minutes

2D03

"Become a star in just one hour"

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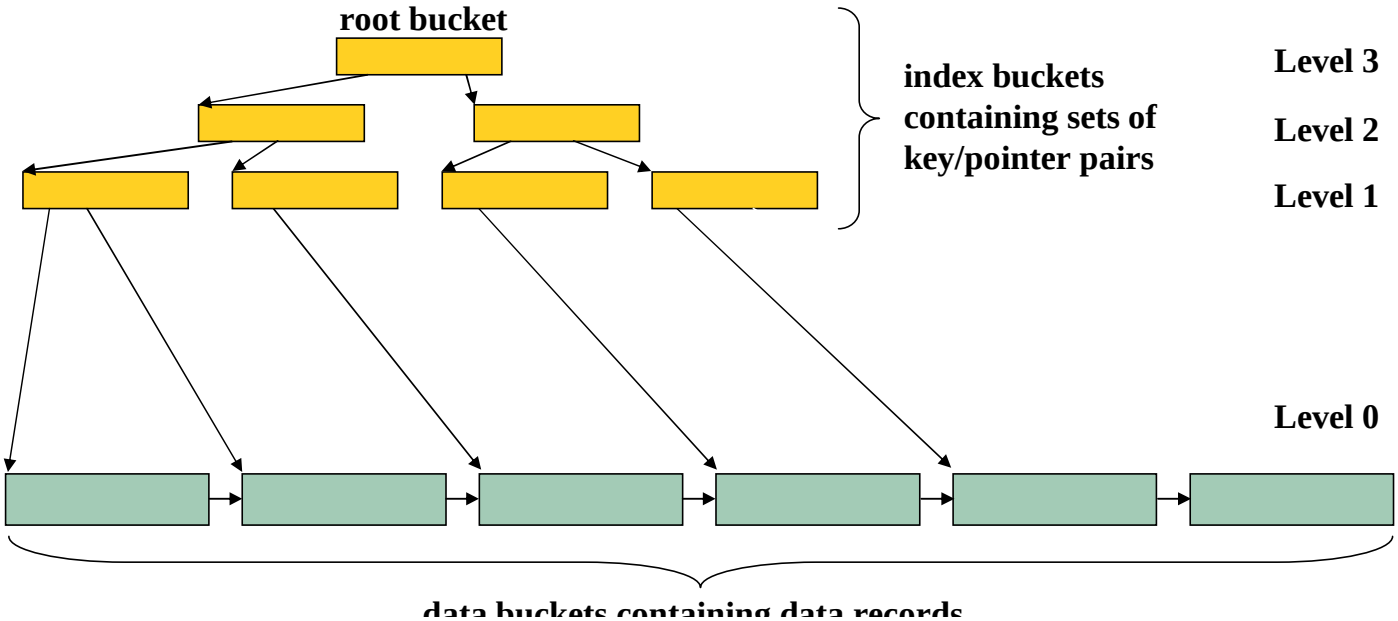
Topics

- Make up your mind!
- "What's in a name?" - some terminology
- Learn application behaviour
- Use the right tools
- The RMS Tuning Cookbook
  - things to try blindly
  - sophisticated techniques

- RMS doesn't use magic (yet)
- RMS behaviour is predictable
- most changes are transparent to applications
- many misconceptions floating around
- you don't even need to understand it - just do it!
- it's open-ended: you want more? Give us a call!

Some Terminology



- hot files
- read/write (update, delete) ratio
- file growth rate
- locality of new records
- key patterns
- shared access, number of users
- when does performance suffer?
- gather metrics

Use the right tools

- OpenVMS-supplied
  - $MONITOR (/RMS) to analyze I/O behaviour
  - $ANALYZE/RMS (/FDL, /STATISTICS) to analyze a file's permanent attributes
  - $EDIT/FDL to change internal file attributes
- Other tools (from OpenVMS freeware CD)
  - RMS_STATS: similar to $MONITOR, but displays raw numbers, more details
  - SIDR: shows count and values of duplicate keys

- Apply CONVERT regularly
- Increase bucket size
- Enable Global Buffers for shared files
- Evaluate compression settings
- Watch out for duplicates
- Adjust fill factor for growing files
- Consider removing secondary keys

Apply CONVERT regularly

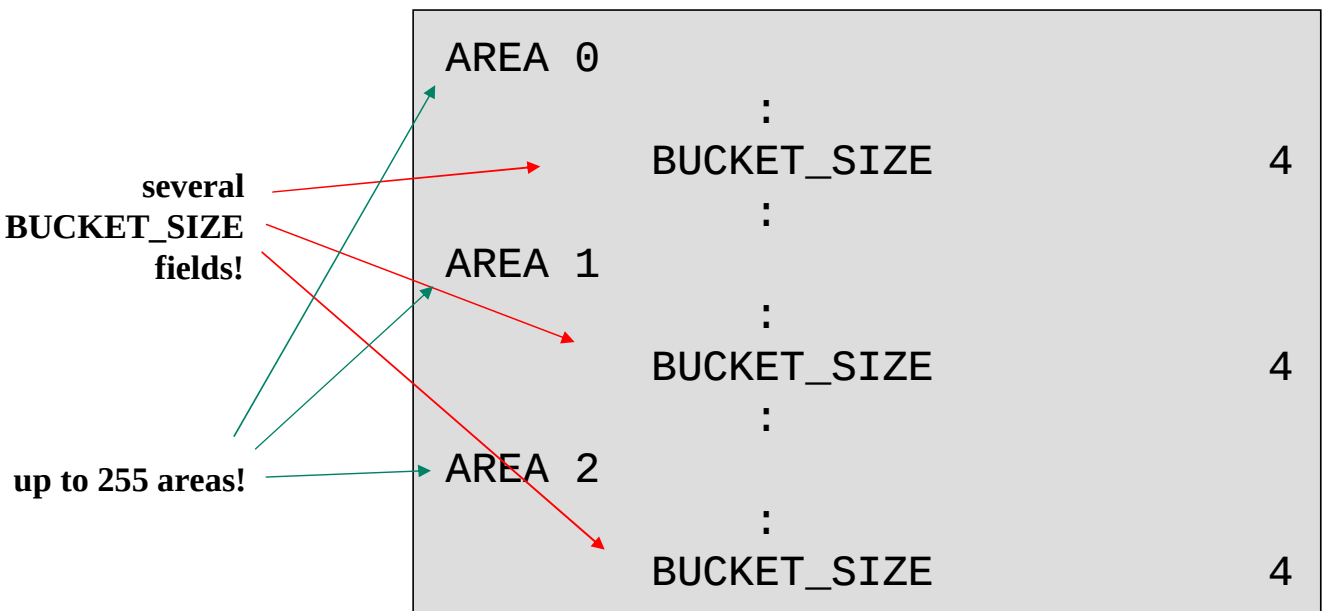

```
$CONVERT input-file output-file
```

- reorganizes internal layout
- removes internal defragmentation
- (removes external defragmentation)
- removes levels of indirection (RRVs)
- removes deleted records

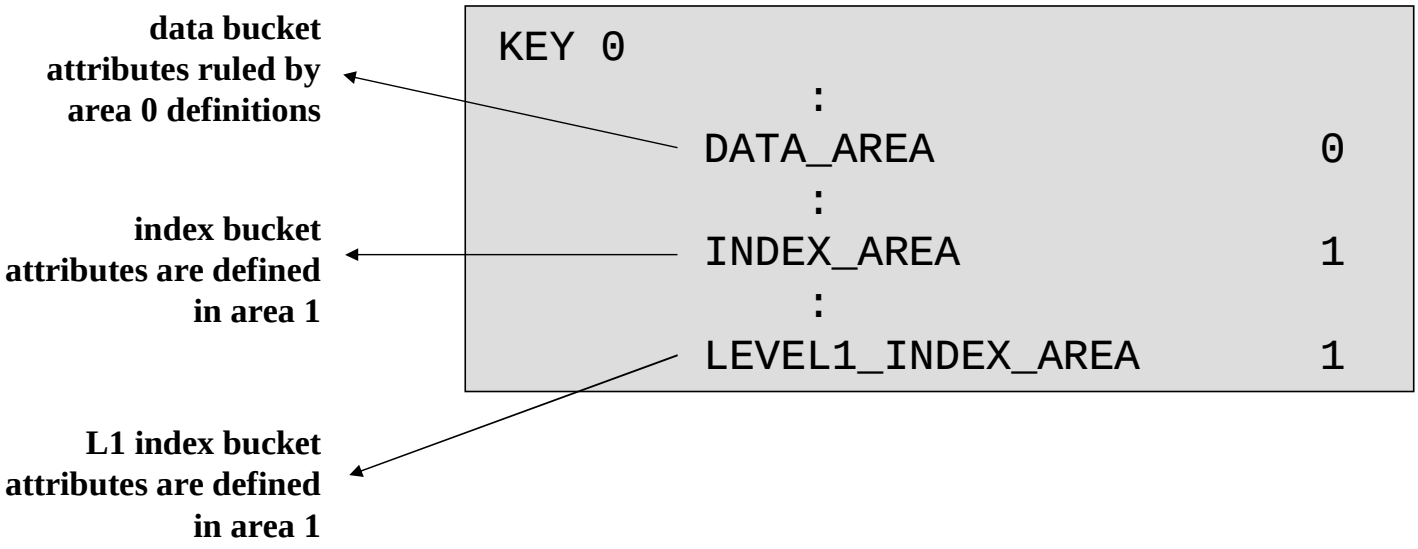
1. change bucket size parameter in FDL file
   - let OpenVMS be smart:
     `$EDIT/FDL/NOINTERACTIVE fdlfile.FDL`
   - be smart yourself:
     calculate better values by hand and edit the FDL-file manually
2. convert the file with the new FDL file
   - **`$CONVERT/FDL=fdlfile infile outfile`**

Increase bucket size - what to change

- which field should i change?

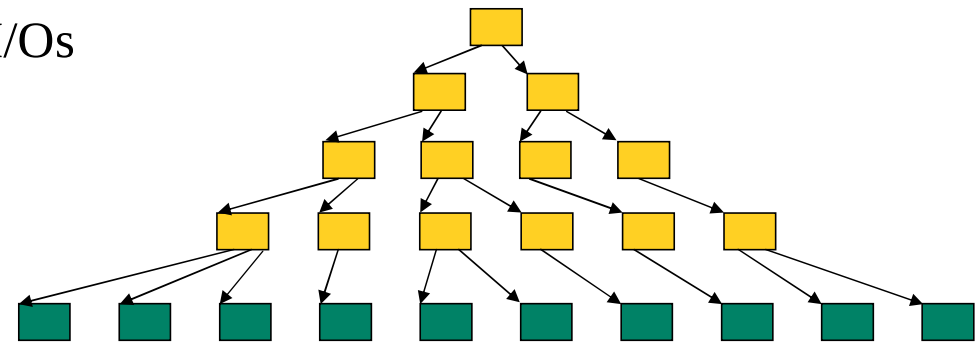


- get the area information from the key definition:

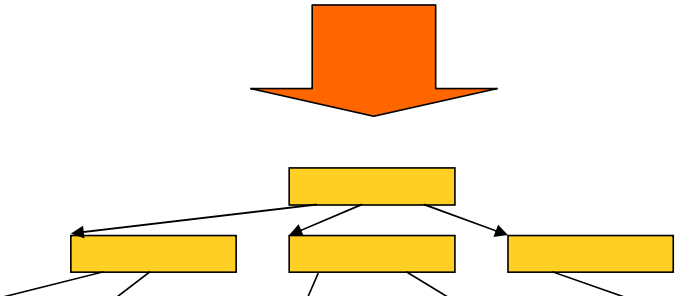


Increase bucket size - potential effect

old: 5 I/Os



new: 3 I/Os



To judge the effectiveness of your changes, examine the index depths of the resulting file:

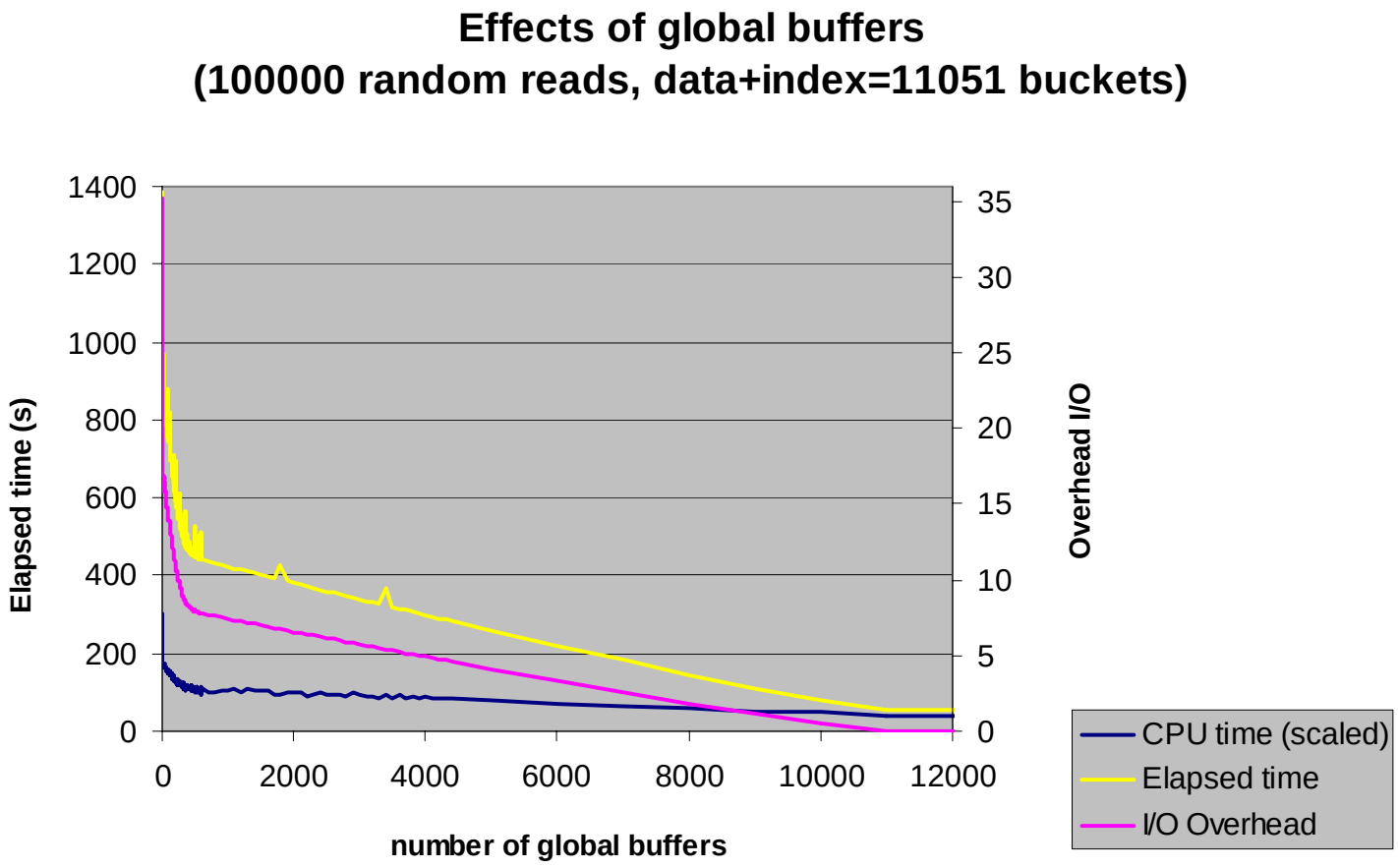
```
$ pipe analyze/rms/statistics newindexfile | -
_$ search sys$input/window=(0,2) "STATISTICS FOR KEY"

STATISTICS FOR KEY #0

        Number of Index Levels:                    4
```

This number should have decreased compared to the original file!

Enable Global Buffers for shared files

`$SET FILE/GLOBAL_BUFFER=n filename`

- probably the easiest RMS tuning method with the highest effects!
- forget all rumours about global buffers
- forget former pitfalls
- adjust GBLPAGES, GBLPAGFIL (dynamic since V7.1)
- adjust GBLSECTIONS

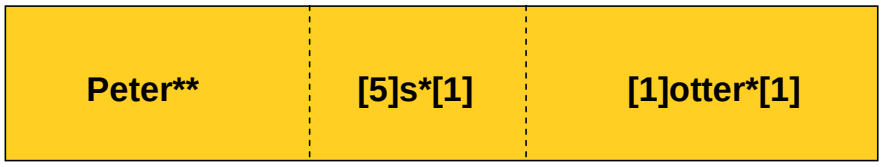


Evaluate compression settings

- concentrate on INDEX_COMPRESSION (FDL)
- default has been ON for historical reasons (disk space), changed in recent OpenVMS versions
- performance-wise, OFF would be better choice, but watch out for introducing additional index levels!
- easy as well:
  - change parameter in FDL file
  - perform CONVERT/FDL
  - enjoy!

traversal of index bucket

with compression: sequential search, performance: N/2



500 entries:
~250 lookups

without compression: binary search, performance: log2(N)

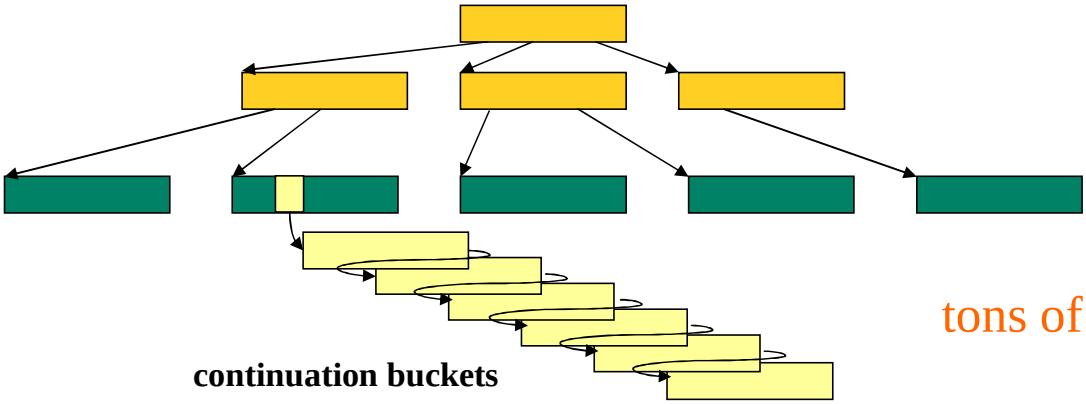
500 entries:
~9 lookups!

Result: less CPU overhead!

Evaluate compression settings

Recent performance tests have shown only marginal CPU-time improvements (<5%). Now, is this "improvement" worth thinking about index compression at all?

- Yes: for specific files with large index buckets (>30?), short keys (<10?), and a deep index (>2?).
- Having plain index entries might ease potential troubleshooting.
- Disabling index compression leads to increased space



tons of I/Os!

- duplicate records are not maintained in the index
- sequential search through continuation buckets
- RMS preserves order of arrival: most recent record is at the end
- insertion of new duplicate is very expensive
- duplicates are often your most-frequent key value (default value?)

Watch out for duplicates - real-life example

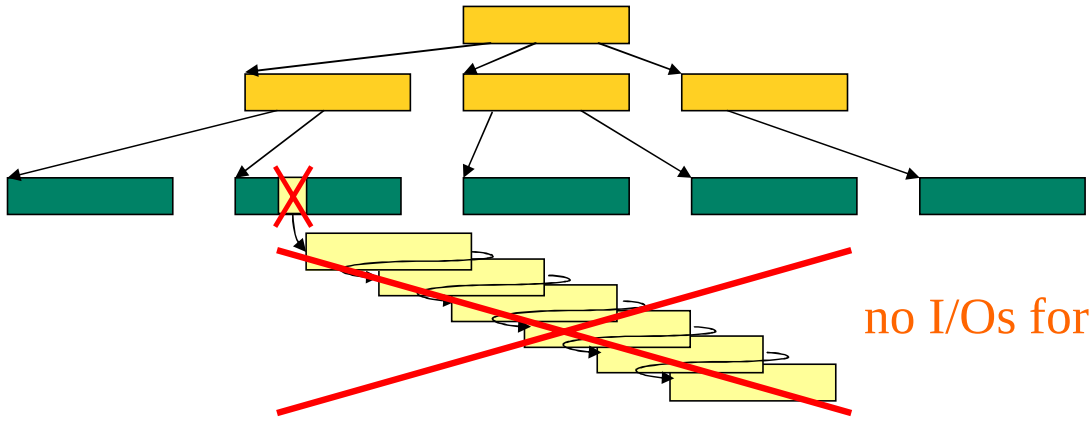
Output of SIDR (file has ~46000 records):

Duplicate count	Buckets	Key value
17824	19	
2982	4	OHNE
1055	1	ohne
173	1	-
139	1	ENTF.LLT
132	1	ENTFAELLT
127	1	ENTF.LLT
82	1	ENTF.

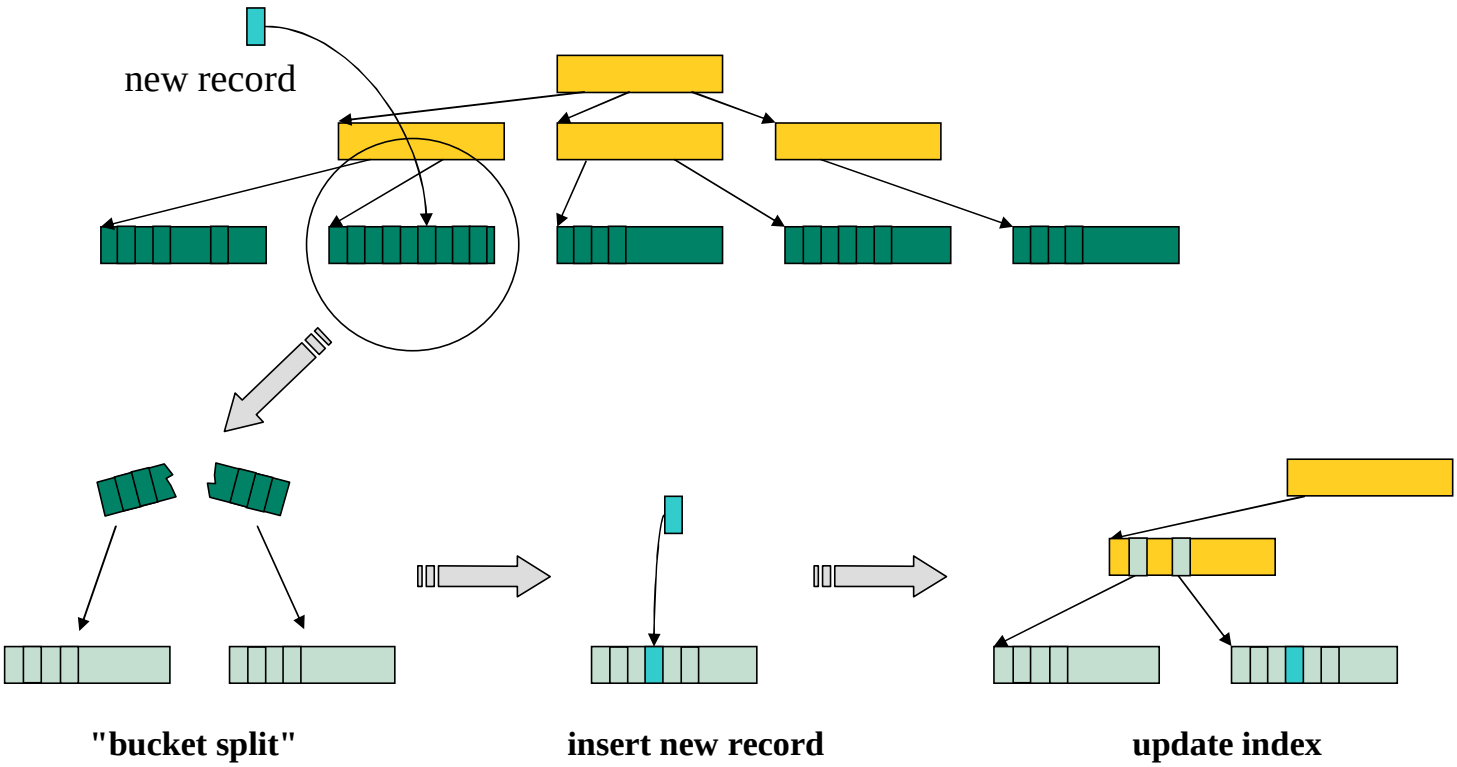
In FDL file: define SPACE character as NULL key value

```
KEY 3
        CHANGES                     yes
        DATA_KEY_COMPRESSION        no
        DATA_AREA                   2
        DATA_FILL                   100
        DUPLICATES                  yes
            :                       :
        LEVEL1_INDEX_AREA           2
        NULL_KEY                    yes
        NULL_VALUE                  ' '
        SEG0_LENGTH                 13
        SEG0_POSITION               40
        TYPE                        string
```


Watch out for duplicates - effect



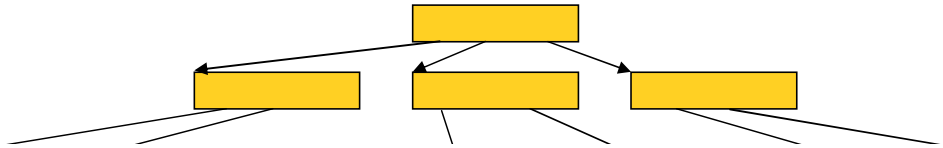
- this particular key value is not maintained in the index
- records with this key value are not seen via indexed access



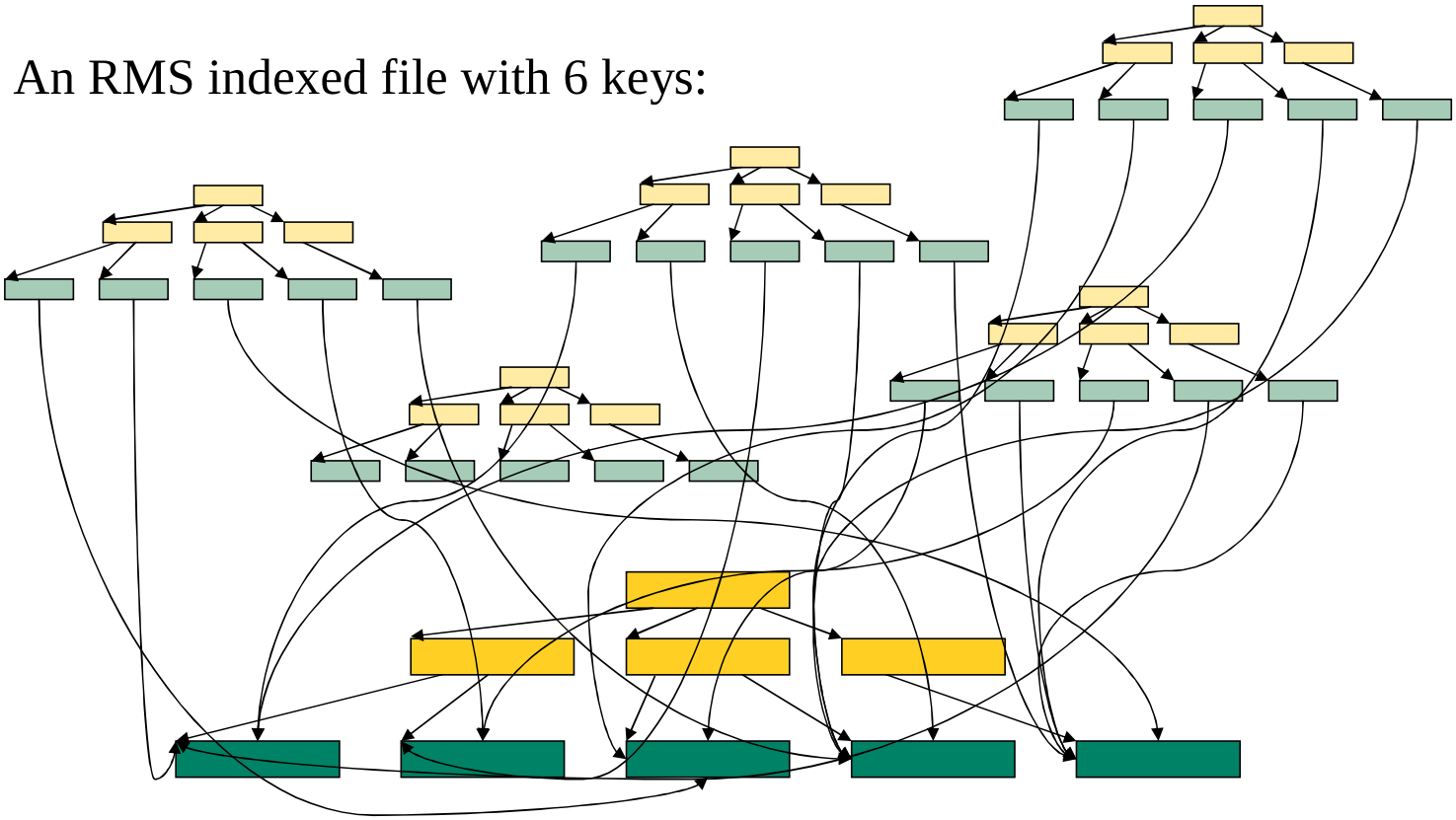
Adjust fill factor for growing files - solution

In FDL file: define Fill Factor for relevant areas

```
KEY 3           :                       :
            DATA_FILL                   50
                :                       :
            LEVEL1_INDEX_AREA           2
            NULL_KEY                    yes
            NULL_VALUE                  ' '
```



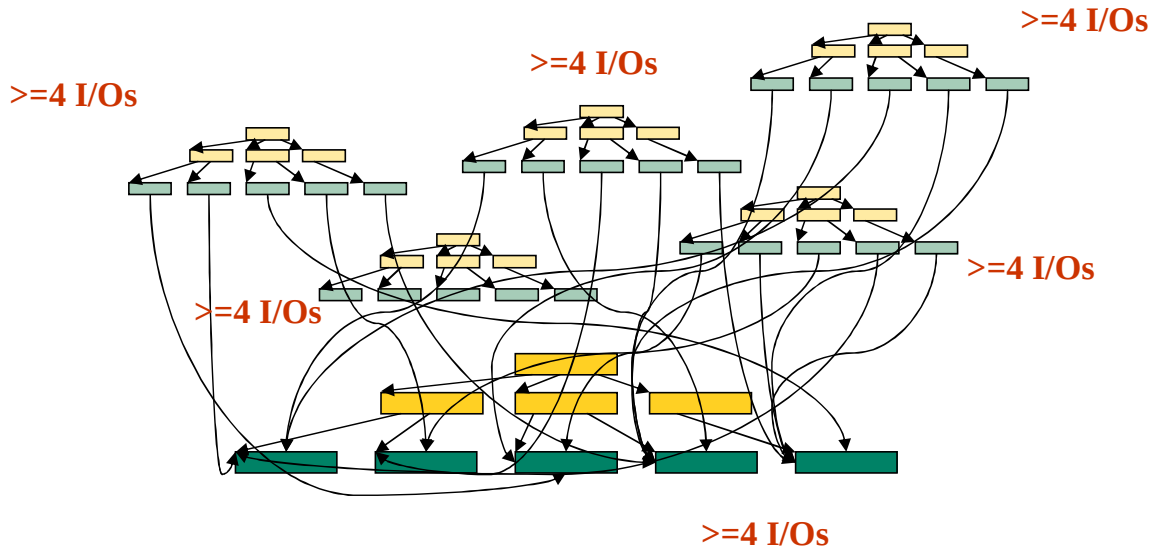
An RMS indexed file with 6 keys:



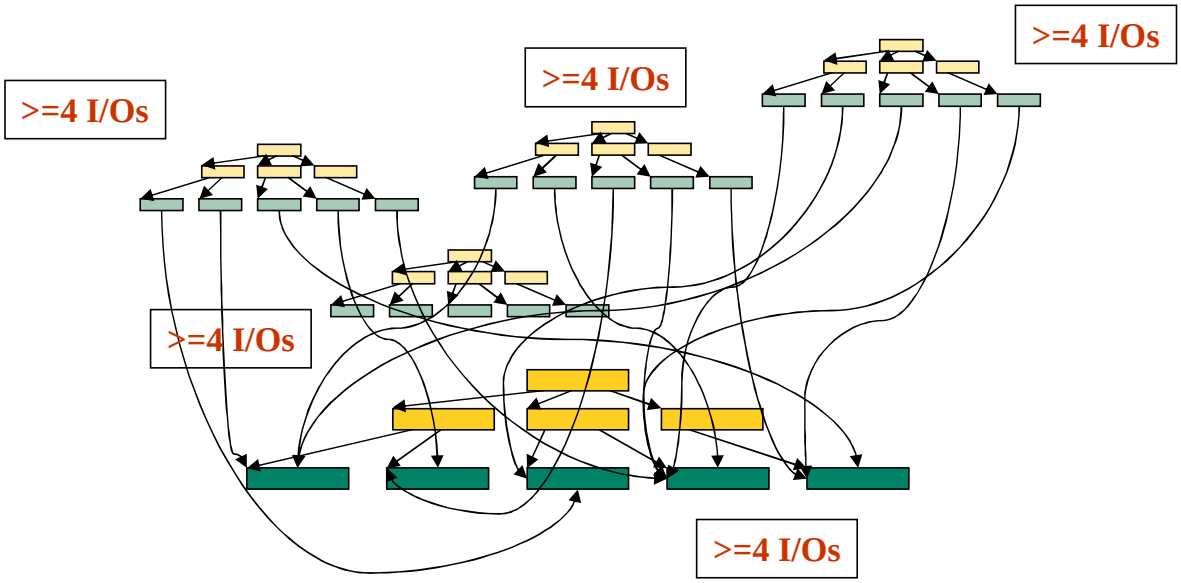
All this chaos works perfectly - but slowly!!

...Consider removing secondary keys

insert just one record:



same file, one key removed:



Removal of one index reduces administrative work (I/O+CPU)

...Consider removing secondary keys

Issues:

- application designers often implement keys 'just to have them handy'
- example: two identical key fields with different sorting order
- often secondary keys have poor 'duplicate behaviour'
- evaluate application impact!
- substitute keyed lookup by other methods
- You may need to change the application!

- Think about employing an RMS DB administrator
- Ask ~~Compaq~~: we sell more than just ~~PCs~~!

HP Printers

- (RMS) Engineering is open to all sorts of problem reports, enhancement requests, discussions...

Questions...

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