Contents of Files and Blocks
Files are files of Records

- Fixed Length Records
- Variable Length Records
  - Variable Length Fields
  - Repeating Fields
  - Optional Fields
- Mixed Record Types
Records Stored in Sectors

• Initial problem: Sector is just a bunch of bytes; how can we find the beginning of a record?
• Info in catalog can help
  – What does this kind of record look like
  – How is it stored in sector?
Fixed Length Records

- fixed length records neatly fill most of a sector
- possibly use spanned records

Block 1

Block 2

Overflow
Fixed Length Records

- fixed length records neatly fill most of a sector
- possibly use spanned records

Block 1

Block 2

Overflow
Fixed Length Records

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Block 1

RECORD  RECORD

Block 2

Overflow
Fixed Length Records

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Fixed Length Records

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Block 1

Block 2

Overflow
Fixed Length Records

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Fixed Length Records

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Fixed Length Records

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- possibly use spanned records

Block 1

Block 2

Overflow
Easy to find $N^{th}$ Record

• New record starts every record.length bytes.
• Easy to get $N^{th}$ record or scan all.

Block 1

Block 2

Overflow
VARIABLE RECORD FORMATS

• Block is just a sequence of bytes
• Problem 1: How find beginning of variable length records?
• Problem 2: How find beginning of fields w/in record?
Finding field, record in block (1)

• Marker Byte Approach
  – Special marker byte for end of variable length field
  – Repeating fields: 2nd marker within field
  – Record Terminator: 3rd marker
• Would work if all variable fields were text but cannot count on that.
• Problem: variable length BLOB fields.
What’s a BLOB?

• Binary Large OBject
  – PNG graphic
  – MPG4 movie
  – ACC sound file
• Some byte in the BLOB will look just like an end-of-field or end-of-record marker
Finding field, record in block (2)

- record length in record header
- variable length field has own header
- Optional Field: header includes name

• To find N\textsuperscript{th} record:
  - Read first header; jump record length.
  - Read next header; jump; repeat.
Finding field, record in block (3)

• Block Indexing: Index entries point to beginnings of records in block.
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### OPERATIONS ON FILES
What DB asks of FileManager

<table>
<thead>
<tr>
<th>Search for Records Meeting a Condition</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Find first</td>
<td></td>
</tr>
<tr>
<td>• Find next</td>
<td></td>
</tr>
<tr>
<td>• Find all</td>
<td></td>
</tr>
<tr>
<td>Retrieve in order</td>
<td>Update</td>
</tr>
<tr>
<td></td>
<td>Insert</td>
</tr>
<tr>
<td></td>
<td>All operations require retrieval of file blocks.</td>
</tr>
</tbody>
</table>