Lab9

filesystem的补充，写过第三个大作业后理解的很快

Bigfile

实际上就是实现文件系统的二级映射

首先修改fs.h（磁盘）和file.h（文件系统）中inode结构，给二级映射页表留个位置

```
//二级索引，256*256（block1024，每个索引都是uint）
#define SECONDDIRECT (BSIZE / sizeof(uint))*(BSIZE / sizeof(uint))
#define MAXFILE (NDIRECT + NINDIRECT+SECONDDIRECT)

// On-disk inode structure
struct dinode {
   short type;                // File type
   short major;               // Major device number (T_DEVICE only)
   short minor;               // Minor device number (T_DEVICE only)
   short nlink;               // Number of links to inode in file system
   uint size;                  // Size of file (bytes)
   uint addrs[NDIRECT+2];    // Data block addresses
};
```

```
// in-memory copy of an inode
struct inode {
   uint dev;                // Device number
   uint inum;               // Inode number
   int ref;                  // Reference count
   struct sleeplock lock; // protects everything below here
   int valid;               // inode has been read from disk?

   short type;             // copy of disk inode
   short major;
   short minor;
   short nlink;
   uint size;
   uint addrs[NDIRECT+2];
};
```

然后仿照前面的bmap映射写二级映射

```
static uint
bmap(struct inode *ip, uint bn)
{
   uint addr, *a;
   struct buf *bp;

   if (bn < NDIRECT)
```

```
    {
        if ((addr = ip->addrs[bn]) == 0)
            ip->addrs[bn] = addr = balloc(ip->dev);
        return addr;
    }
    // 一级索引
    bn -= NDIRECT;

    if (bn < NINDIRECT)
    {
        // Load indirect block, allocating if necessary.
        if ((addr = ip->addrs[NDIRECT]) == 0)
            ip->addrs[NDIRECT] = addr = balloc(ip->dev);
        bp = bread(ip->dev, addr);
        a = (uint *)bp->data;
        if ((addr = a[bn]) == 0)
        {
            a[bn] = addr = balloc(ip->dev);
            log_write(bp);
        }
        brelse(bp);
        return addr;
    }

    // 二级索引
    bn -= NINDIRECT;
    if (bn < SECONDDIRECT)
    {
        if ((addr = ip->addrs[NDIRECT + 1]) == 0)
            ip->addrs[NDIRECT + 1] = addr = balloc(ip->dev);
        bp = bread(ip->dev, addr);
        a = (uint *)bp->data;
        // 检测有没有一级索引
        if ((addr = a[bn / NINDIRECT]) == 0)
        {
            a[bn / NINDIRECT] = addr = balloc(ip->dev);
            log_write(bp);
        }
        brelse(bp);

        // 检测有没有二级索引
        bp = bread(ip->dev, addr);
        a = (uint *)bp->data;
        if ((addr = a[bn % NINDIRECT]) == 0)
        {
            a[bn % NINDIRECT] = addr = balloc(ip->dev);
            log_write(bp);
        }
        brelse(bp);
        return addr;
    }
    panic("bmap: out of range");
}
```

最后记得改一下itrunc，抄前面的代码就行

```
void itrunc(struct inode *ip)
{
    int i, j;
    struct buf *bp, *secbp;
    uint *a, *a2;

    for (i = 0; i < NDIRECT; i++)
    {
        if (ip->addrs[i])
        {
            bfree(ip->dev, ip->addrs[i]);
            ip->addrs[i] = 0;
        }
    }

    if (ip->addrs[NDIRECT])
    {
        bp = bread(ip->dev, ip->addrs[NDIRECT]);
        a = (uint *)bp->data;
        for (j = 0; j < NINDIRECT; j++)
        {
            if (a[j])
                bfree(ip->dev, a[j]);
        }
        brelse(bp);
        bfree(ip->dev, ip->addrs[NDIRECT]);
        ip->addrs[NDIRECT] = 0;
    }

    //二级索引释放
    if (ip->addrs[NDIRECT + 1])
    {
        bp = bread(ip->dev, ip->addrs[NDIRECT + 1]);
        a = (uint *)bp->data;
        for (i = 0; i < NINDIRECT; i++)
        {
            if (a[i])
            {
                secbp = bread(ip->dev, a[i]);
                a2 = (uint *)secbp->data;
                for (j = 0; j < NINDIRECT; j++)
                {
                    if (a2[j])
                        bfree(ip->dev, a2[j]);
                }
                brelse(secbp);
                bfree(ip->dev, a[i]);
                a[i] = 0;
        }
     }
      brelse(bp);
      bfree(ip->dev, ip->addrs[NDIRECT + 1]);
      ip->addrs[NDIRECT + 1] = 0;
  }
   ip->size = 0;
   iupdate(ip);
}
```

Symbolic links

实现类似于快捷方式的软连接（引用）的系统调用

注意，这个快捷方式可以指向另一个快捷方式，也可以指向另一个文件

首先注册这个系统调用，和lab2一样不再赘述

然后按照实验手册要求添加两个符号标志位，一个标志这个文件是”软连接“，另一个是要求打开”软连接“文件而不是去跟着快捷方式搜索到指定的文件

然后实现symlink系统调用，处理参数并创建一个”快捷方式文件“

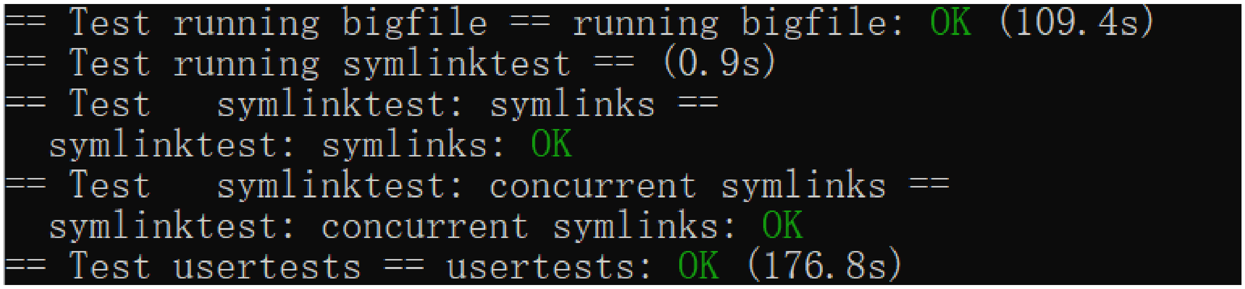
```
uint64 sys_symlink(void){
   char path[MAXPATH],target[MAXPATH];
   struct inode* ip;
   if(argstr(0,target,MAXPATH)<0)
      return -1;
   if(argstr(1,path,MAXPATH)<0)
      return -1;
   //开始事务
   begin_op();
    // 为这个符号链接新建一个 inode
   if((ip = create(path, T_SYMLINK, 0, 0)) == 0) {
      end_op();
      return -1;
  }
   // 在符号链接的 data 中写入被链接的文件
   if(writei(ip, 0, (uint64)target, 0, MAXPATH) < MAXPATH) {
      iunlockput(ip);
      end_op();
      return -1;
  }

   //commit
    iunlockput(ip);
    end_op();
    return 0;
}
```

最后根据实验手册要求修改open函数

- 由于快捷方式可以指向另一个快捷方式，因此可以成环。为了避免这个问题根据实验手册要求设置了搜索深度为10

```
while(ip->type==T_SYMLINK&&!(omode&O_NOFOLLOW)){
     searchtime++;
     //防止链接成环，设置上限为10
     if(searchtime>=10){
        iunlockput(ip);
        end_op();
        return -1;
    }
     // 读取对应的 inode存储的target路径
     if(readi(ip, 0, (uint64)path, 0, MAXPATH) < MAXPATH) {
        iunlockput(ip);
        end_op();
        return -1;
    }
     iunlockput(ip);
     // 根据文件名称找到链接上的的 inode
     if((ip = namei(path)) == 0) {
        end_op();
        return -1;
    }
     ilock(ip);
 }
```

实验结果



```
== Test running bigfile == running bigfile: OK (109.4s)
== Test running symlinktest == (0.9s)
== Test   symlinktest: symlinks ==
  symlinktest: symlinks: OK
== Test   symlinktest: concurrent symlinks ==
  symlinktest: concurrent symlinks: OK
== Test usertests == usertests: OK (176.8s)
```