



Android External Storage

Architecture and implementation

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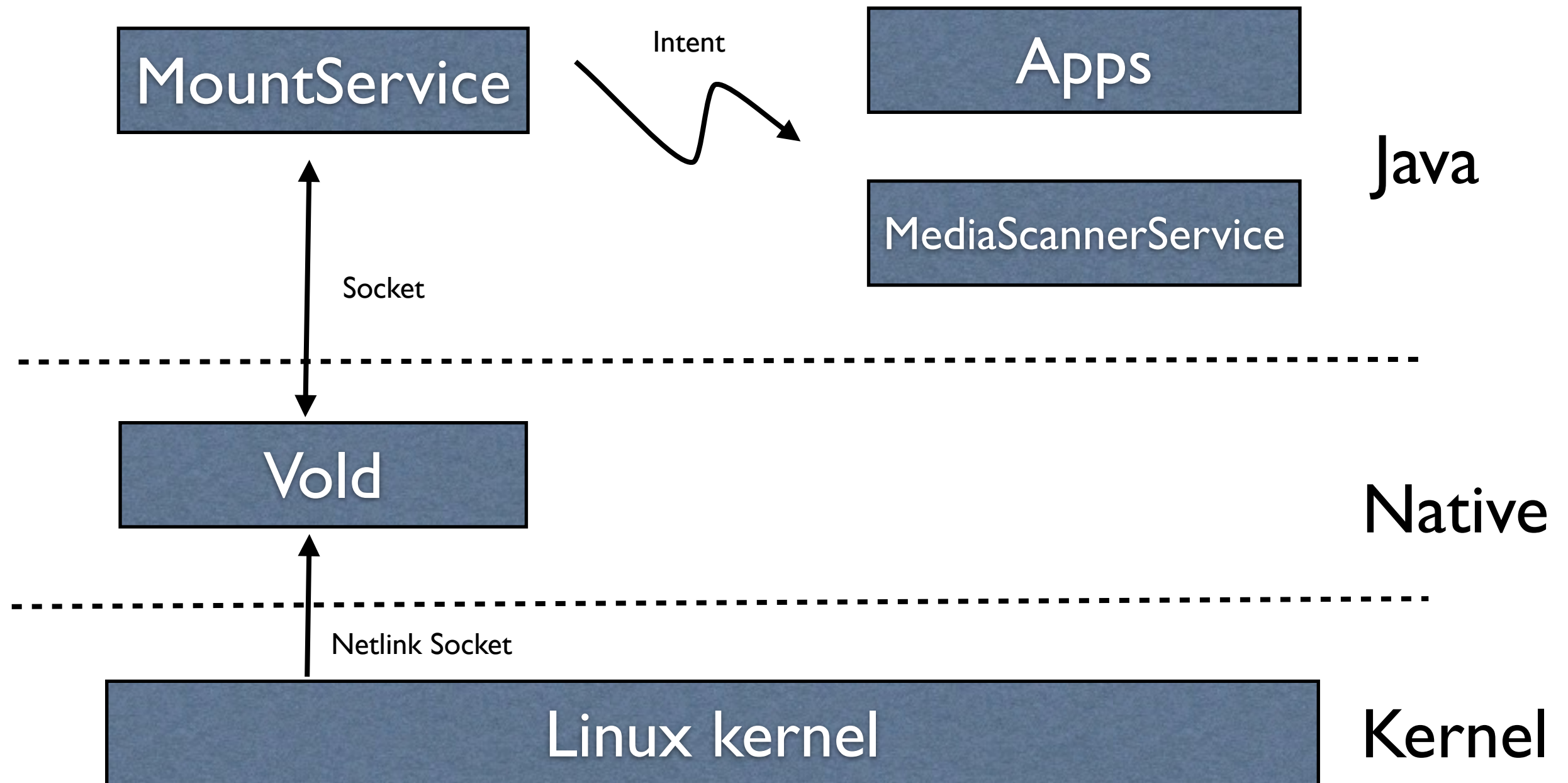
Agenda

- External storage in Android 4.2
- Vold, MountService and their companions
- New features we implement
- Setup instruction
- Future plan

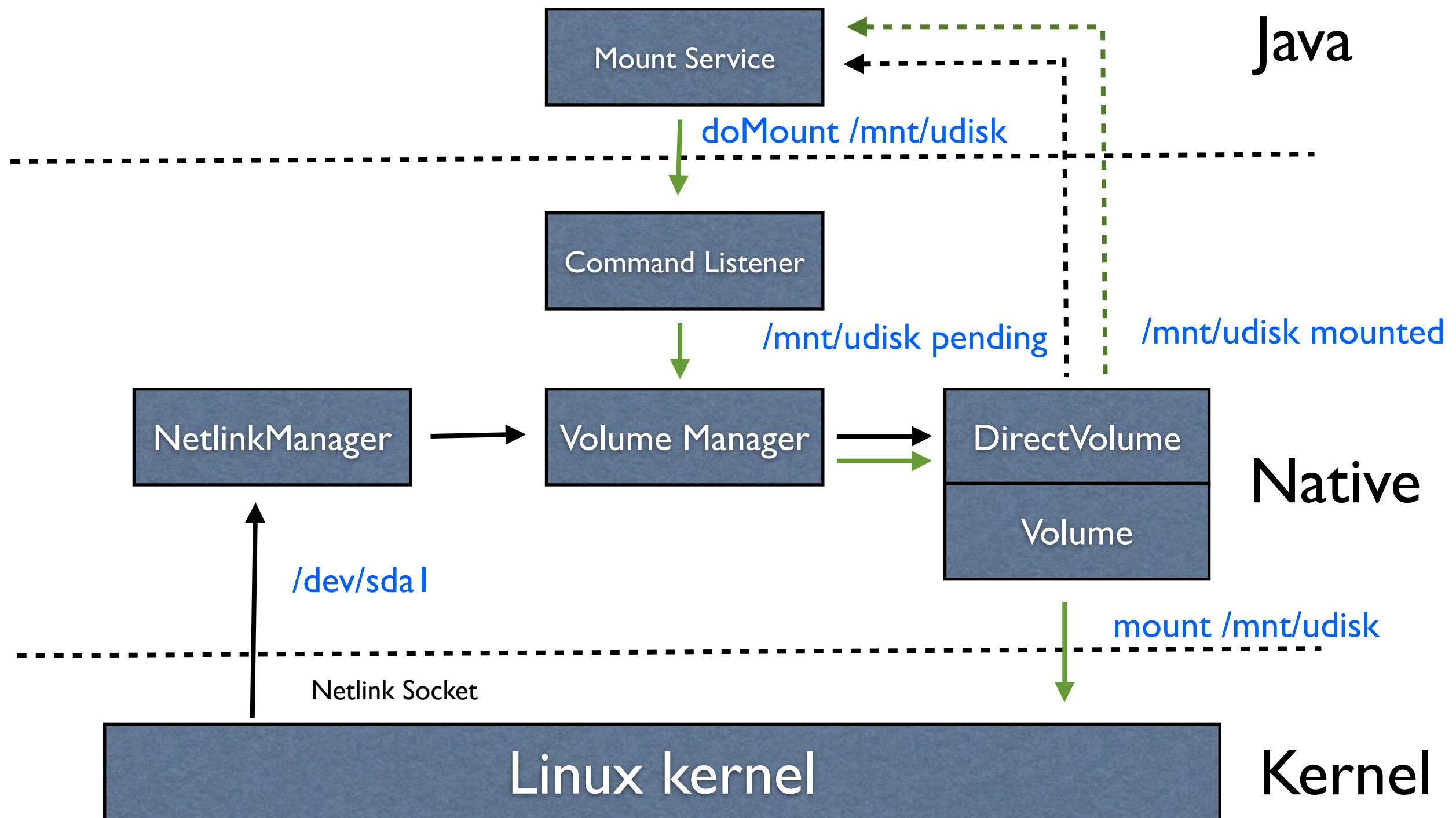
External Storage in Android 4.2

- Primary external storage
 - Only one, cannot change
 - External APPs installed location
 - Exposed to Android SDK API
- Secondary external storage
 - Multiple, used as data storage
 - Apps know them by intent

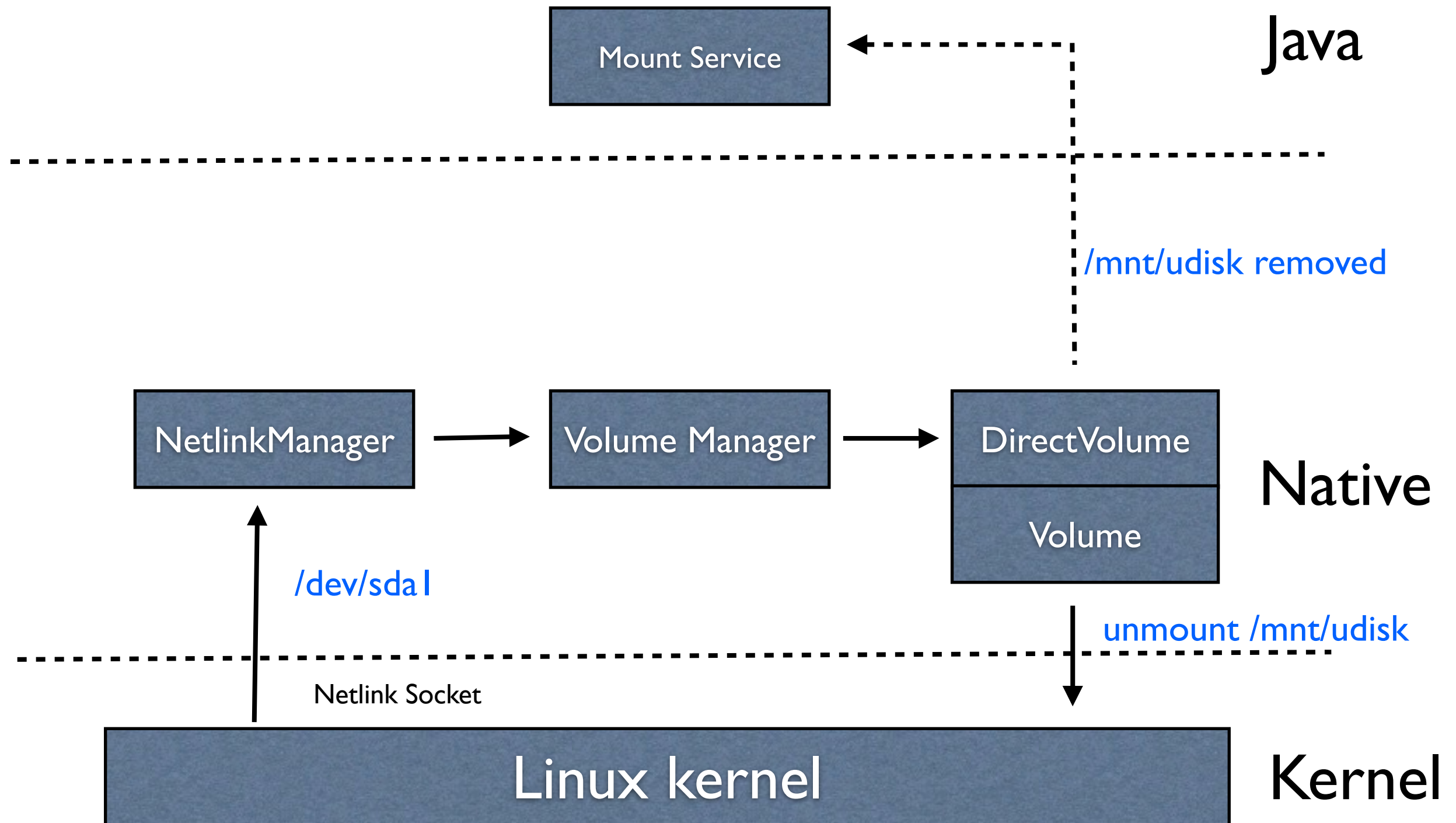
Architecture



Mount Process



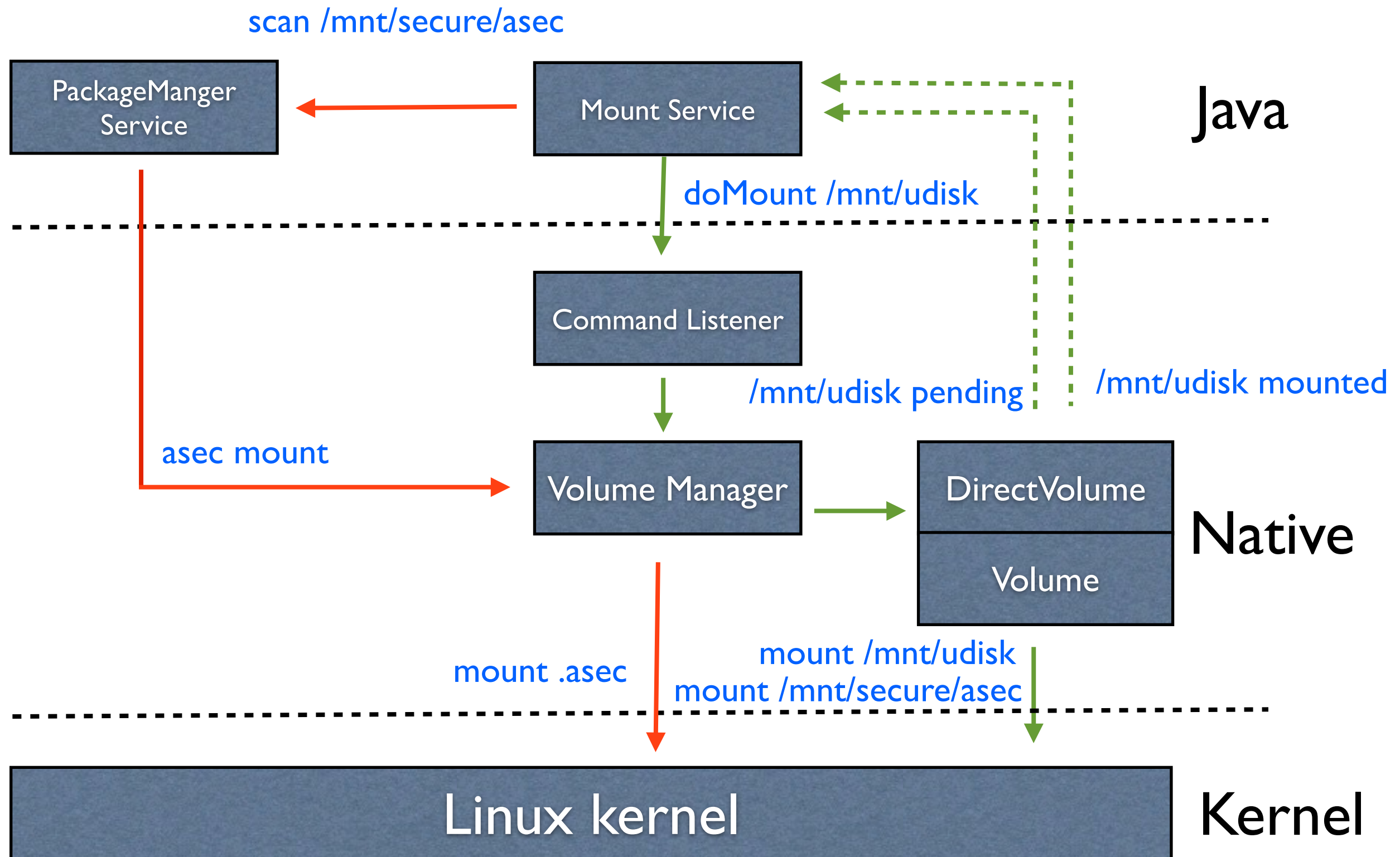
Unmount Process



Primary External Storage

- environment variable
 - `EXTERNAL_STORAGE`
- `mount /mnt/secure/asec/ as tmpfs`
 - contains `.asec` files
 - `./android/secure` on physical device
 - loop device, each file occupied one mount point
 - `/dev/block/dm-xxxxx-l`

Mount ASEC



Configuration Files

- Mount Service

- storage_list.xml

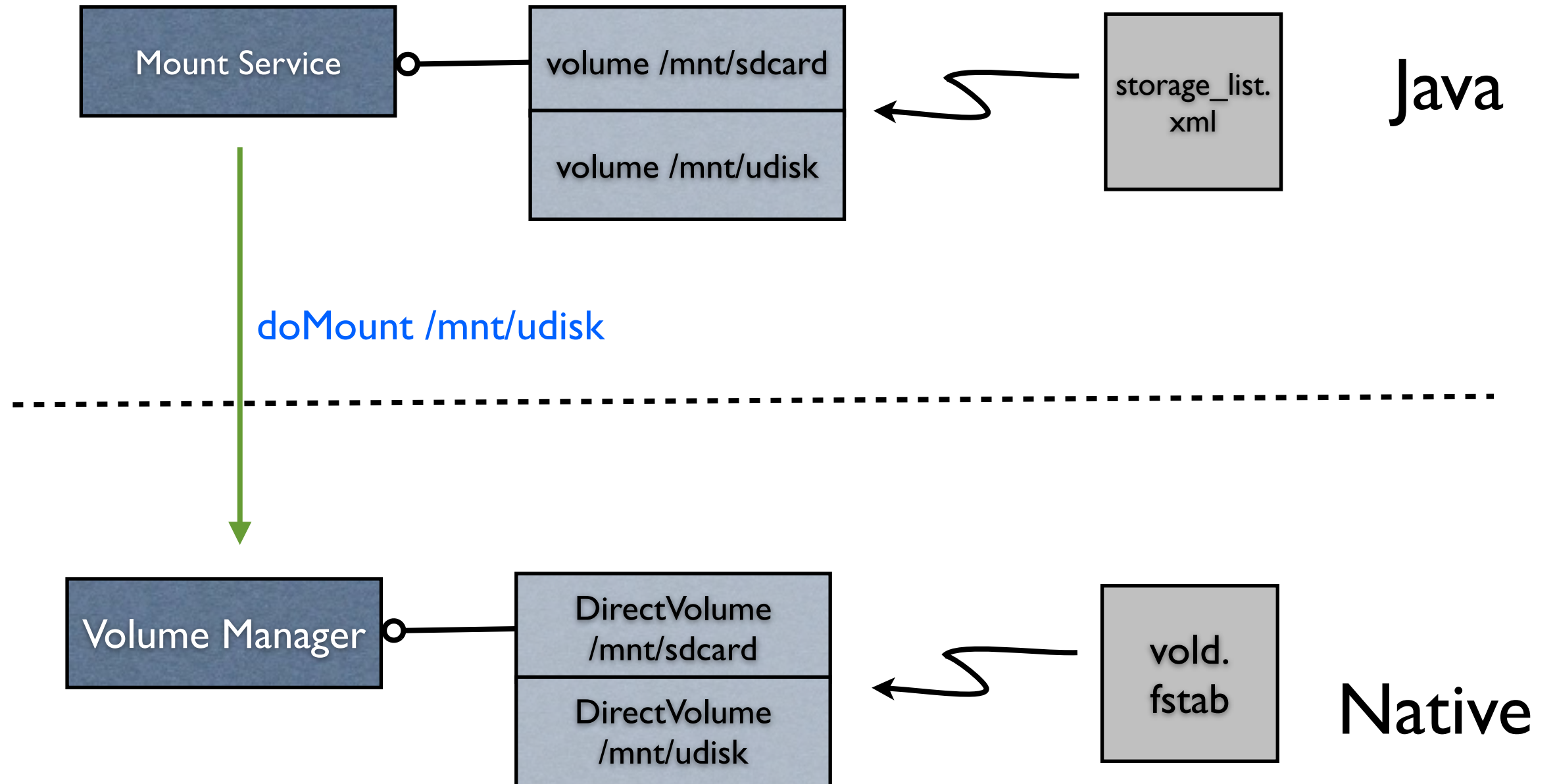
```
<storage android:mountPoint="/mnt/udisk"  
        android:storageDescription="@string/sd_card"  
        android:removable="true"  
        android:primary="true" />
```

- Vold

- vold.fstab

```
dev_mount sdcard /storage/sdcard auto /devices/platform/rtksdio/mmc_host/mmc0  
dev_mount disk /mnt/udisk auto /devices/platform/xhci-hcd/usb1 /devices/platform/xhci-hcd/usb2
```

Configurations



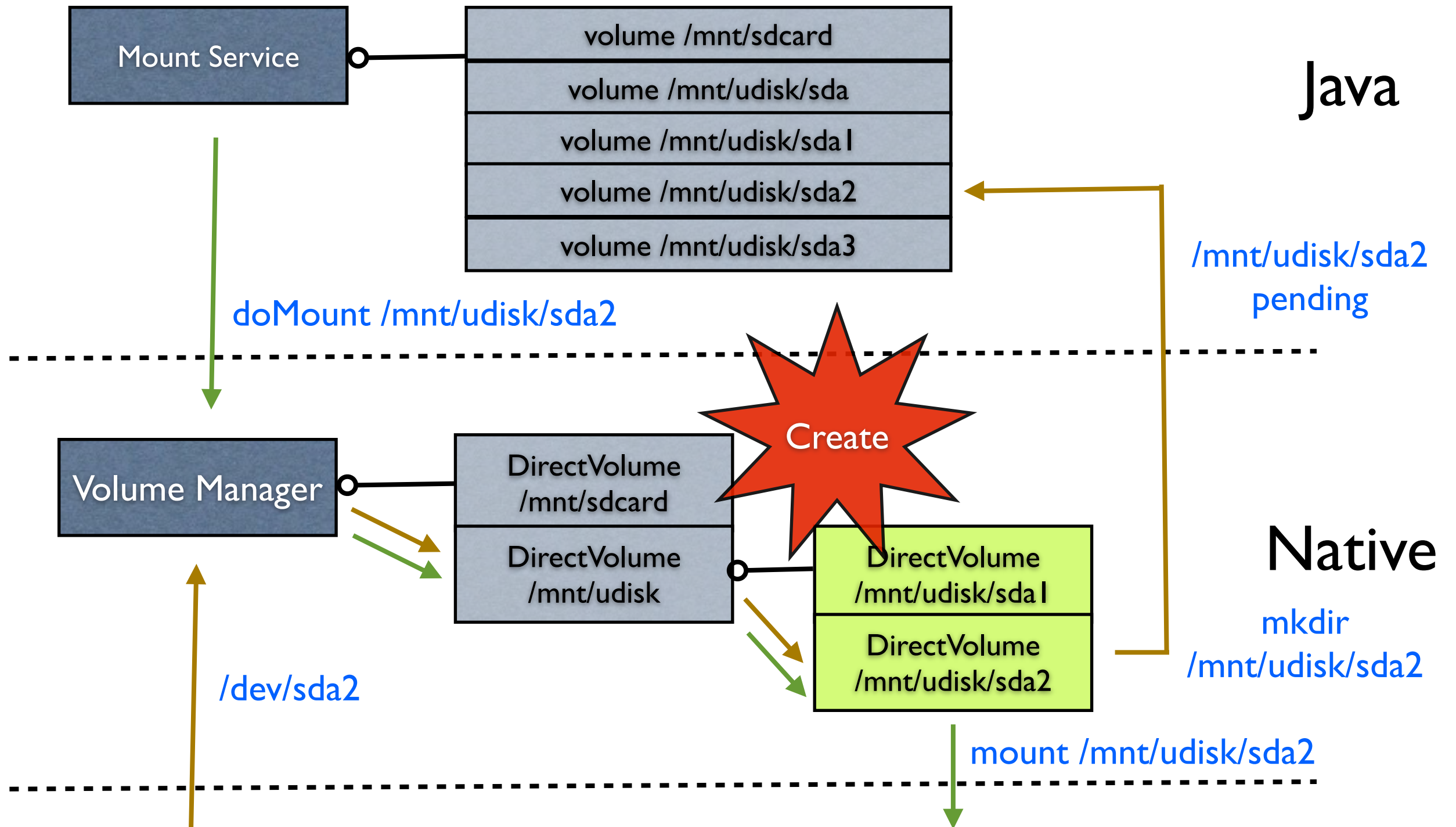
Our New Features

- Multi-partition and disk support
- Dynamic primary storage simulation
- Mount samba share

Design Goal

- Comply Android design
- Change as less code as possible
- New feature not change system behaviors
- Clarify each component's function

Support Multiple Disk



Dynamic Primary Storage

- MountService explicitly mount a volume as primary

- When no primary volume is mounted
- Mount when boot complete will mount path which EXTERNAL_STORAGE points first

- Vold just follow

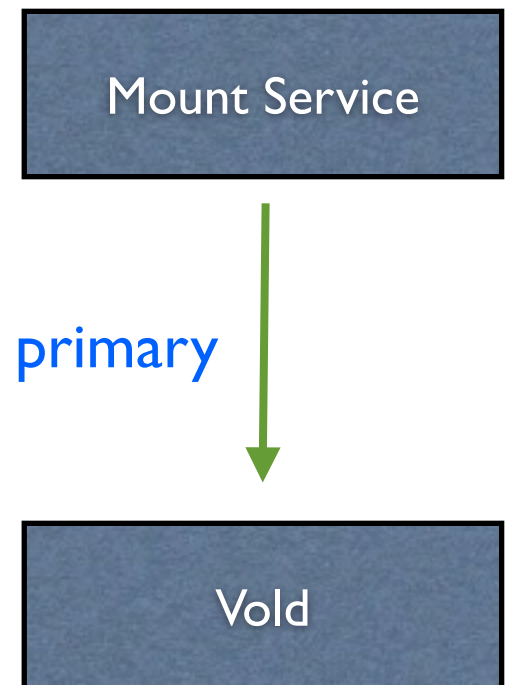
- ignore EXTERNAL_STORAGE

`mount /mnt/udisk primary`

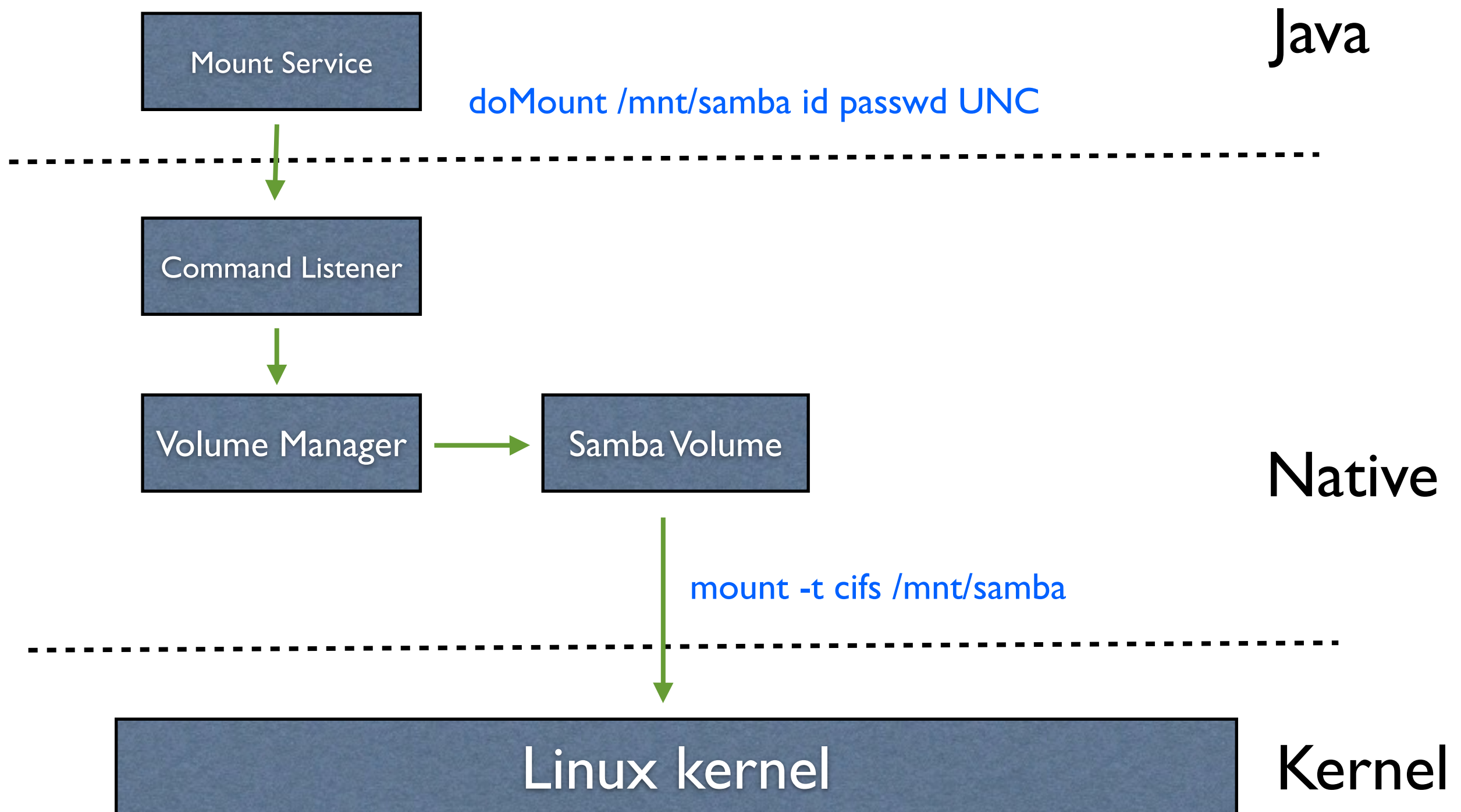
- In -s /mnt/sdcard & /sdcard

- Android API behavior changes!

- `Environment.getExternalStorageDirectory()`



Mount Samba



Set Up Instruction

- storage_list.xml
- vold.fstab
- init.rc
 - mkdir, symlink related path (/mnt/udisk, etc.)
 - EXTERNAL_STORAGE
 - EMULATED_STORAGE_SOURCE
 - EMULATED_STORAGE_TARGET

Important System Property

ro.rtk.storage.usb_mp	Path support multi-disk
ro.rtk.storage.simulate_sd	Dynamic set primary storage
ro.rtk.storage.set_perm	change mount file permission
ro.rtk.storage.disable_dfolder	Do not create default folders

One More Thing

- Our Vold also responsible for driver loading
 - root privilege
 - handle uevent
 - Handle wireless dongle driver
- `ro.rtk.driver.autoload=1`

Future Plan

- Increase fsck speed
- Mount asec files from all disks
- Separate rule and mount entities in Vold
 - Make DirectVolume more clear
- Unmount disk won't kill processes

Q & A

