Using Allocation Classes

ZFS* User Conference

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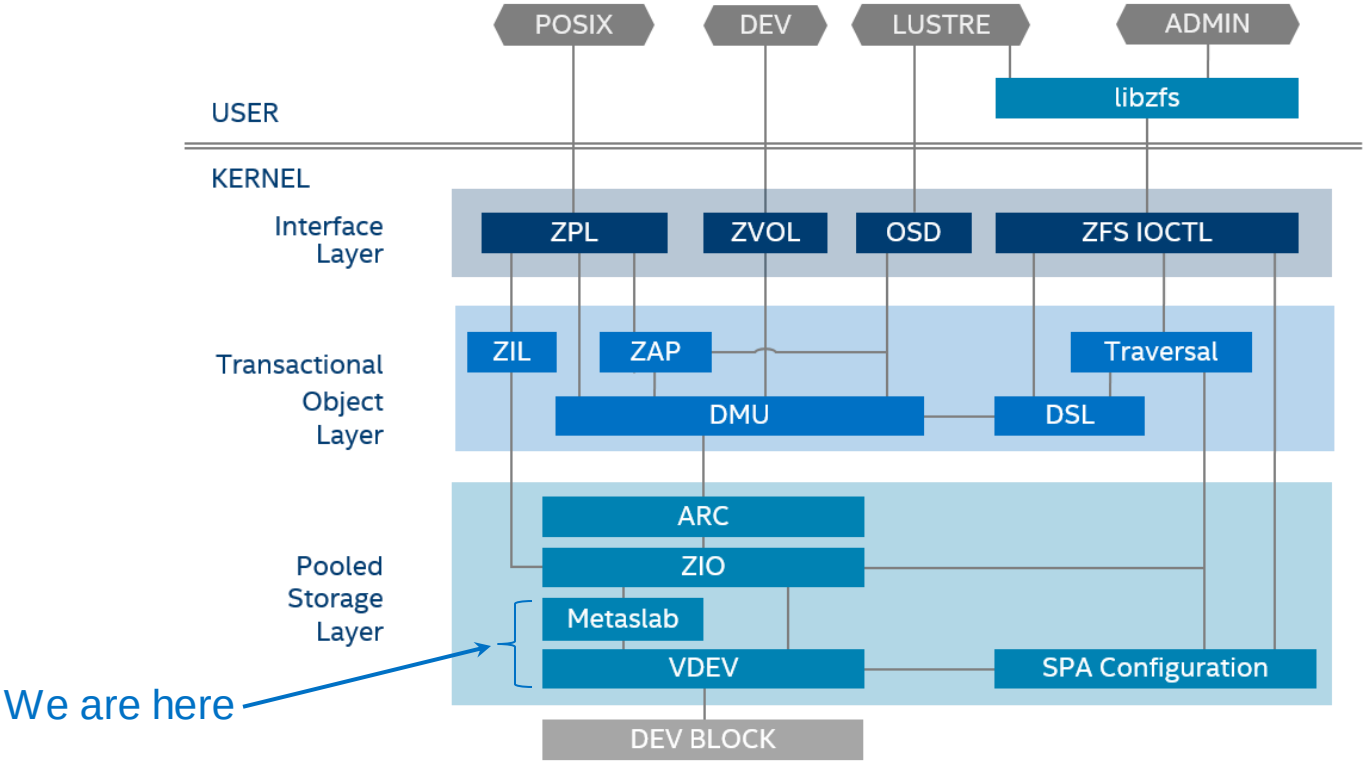
Using Allocation Classes

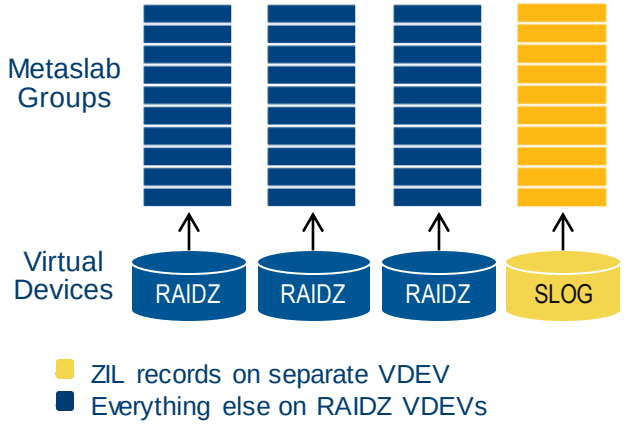
- SLOG Background
- SLOG Extensions
- Allocation Classes
- Management CLI

ZFS Block Allocation



Separate Log (SLOG)

- ZIL data uniqueness
  - Highly transient (don't worry about holes)
  - Want to involve all metaslabs
  - Want low latency (roving first-fit and wrap)
- SLOG allows different devices and allocation policies for ZIL data record
- Everything else uses primary VDEVs
- Can be stripped and/or mirrored

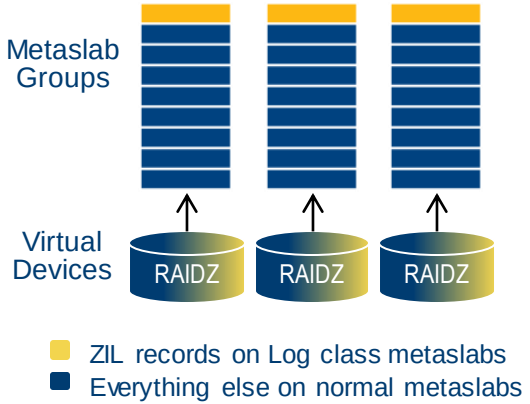


New SLOG Variation

- What if using a virtual LUN, or due to hardware constraints cannot have a dedicated SLOG?
- Still beneficial to isolate the transient ZIL data from all other allocations

Solution:

- Set aside one metaslab per top-level VDEV to service log data
- Introduces new concept called *VDEV Segregation*



Example: `zpool create -o segregate_log=on dozer raidz sda sdb sdc sdd sde`

Allocation Classes
(Variation #2)

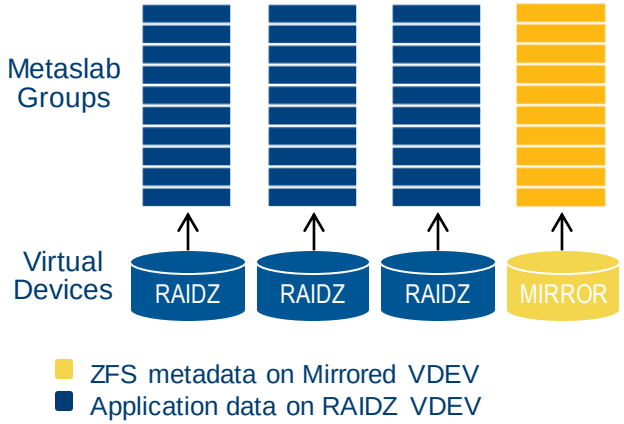
In addition to ZIL data, what other categories might we want to isolate?

- dedup, metadata, small blocks
- Two ways to opt in
  - *Dedicated* VDEVs (just like SLOG)
  - *Segregated* VDEVs
- feature@allocation_classes

Class	Designation
`Normal`	Any block type
`Log`	ZIL records
`Dedup`	DDT blocks
`Metadata`	Pool/Filesystem Metadata
`Small Blocks`	Small block sizes (32K)

Dedicated Class VDEV

- Enables different allocation policies for each allocation class
- All VDEV metaslabs dedicated to a specific allocation class
  - Application data uses RAIDZ VDEV
  - Metadata or small files use mirrored VDEV
- Opt-in during create with a class designation:
  - log
  - metadata
  - smallblks



Dedicated VDEV CLI

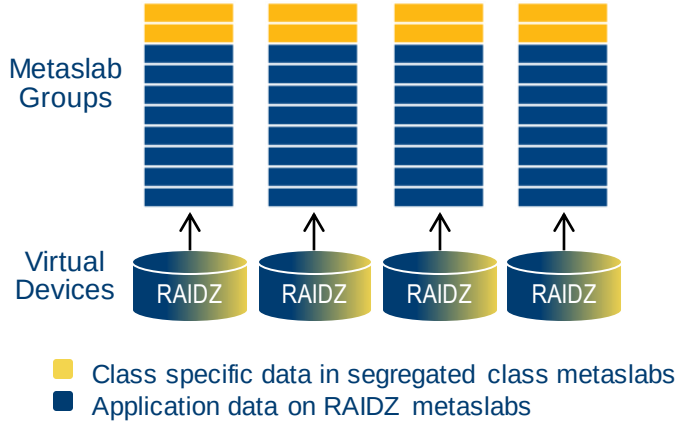
Create

```
zpool create <pool> <main-vdev>… <alloc-class> mirror <disks>…
```

```
# zpool create dozer \
  raidz1 sda sdb sdc sdd sde \
  raidz1 sdf sdg sdh sdi sdj \
  metadata mirror sdk sdl \
  log mirror sdm sdn
```

Segregated VDEV

- When separate devices for classes not feasible
- Set aside some metaslabs for specific class
- Application data is allocated on different metaslabs from the ZFS metadata
- Opt-in with a pool property:
  - segregate_metadata
  - segregate_smallblks
  - segregate_log
- dRAID -- metadata metaslabs are backed by mirror while normal class is backed by RAID



Segregated VDEV CLI

Create

```
zpool create <pool> -o segregate_[class]=on raidz2 <disks>…
```

```
# zpool create dozer \
  -o segregate_metadata=on \
  raidz1 sda sdb sdc sdd sde \
  raidz1 sdf sdg sdh sdi sdj
```

Management CLI

Listing VDEVs

```
$ zpool status demo
  pool: demo
 state: ONLINE
  scan: none requested
config:
        NAME                    STATE     READ WRITE CKSUM
        demo                    ONLINE       0     0     0
          raidz1-0              ONLINE       0     0     0
            sda                 ONLINE       0     0     0
            sdb                 ONLINE       0     0     0
            sdc                 ONLINE       0     0     0
            sdd                 ONLINE       0     0     0
            sde                 ONLINE       0     0     0
          metadata:mirror-1     ONLINE       0     0     0
            sdf                 ONLINE       0     0     0
            sdg                 ONLINE       0     0     0
```

Management CLI

Checking Segregate Property

```
$ zpool list -o name,segregate_log,segregate_metadata,segregate_smallblks
NAME        SEGREGATE_LOG  SEGREGATE_METADATA  SEGREGATE_SMALLBLKS
demo                  off                  on                   on
```

Management CLI

Listing Class Allocation Stats

```
$ zpool list -C demo
                     Generic Blocks          Small Blocks      Metadata Blocks
NAME          SPACE  ALLOC  USING  SPACE  ALLOC  USING  SPACE  ALLOC  USING
------------  -----  -----  -----  -----  -----  -----  -----  -----  -----
demo          3.62T  46.2G  1.24%   696G  22.7G  3.26%   232G  1.26G  0.54%
  raidz1-0    3.62T  46.2G  1.24%   696G  22.7G  3.26%   232G  1.26G  0.54%
```

Management CLI

Observing Metaslabs

```
# zdb -m demo
Metaslabs:
        vdev          0   segregate
        metaslabs   145   offset              spacemap          free          class
        ---------------   ------------------  ---------------   ------------  --------
        metaslab      0   offset            0   spacemap     75   free   32.0G  smallblk
        metaslab      1   offset    800000000   spacemap     74   free   32.0G  smallblk
        metaslab      2   offset   1000000000   spacemap     73   free   32.0G  smallblk
        metaslab      3   offset   1800000000   spacemap      4   free   20.5G  smallblk
        . . .
        metaslab     29   offset   e800000000   spacemap      5   free   16.0G    normal
        metaslab     30   offset   f000000000   spacemap      6   free   16.0G    normal
        metaslab     31   offset   f800000000   spacemap     10   free   17.8G    normal
        metaslab     32   offset  10000000000   spacemap      0   free     32G    normal
        metaslab     33   offset  10800000000   spacemap      0   free     32G    normal
        metaslab     34   offset  11000000000   spacemap      0   free     32G    normal
        . . .
        metaslab    144   offset  48000000000   spacemap      0   free     32G    normal
```

Management CLI

Observing Metaslabs

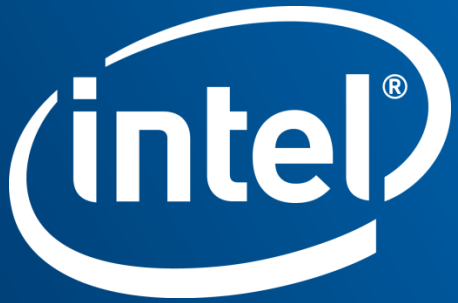
```
# zdb -mm [-P] demo

        Allocation Summary:       33180160 allocated
                  metadata:    2633216
                smallblks:   30546944
                    dedup:          0
                  generic:          0
```

Progress Update

- Work-in-progress pull request posted for community feedback

  https://github.com/zfsonlinux/zfs/pull/5182

- Intel CORAL project: using allocation classes with dRAID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