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# XFS Overview & Internals 07 – Extended Attributes

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# Extended Attributes

- Extended Attributes (EA) are a set of <name,value> pairs associated with an inode

- Who uses them?
  - Access Control Lists (ACL)
  - SELinux
  - Beagle indexer

- Name is a null terminated string <= 255 chars

- Value is binary data <= 64K

# EA Namespaces

- The EA set is typically divided into namespaces

- For Linux the namespace is the prefix of the EA name:
  - user
  - trusted
  - security
  - System

- For XFS, the namespace is encoded in bits in a flags field with these values:
  - “user” has value of 0x0000 – by default an attribute is in the user namespace

```
#define ATTR_ROOT       0x0002  /* use attrs in root (trusted) namespace */
#define ATTR_SECURE     0x0008  /* use attrs in security namespace */
#define ATTR_SYSTEM     0x0100  /* use attrs in system (pseudo) namespace */
```

- So for XFS, EAs are really a triple <name, value, flags>

# EA Command Line Interface

- attr package maintained by Andreas Gruenbacher and SGI
  - getfattr(1) for getting/listing EAs
  - setfattr(1) for setting and removing EAs,
  - Names are prefixed with the namespace
- attr command sets/removes/gets/lists EAs
  - Based on IRIX command, provides common interface for XFS EAs
  - Namespace specified with options
  - More closely models what XFS actually stores since names are the actual names

```
# getfattr -e hex -dm '.*' file1
   system.posix_acl_access=0x0200000001000600ffffffff040006...
   trusted.SGI_ACL_FILE=0x0000000400000001ffffffff0006...
# attr -Rl file1
   Attribute "SGI_ACL_FILE" has a 52 byte value for file1
```

# EA Ondisk Format

- The name can actually be binary data since it has a length field on disk
  - XFS kernel functions have been changed to handle binary names (used for future parent pointer EA's)

- XFS EA's are stored in a variety of forms according to how big they are
  - Local or short form
    - within the inode
  - Attribute-fork extents in either
    - a filesystem leaf block
    - btree form with node blocks and leaf blocks
  - Extent form
    - the EA value can be in a remote filesystem block if it's large

# EA Tuning

- If using ACLs, every file access will require an EA lookup
- For performance, it is important to keep the EA's within the inode in shortform
  - Only a single filesystem block needs to be read in.
  - ACLs are a good example where the access checks occur frequently
- To increase the chance of being in shortform
  - increase the inode size, and/or
  - enable attr2

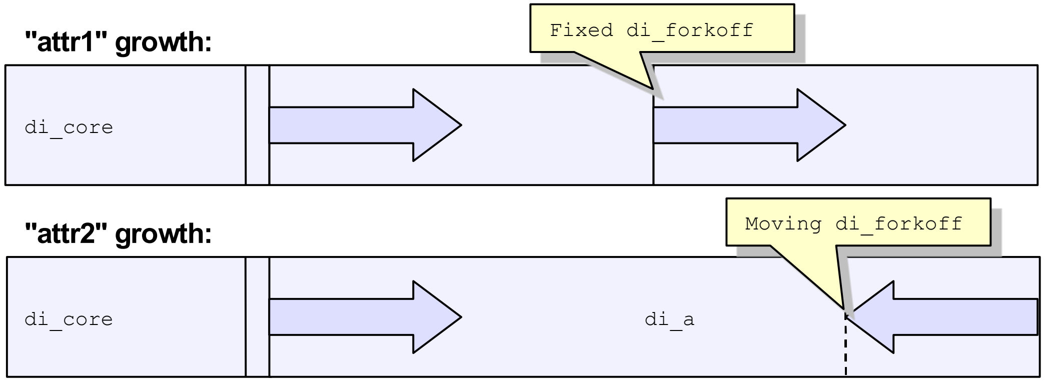
```
mkfs.xfs -i size=512,attr=2 device
```

- The short-form EA resides at the end of the inode and competes for space with the data extents.

# EA and Attr2

- Attr2 overcomes a restriction in the initial EA implementation that divided up the literal area at a fixed location (fork offset)

- With attr2 the fork offset is variable



# EA and Backup

- Cpio and tar do not backup and restore extended attributes
- If using extended attributes, an EA backup tool like xfsdump and xfsrestore must be used

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