The Linux Storage Stack Diagram version 4.0, 2015-06-01 outlines the Linux storage stack as of Kernel version 4.0 Fibre Channel mmap (anonymous pages) Applications (processes) LIO read(2) chmod(2 vfs_writev, vfs_readv, .. **VFS** Block-based FS Pseudo FS Special Network FS purpose FS Direct I/O Page (O DIRECT) cache target_core_file Stackable FS target_core_iblock userspace (e.g. sshfs) target_core_user target_core_pscsi network stackable (optional) struct bio sector on disk sector cnt bio vec cnt bio vec index bio vec list Devices on top of "normal" BIOs (block I/Os) BIOs (block I/Os) block devices (drbd) device mapper (mdraid) **bcache** userspace BIOs BIOs V BIOs **Block Layer** I/O scheduler blkmq Maps BIOs to requests multi queue hooked in device drivers noop Software (they hook in like stacked queues devices do) deadline Hardware Hardware dispatch dispatch Request based drivers BIO based drivers Request based drivers Request-based device mapper targets dm-multipath SCSI mid layer sysfs (transport attributes) /dev/zram* /dev/rbd* /dev/mmcblk*p* /dev/rssd* /dev/skd* /dev/vd* scsi-mq /dev/nullb* SCSI upper level drivers /dev/nvme*n* /dev/rsxx* /dev/sda) (/dev/sd*) Transport classes scsi_transport_fc /dev/sr* /dev/st* null_blk virtio_blk) mtip32xx nvme (zram) (mmc) (skd) scsi_transport_sas **→** network scsi transport ► memory SCSI low level drivers megaraid_sas (iscsi_tcp) (virtio_scsi (ahci) (ata_piix) (... mpt3sas (lpfc vmw pvscsi aacraid network para-virtualized SCSI (HDD) PMC-Sierra Micron PCle card nvme device stec mobile device flash memory RAID virtio_pci HBA VMware's para-virtualized SCSI LSI 12Gbs Adaptec RAID Emulex HBA SD-/MMC-Card IBM flash adapter

Physical devices