Ext4: the reliable all-rounder

Ext4 (Fourth Extended File System) is a high-performance, journaling file system widely used in Linux environments. It is an evolution of its predecessors, **Ext3** and **Ext2**. Ext4 is the default file system for many Linux distributions, as it is battle-tested and a good choice for general purpose desktop computing needs.

Key features of Ext4 include:

1. **Journaling**: Like Ext3, Ext4 is a journaling file system, meaning it keeps a log (or journal) of changes to the file system before committing them to disk. This helps prevent data corruption in the event of a system crash or power failure, as the journal can be used to roll back or replay incomplete operations. Additionally, Ext4 uses checksums in the journal to improve reliability. This feature has a side benefit: it can safely avoid a disk I/O wait during journaling, improving performance slightly.
2. **Larger File and Volume Support**: Ext4 supports file sizes between 16 - 256 TiB and volumes up to 1 EiB, making it suitable for modern storage needs. This was a significant improvement over Ext3, which, depending on block size, was limited to 2 - 32 TiB volumes and 16 GiB - 2 TiB file sizes.
3. **Extents**: Extents replace the traditional block mapping scheme used by ext2 and ext3. An extent is a range of contiguous physical blocks, improving large-file performance and reducing fragmentation.
4. **Backward Compatibility**: Ext4 is backward compatible with Ext3, meaning you can mount an Ext3 file system as Ext4 and take advantage of the newer features without needing to reformat the partition.
5. **Delayed Allocation**: Ext4 provides better performance compared to Ext3, thanks to delayed allocation, which improves write performance and multi-block allocation, optimizing space usage. This further helps to reduce fragmentation.
6. **Extended Attributes**: Ext4 supports extended attributes, allowing additional metadata to be attached to files (e.g. security labels, file system flags, user tags). This is useful for extending file properties with arbitrary application metadata to offer advanced file management.
7. **Online Defragmentation**: Unlike Ext3, Ext4 provides the ability to perform online defragmentation, which allows the file system to be defragmented while the system is running, reducing the impact on performance.

Ext4 is a solid choice for every-day computing needs. It's simple, robust and well tested in the field. However, its developers have stated that Ext4 is just a stop-gap until more modern file systems like Btrfs mature and reach the same performance and robustness levels as Ext4.

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