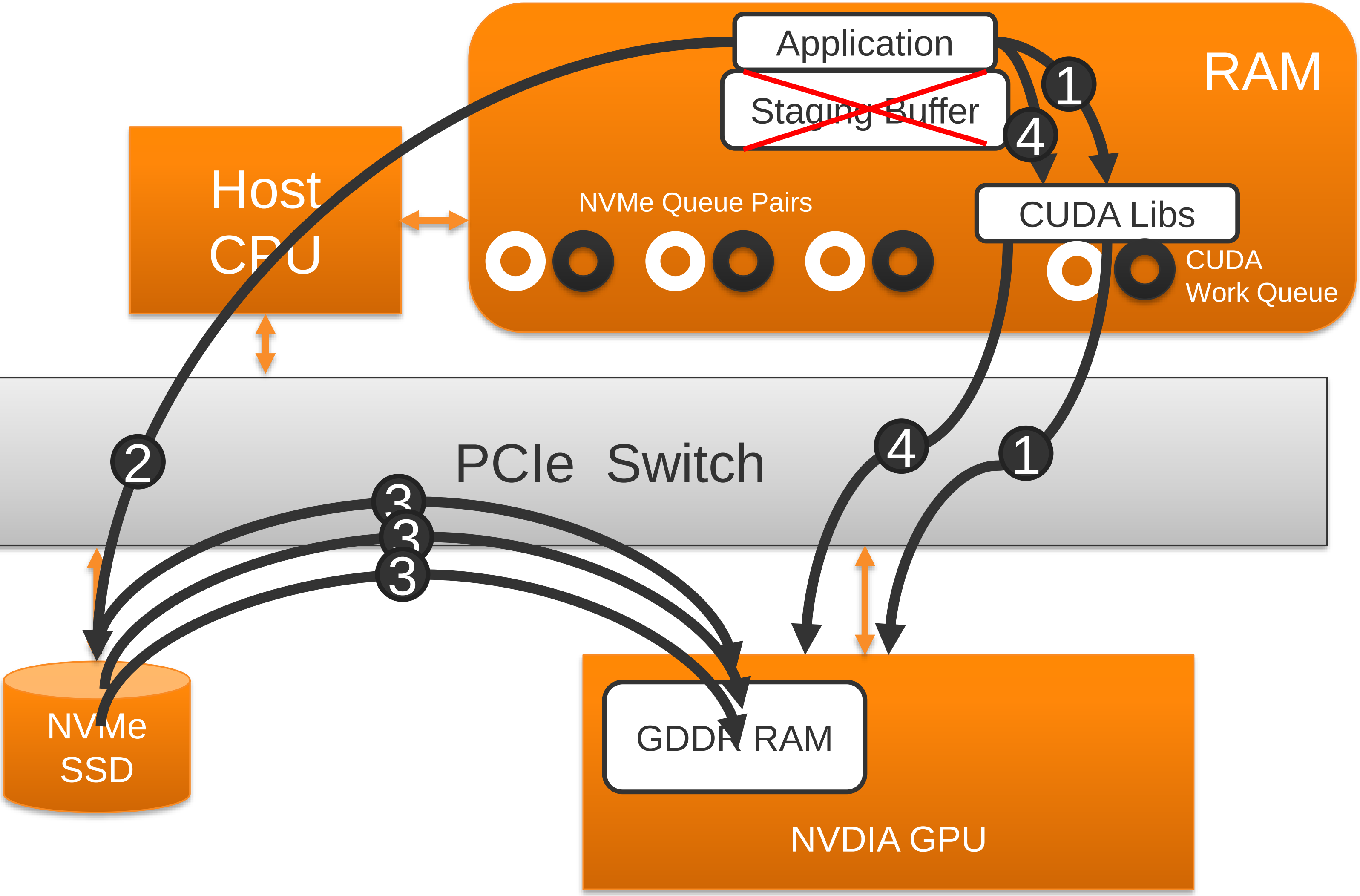


将支持SRIOV的PCIE设备透明转换为MRIOV模式

PCIE Switch能做什么——P2P传输



PCIE Switch能做什么——P2P传输



利用P2P GPU Direct加速图像搜索过程

数据读取速度	带宽(GB/s)	主机RAM相对使用率
传统做法	1.90	5230
P2P	**2.50**	**1**

图像处理速度	HDD	SDD	
	兆像素/秒	兆像素/秒	瓶颈点
CPU	77.0	122.8	CPU
CUDA	95.1	312.5	DRAM
P2P	**N/A**	**534.2**	**GPU**

实现P2P传输的条件

- 支持将MMIO BAR注册为DAX块设备的Linux内核。Microsemi开发了参考代码，对Linux内核有88行的变更。从而可支持将 DAX设备地址空间作为DMA的源端。

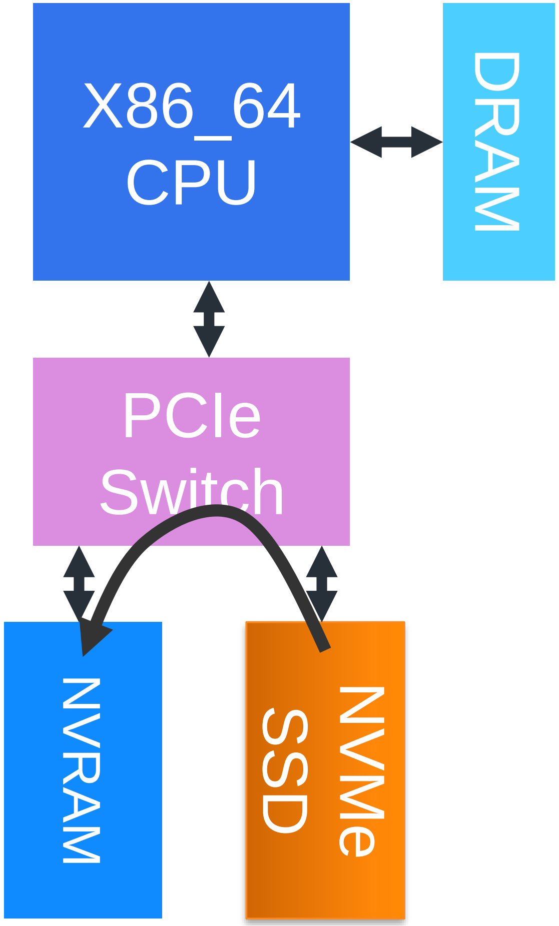
- CUDA 6.0 以上版本， 支持GPU Direct P2P传输

- 将DMA过程中的get_user_pages()， 以及put_pages()下游代码进行变更。通过对应的DAX设备的IOCTRL 下发P2P DMA传输。#define NVME_IOCTL_SUBMIT_GPU_IO _IOW('N', 0x45, struct nvme_gpu_io)

应用场景: NVMe SSD <-> NVRAM

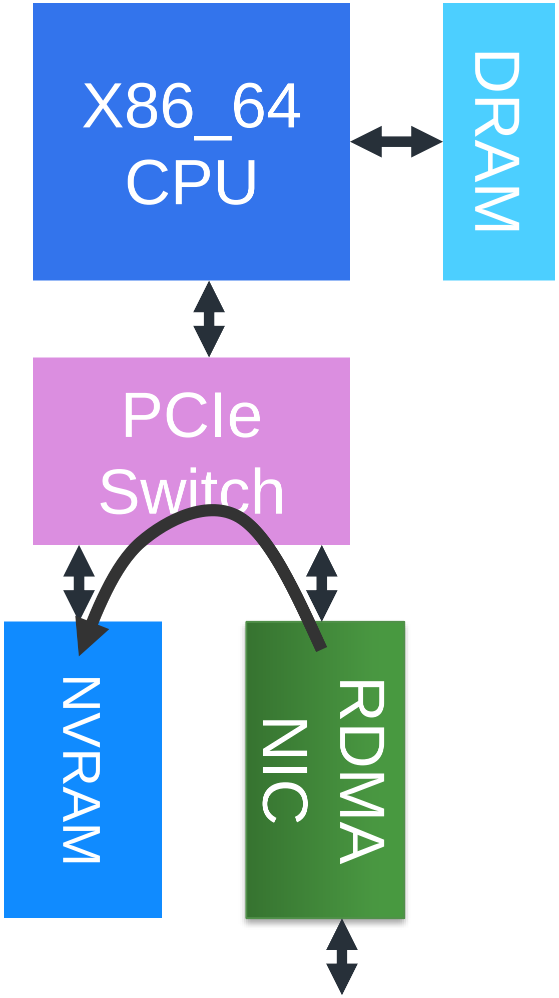
- NVRAM作为写缓存，NVMe SSD直接从NVRAM中读取数据并写入Flash， bypass本地CPU

- 可以使用NVRAM DAX设备提供的mmap()将文件映射到NVRAM锁对应的内存区域， NVMe SSD直接读写该区域。



应用场景: RDMA NIC <-> NVRAM

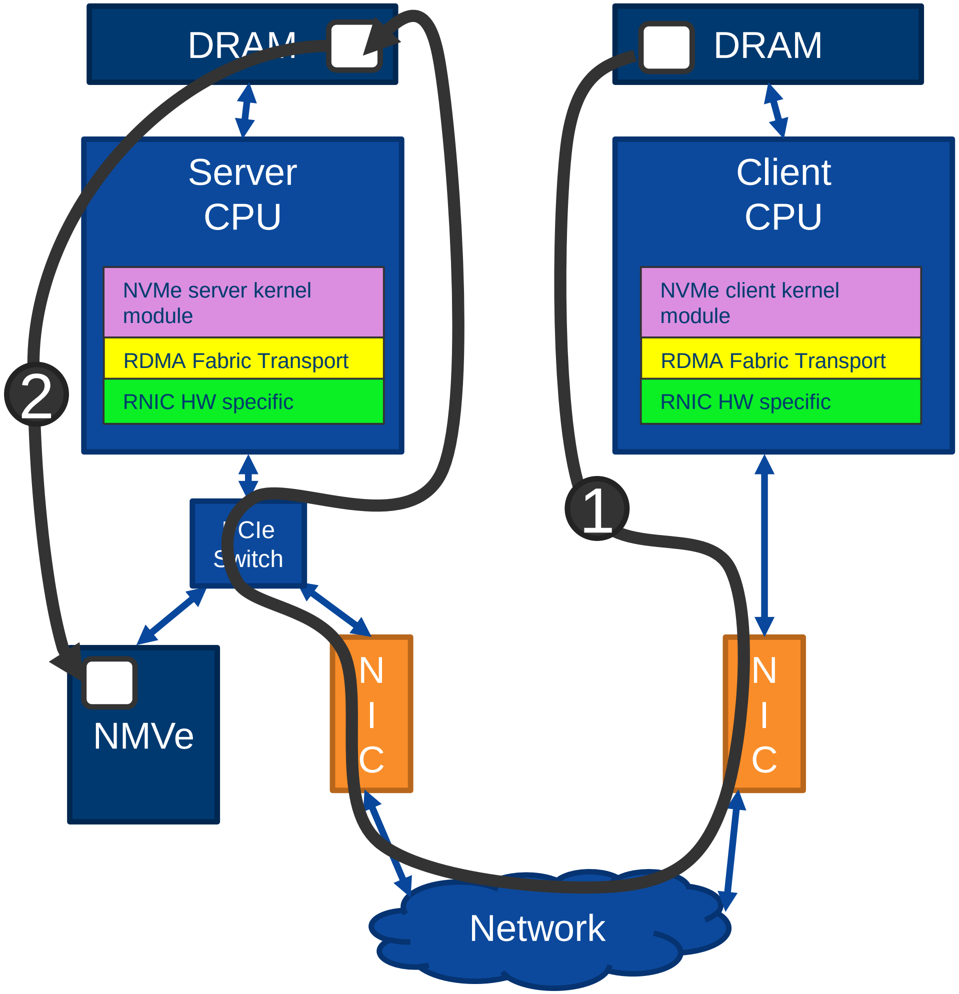
- 对端主机向本端NVRAM直接推送数据， 数据传送过程bypass两端的CPU
- 可以使用NVRAM DAX设备提供的mmap()将文件映射到对应的内存区域， 对端RDMA访问本端文件



应用场景: NVMe over Fabric with RDMA

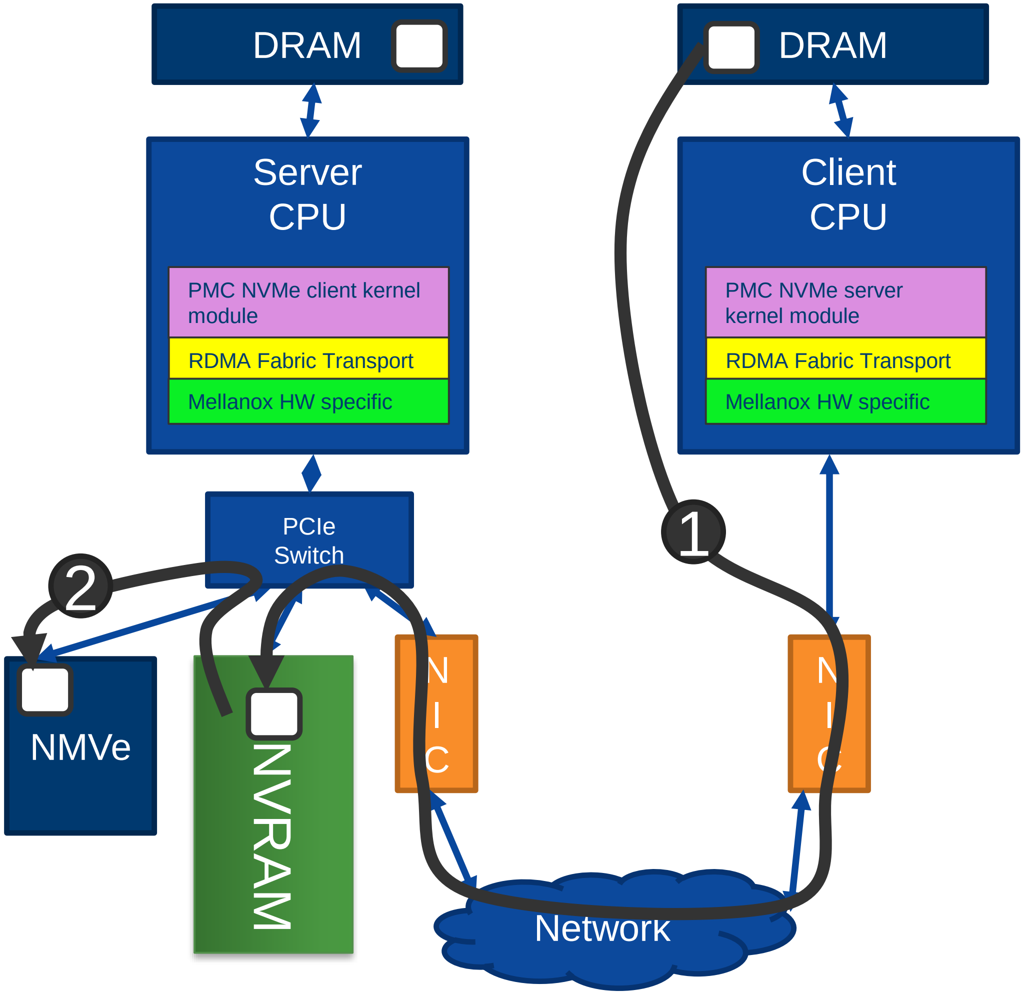
- NVMe Initiator端与Target端预先注册好双方各自的Memory Region，将对应的NVMe Queue映射到RNIC的Queue Pair，采用RDMA交互指令及数据，

- NVMe Target端程序接收到IO及数据之后，经过处理，向本地NVMe SSD发起IO读写请求。



应用场景: NVMEoF with RDMA & Cache & P2P

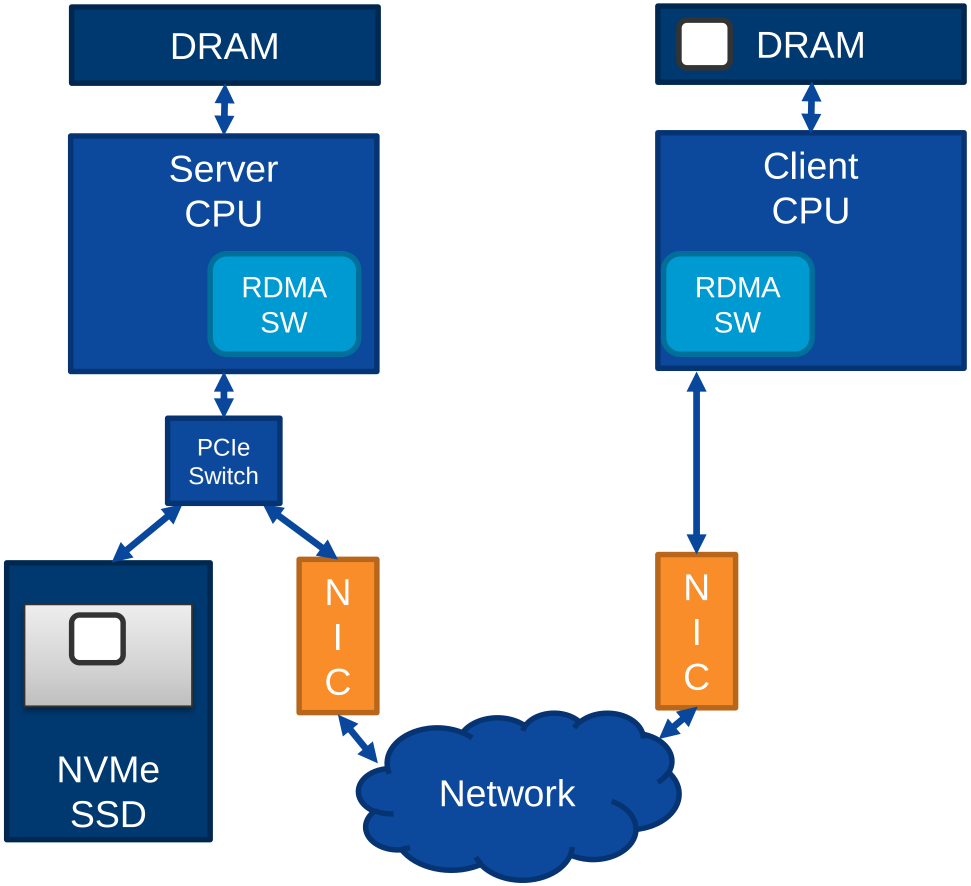
- NVMe Initiator端与Target端预先注册好双方各自的Memory Region, 其中一方落入NVRAM空间。将对应的NVMe Queue映射到RNIC的Queue Pair, 采用RDMA交互指令及数据。
- NVRAM作为写缓存，可降低全固态阵列的时延抖动。
- NVMe Target端程序接收到IO及数据之后, 向本地NVMe SSD发起IO读写请求，在数据传输时，NVMe SSD直接从NVRAM中将数据读出，bypass CPU。



应用场景: NVMEoF with RDMA & CMB & P2P

- NVMe CMB作为RNIC的MR，远端将指令和数据直接通过RDMA写入CMB。远端直接读写本地NVMe盘。

- NVMe IO completion消息依然需要本地代码处理。可以在NVMe盘固件中做开发支持RDMA verb，从而可bypass本地CPU。



Thank YOU!

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