- Changes to files involve multiple stages: commit, allocation, targets, etc.
- File systems:
  - Some popular
  - Linux ext3, MS win NQFS, FAT

```
  e File Logical Level
    e File Physical Level
```

- Disks & Filesystems
- Lecture 15
Note: Bootsector Notes

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00</td>
<td>Offset of one 16-byte partition record</td>
</tr>
<tr>
<td>0x04</td>
<td>Partition Type ID</td>
</tr>
<tr>
<td>0x08</td>
<td>Cylinder-Head-Address of the first sector in the partition</td>
</tr>
<tr>
<td>0x0c</td>
<td>Logical block address of the first sector in the partition</td>
</tr>
<tr>
<td>0x10</td>
<td>Cylinder-Head-Address of the last sector in the partition</td>
</tr>
<tr>
<td>0x14</td>
<td>Logical block address of the last sector in the partition</td>
</tr>
</tbody>
</table>

**MBR (Master Boot Record)**

- **MBR** - Contains the system boot loader program
- **Guid-PT** - Globally Unique Identifier (GUID)
GUID Partition Table Format

**GUID Partition Entry Format**
- *va* - 1
- *va - 2
- *va - 3
- *va - 4

Guid Partition Table Scheme

---
**Note:** LBA's may be 48 bits.

---
**Partition Table Format**

- *signature ("EF" PART", "4d 49 20 30 44 52 54")*
Faults & NTFS (Meet)
<table>
<thead>
<tr>
<th>Feature</th>
<th>Linux, BSD, Windows (throughout FIPS)</th>
<th>Systems</th>
<th>Operating System Supported</th>
<th>Encryption (No provided at the block device level)</th>
<th>Compression (No)</th>
<th>Permissions (Linux 2.6 and later)</th>
<th>File System</th>
<th>Journal - secure-deletes (top directory)</th>
<th>No-dump (Filesystem)</th>
<th>Immutable, Nouestion-Only, Statically Written</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>December 14, 1991 - January 18, 2038</td>
<td>True</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>False</td>
</tr>
</tbody>
</table>

### Features

- **Journal**: secure-deletes (top directory)
- **No-dump**: Filesystem
- **Immutable, No-question-Only, Statically Written**: Filesystem

### Constraints

- **Size**: 2 TB - 16 TB
- **Name**: Max volume
- **Metadata**: 255 bytes
- **Max of files**: Variable, allocated at creation time
- **Max file size**: 2 TB

### Latches

- **Bad blocks**: Table
- **Allocation**: File
- **Metadata**: Table, hashed 8-256 with dir: index embedded

### Structures

- **Header**: EBDA0A2-89E5-4433-870C-09B6B72699C
- **Partition**
  - MBR (83h): November 2000 (Linux 2.4.15)
- **Full Name**: Third extended File system

### Developers

- Stephen Tweedie