OS Project 4

OS Team 7

Demo

- Team7-demo.mkv

gps_location (little endian)

- Define i_values in ext2_inode, ext2_inode_large (=>)
- Set values using le32_to_cpu, cpu_to_le32 in ext2_iget/write_inode

```
__le32  i_lat_integer;
__le32  i_lat_fractional;
__le32  i_lng_integer;
__le32  i_lng_fractional;
__le32  i_accuracy;
```

```
struct inode *ext2_iget (struct super_block *sb, unsigned long ino)
{
ei->i_loc.lat_integer = (signed)le32_to_cpu(raw_inode->i_lat_integer);
ei->i_loc.lat_fractional = (signed)le32_to_cpu(raw_inode->i_lat_fractional);
ei->i_loc.lng_integer = (signed)le32_to_cpu(raw_inode->i_lng_integer);
ei->i_loc.lng_fractional = (signed)le32_to_cpu(raw_inode->i_lng_fractional);
ei->i_loc.accuracy = (signed)le32_to_cpu(raw_inode->i_accuracy);
```

```
static int __ext2_write_inode(struct inode *inode, int do_sync)
{
raw_inode->i_lat_integer = cpu_to_le32(ei->i_loc.lat_integer);
raw_inode->i_lat_fractional = cpu_to_le32(ei->i_loc.lat_fractional);
raw_inode->i_lng_integer = cpu_to_le32(ei->i_loc.lng_integer);
raw_inode->i_lng_fractional = cpu_to_le32(ei->i_loc.lng_fractional);
raw_inode->i_accuracy = cpu_to_le32(ei->i_loc.accuracy);
```

```
struct gps_location {
  int lat_integer;
  int lat_fractional;
  int lng_integer;
  int lng_fractional;
  int accuracy;
};
```

ext2_set_gps_location
ext2_get_gps_location

- Add set_gps_location, get_gps_location in inode_operations
- Set set_gps_location = ext2_set_gps_location in ext2_file_inode_operations
- Set get_gps_location = ext2_get_gps_location in ext2_file_inode_operations
- Implement

```
int ext2_set_gps_location(struct inode *inode) {
        struct ext2_inode_info *ei = EXT2_I(inode);
        ei->i_loc = current_location;
        return 0; // return value????
}

int ext2_get_gps_location(struct inode *inode, struct gps_location *loc) {
        struct ext2_inode_info *ei = EXT2_I(inode);
        memcpy(loc, &ei->i_loc, sizeof(struct gps_location));
        return 0;
}
```

Permission

- geo_permission
  - Calculates distance between file's current location and device's current location
  - If two location can be same, returns 1. else returns 0.
- ext2_permission
  - If geo_permission fails, returns -EACCES.
  - Else, calls generic_permission and returns.

Calculate distance

- Assumptions
  - Earth is a perfect sphere
  - Earth's perimeter is 40,000km = 4 * 10^7 m

- Because we can't use cos, sin, 64bit division, we created it!
  - long long Div(long long a, long long b)
    - Implemented basic division algorithm in binary system
  - int cosine(long long a), sine(long long a)
    - Get cosine value using taylor expansion method
    - Function returns cos(a / 10^6), sin(a / 10^6) value

- Using above functions, we calculated (almost) correct distance between two points on earth.

System call(set/get_gps_location)

- set_gps_location
  - check input is valid / Change current_location
  - return 0 on success / -EINVAL on invalid location input.
- get_gps_location syscall
  - Check valid file, pathname, permission
  - return 0 on success
  - -ENOENT on invalid filepath
  - -EFAULT on invalid user pointer
  - -EINVAL on invalid path name
  - -EACCES on no permission
  - -ENODEV on invalid gps position.

EXTRA: Ext4

- Quite similar to ext2 file system case, but there are some differences
  - We don’t need to explicitly add variable to inode struct: Use xattr!
    - xattr: Extra attributes are stored here.
  - ext4 file system is mainly used in booting kernel/other important parts
    - We have to skip location check for those cases.
    - When user is root/there is no location information set, skip location check process.
  - We can test this file system without loopback device.

- Some implementations were changed:
  - ext4_set_gps_location
  - ext4_get_gps_location
  - ext4_permission
  - ext4_package_mkwrite

EXTRA: Ext4

- Ext4_set_gps_location
  - Set gps_location value using ext4_xattr_set function
- Ext4_get_gps_location
  - Get gps_location value using ext4_xattr_get function
  - If there was no value set, we can know it by error value returned.
- Ext4_permission
  - Check inode’s access location permission with some exceptions.
  - If user is root or there is no file location set, we don’t check permission for location.
  - Also checks generic_permission.
- Ext4_page_mkwrite
  - Functions(ex4_set_gps_location, ext4_get_gps_location, ext4_permission) are added here.
  - Added set_gps_location(inode) after update_time function called