SQL Server

Index Internals

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Microsoft MVP - SQL Server


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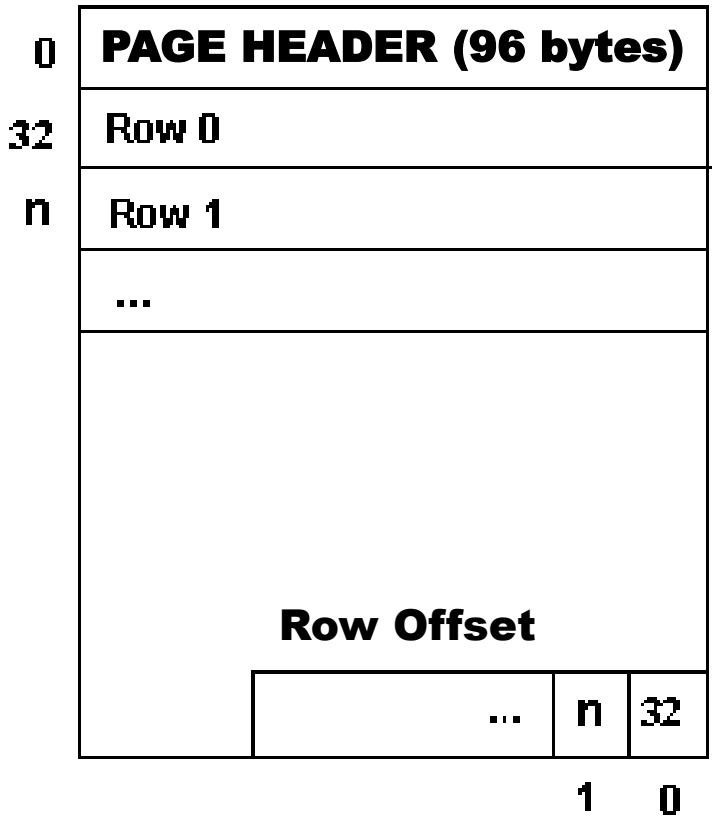
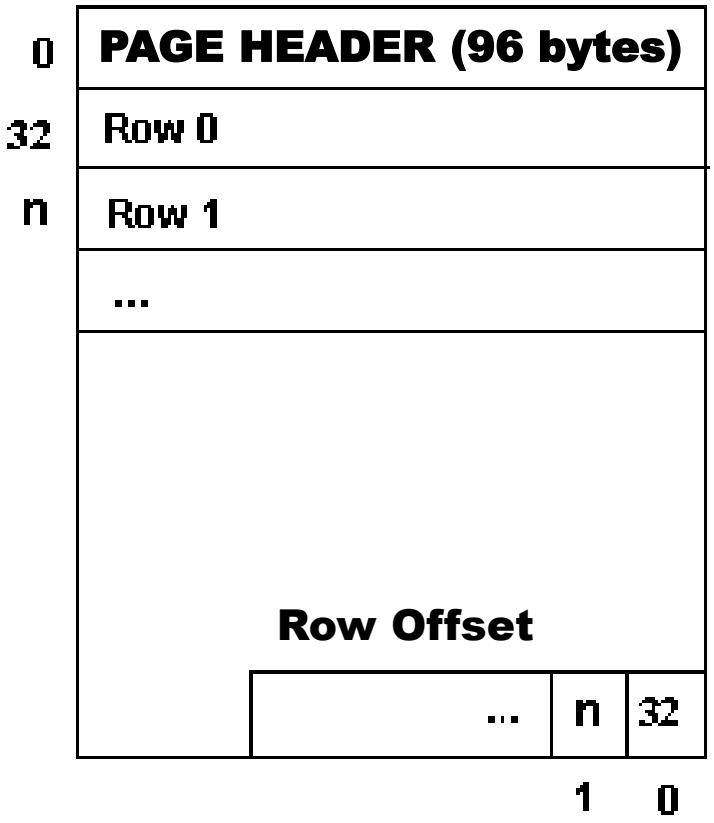
How do
indexes?
work

the better question to ask is


How is
data stored?

Stored in **8K** pages





8 Pages = **1 extent** (64K)

Stored in either

heaps

or

B-trees

(hobt)

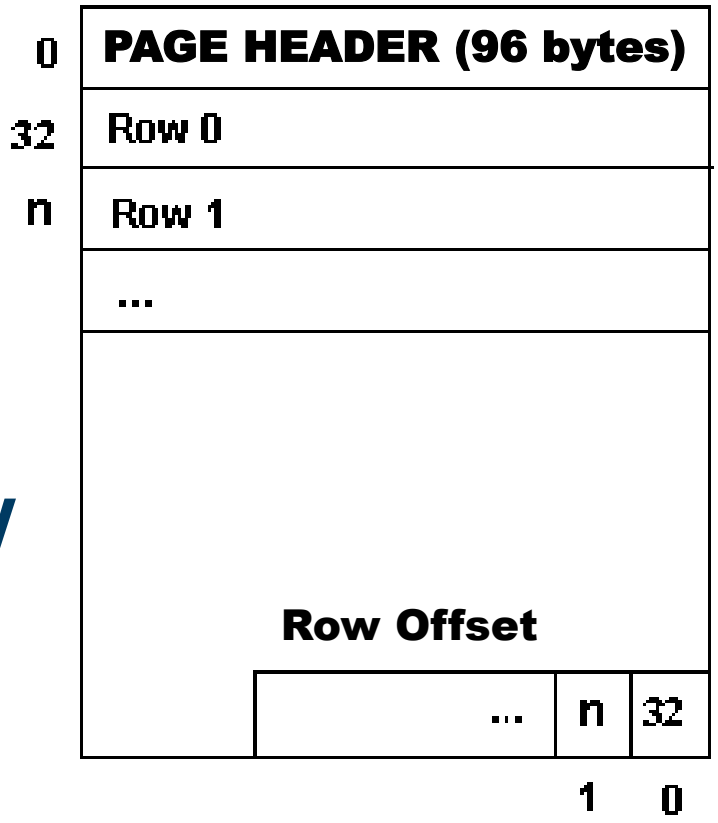
heaps

unordered data

```
CREATE TABLE [dbo].[Employee](
    [EmployeeID] [int] IDENTITY(1,1) NOT NULL,
    [LastName] [nchar](30) NOT NULL,
    [FirstName] [nchar](29) NOT NULL,
    [MiddleInitial] [nchar](1) NULL,
    [SIN] [char](11) NOT NULL,
    [OtherColumns] [char](258) NOT NULL DEFAULT 'OTHERS',
  )
```

if...

* 400 bytes/row
* 80,000 rows



***8096 bytes/page**

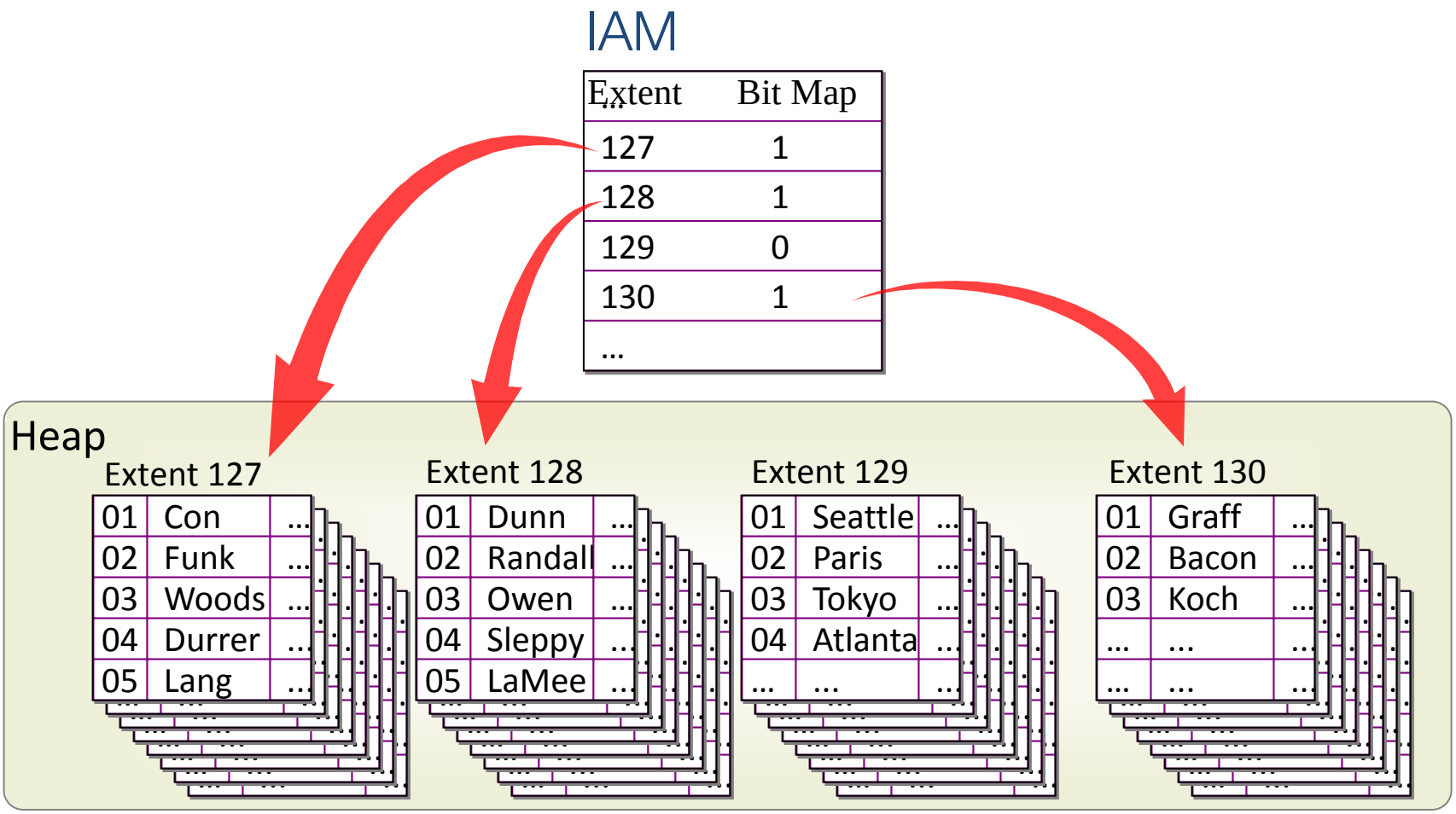
(1024 x 8) – 96 bytes

$$\frac{\text{8096 bytes/page}}{\text{400 bytes/row}} = \textbf{20 rows/page}$$

$$\frac{\text{80,000 rows}}{\text{20 rows/page}} = \textbf{4,000 pages}$$

finding rows in

heaps

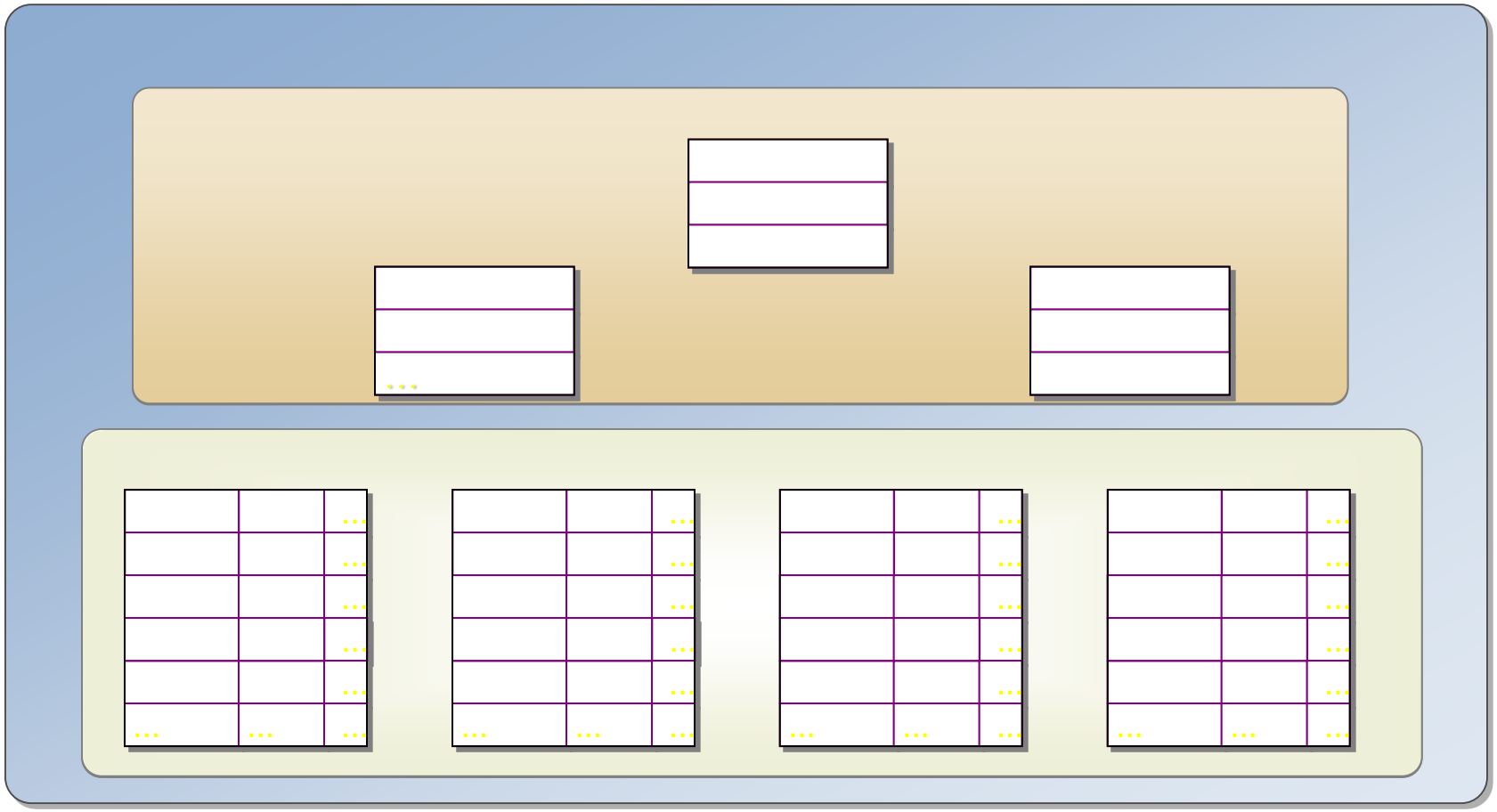

IAM
Extent
Bit Map
127
1
128
1
129
0
130
1
...
Heap
Extent 127
01 Con ...
02 Funk ...
03 Woods ...
04 Durrer ...
05 Lang ...
Extent 128
01 Dunn ...
02 Randall ...
03 Owen ...
04 Sleppy ...
05 LaMee ...
Extent 129
01 Seattle ...
02 Paris ...
03 Tokyo ...
04 Atlanta ...
... ...
Extent 130
01 Graff ...
02 Bacon ...
03 Koch ...
... ...
... ...

B-trees

ordered data

finding rows in

B-trees



Certified Nurses Aide, 46
Chest pain, 256–57
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  prevention, 253
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  choosing, 20–22
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  questions to ask, 25–27
  visits with, 24–25
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  dressing aids, 127–28
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E

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F

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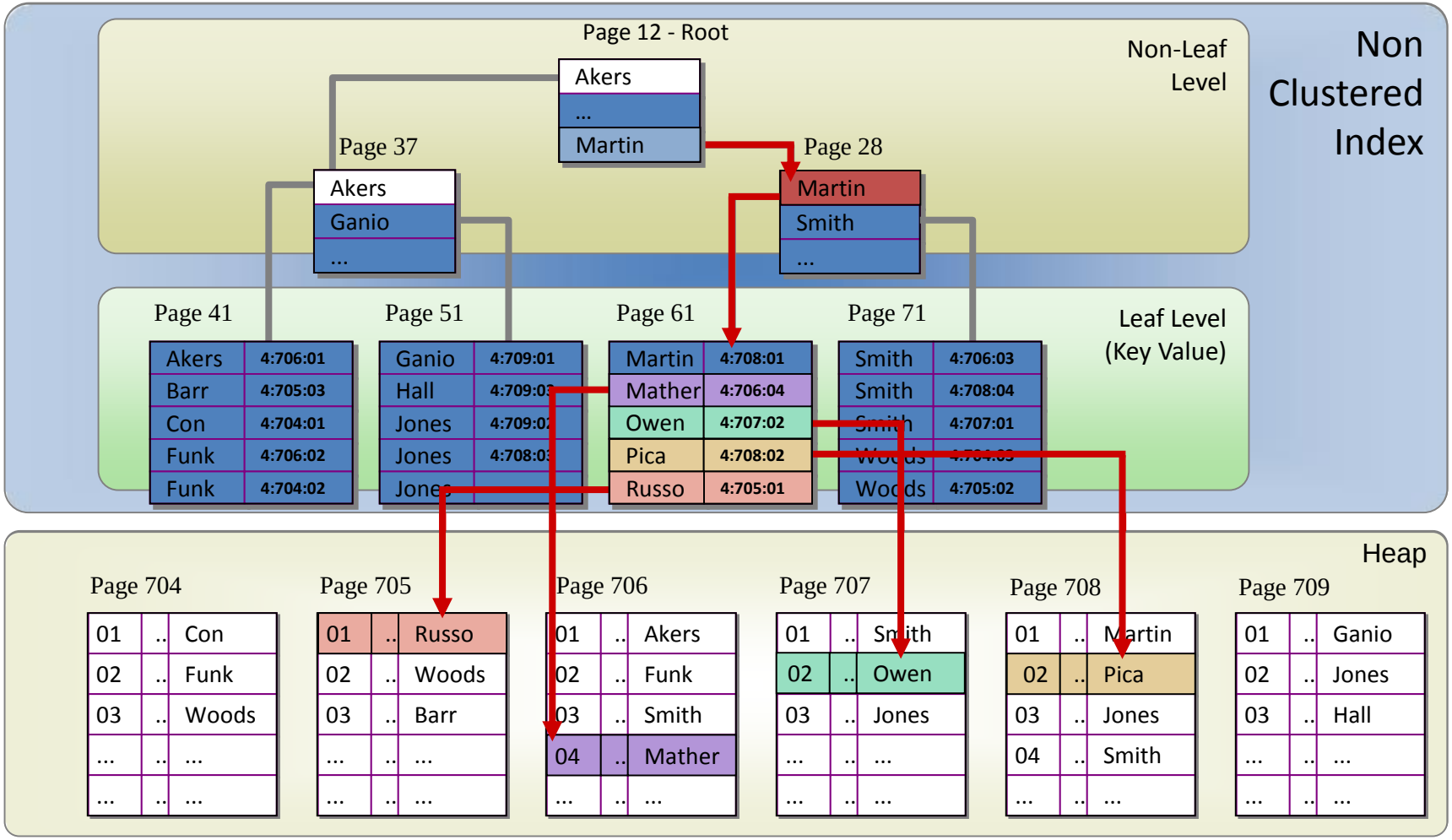
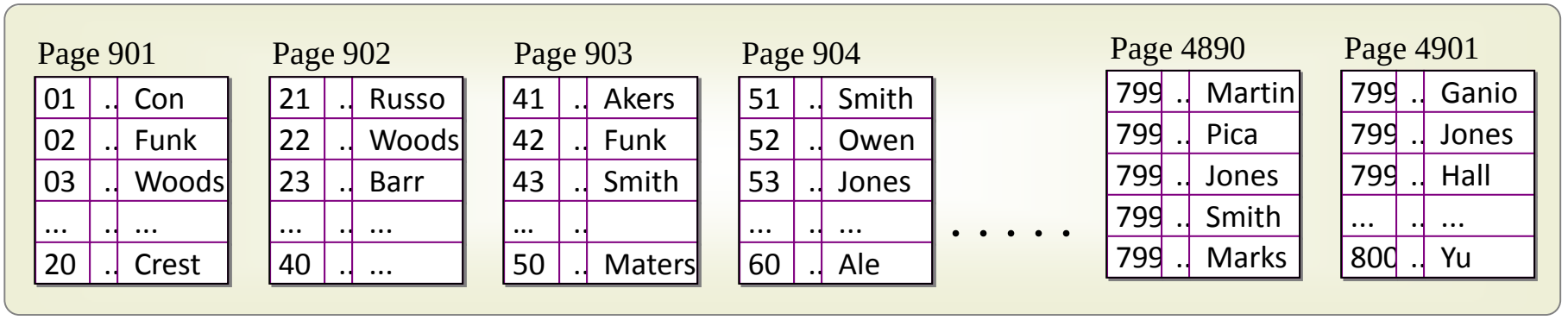
How do I find rows
in a heap with a
non-clustered
index
?


Non Clustered Index
Non-Leaf Level
Page 12 - Root
Akers
...
Martin
Page 37
Akers
Ganio
...
Page 28
Martin
Smith
...
Leaf Level (Key Value)
Page 41
Akers 4:706:01
Barr 4:705:03
Con 4:704:01
Funk 4:706:02
Funk 4:704:02
Page 51
Ganio 4:709:01
Hall 4:709:03
Jones 4:709:02
Jones 4:708:03
Jones
Page 61
Martin 4:708:01
Mather 4:706:04
Owen 4:707:02
Pica 4:708:02
Russo 4:705:01
Page 71
Smith 4:706:03
Smith 4:708:04
Smith 4:707:01
Woods
Woods 4:705:02
Heap
Page 704
01 .. Con
02 .. Funk
03 .. Woods
... .
... .
Page 705
01 .. Russo
02 .. Woods
03 .. Barr
... .
... .
Page 706
01 .. Akers
02 .. Funk
03 .. Smith
04 .. Mather
... .
Page 707
01 .. Smith
02 .. Owen
03 .. Jones
... .
... .
Page 708
01 .. Martin
02 .. Pica
03 .. Jones
04 .. Smith
... .
Page 709
01 .. Ganio
02 .. Jones
03 .. Hall
... .
... .

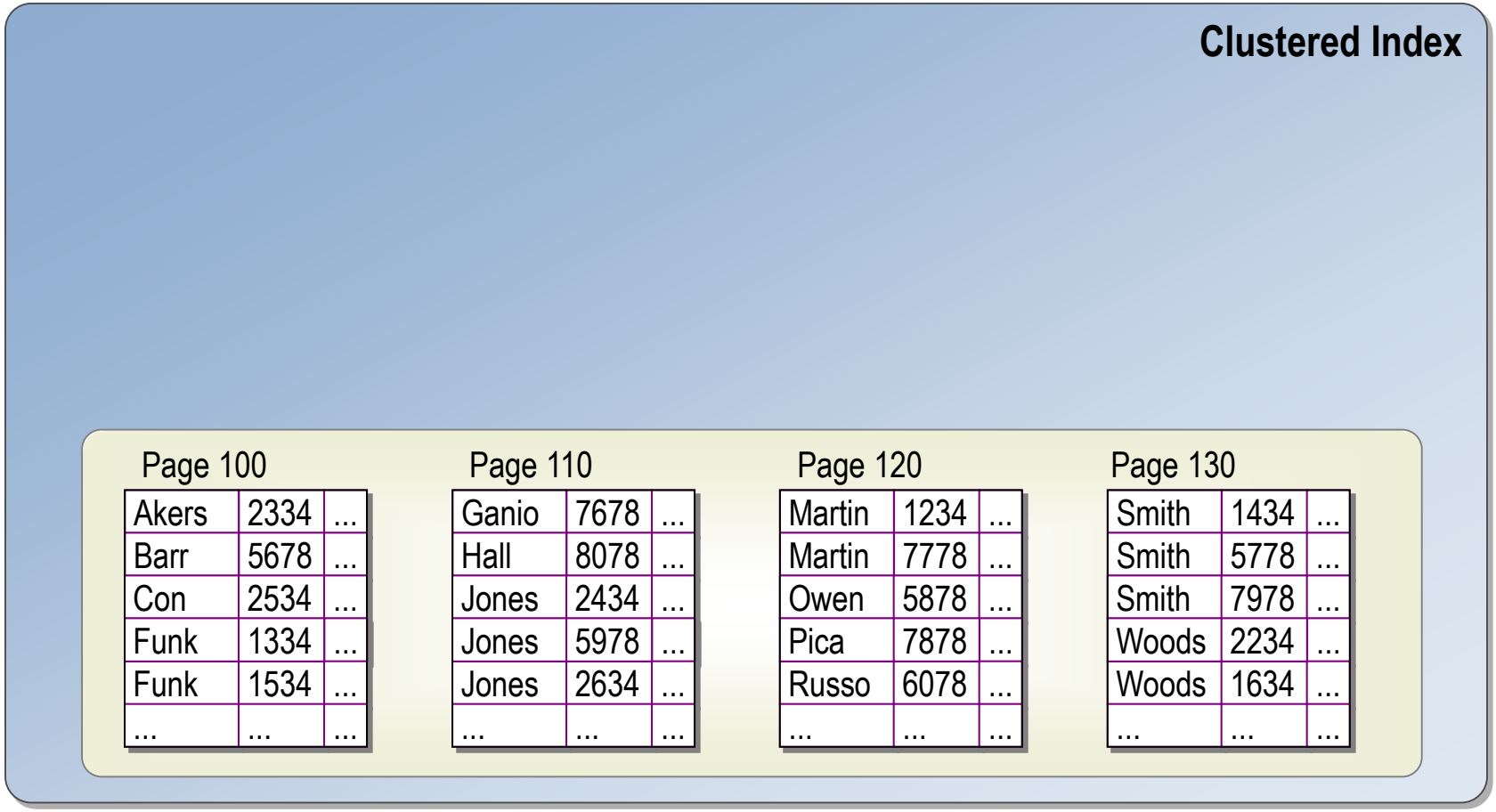
What happens when you

cluster

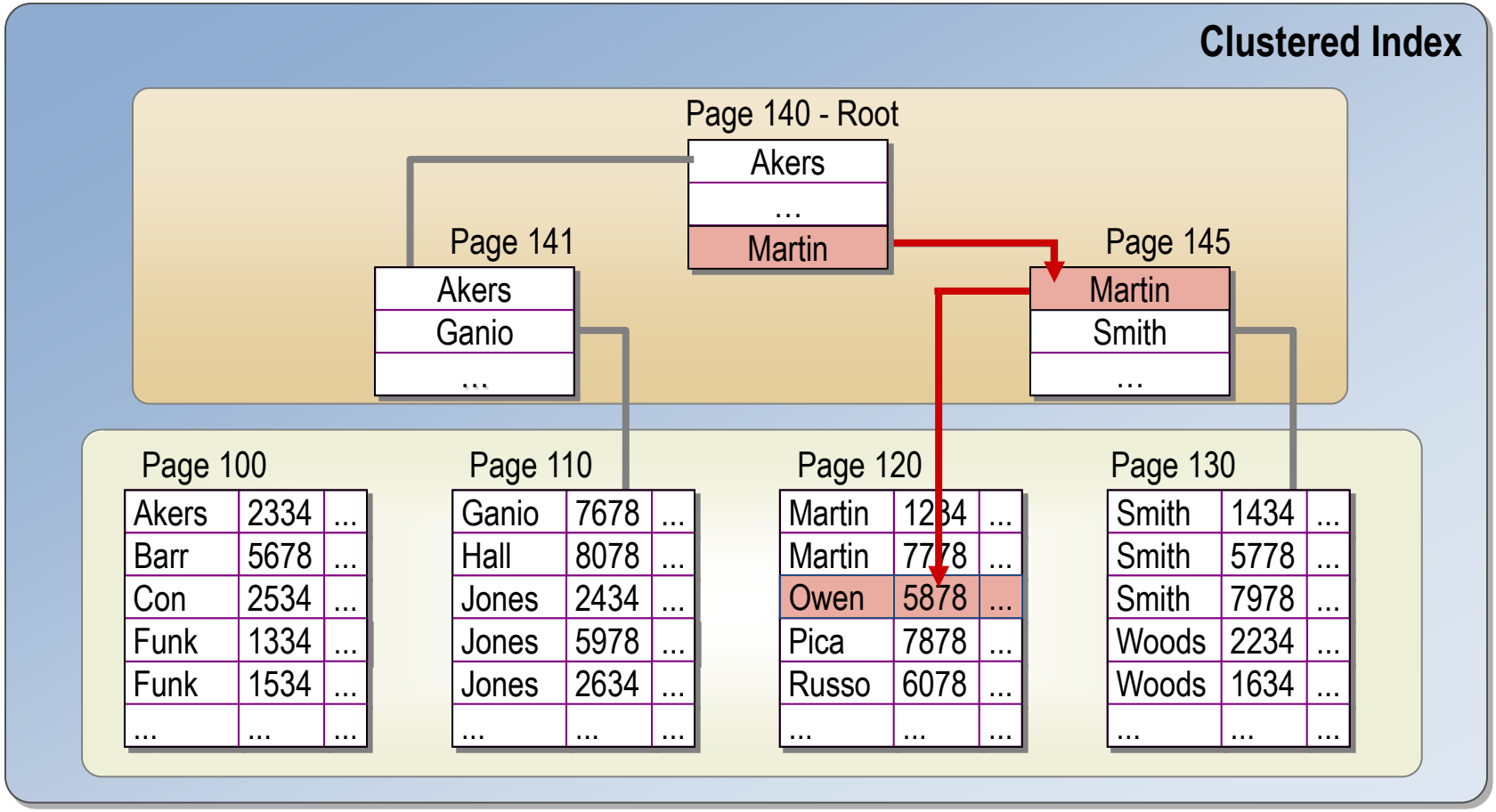
a table?

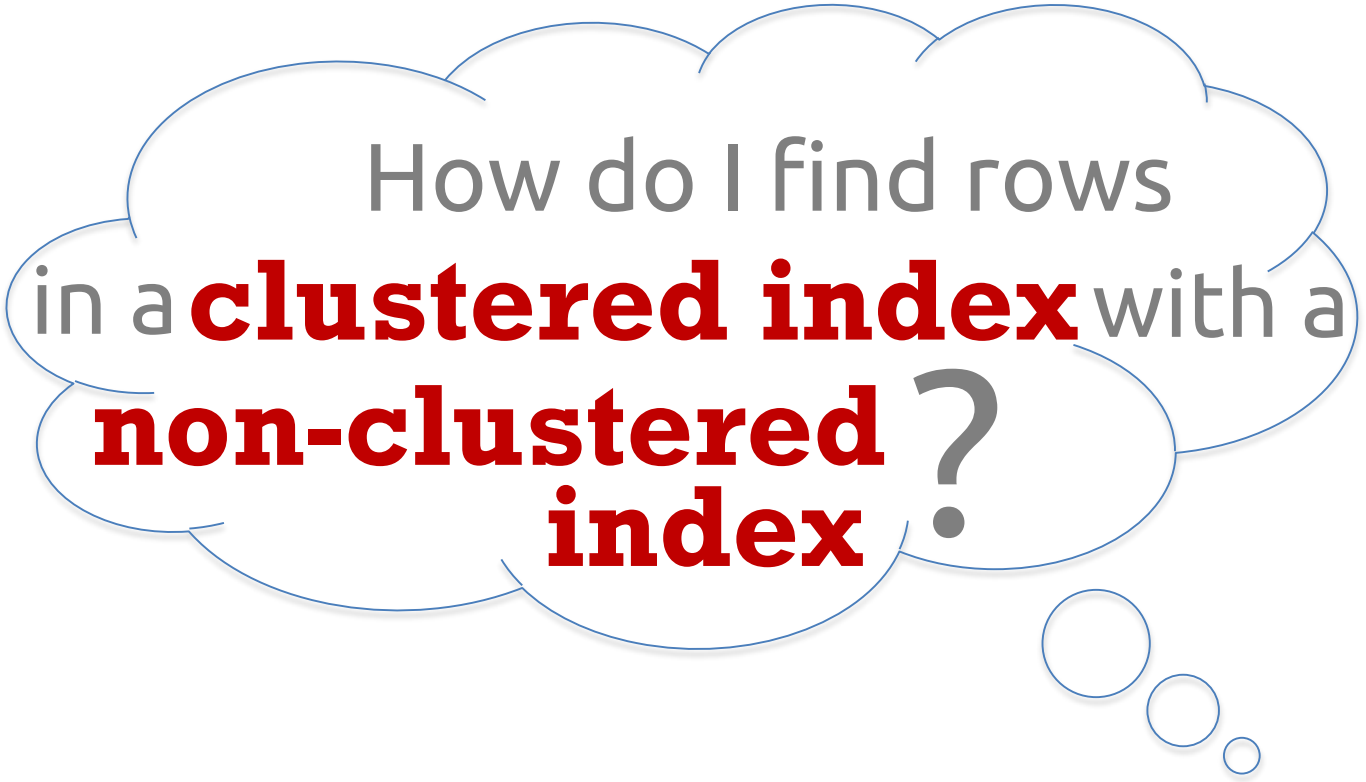


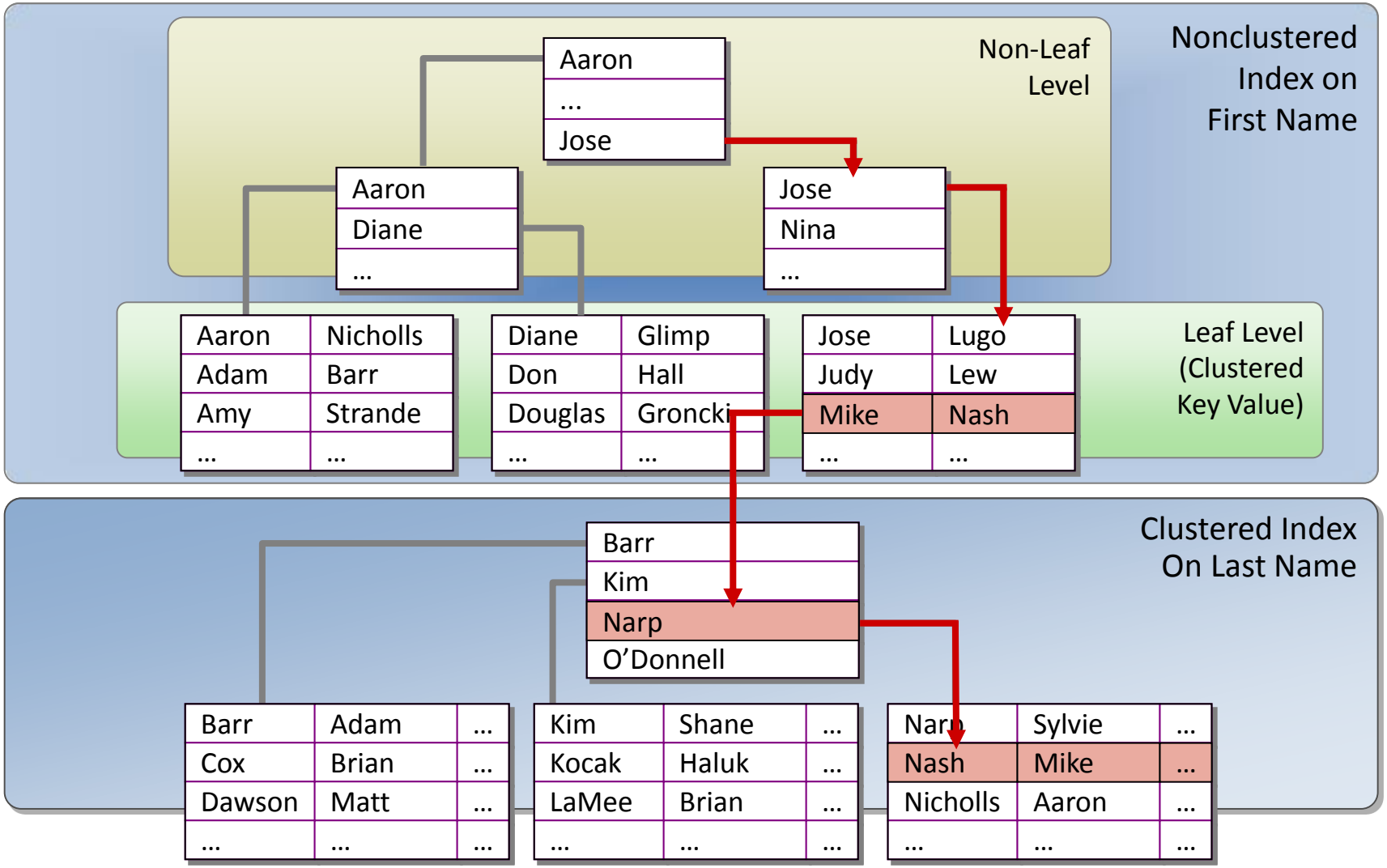
Clustered Index




How do I find rows
in a table with a
clustered index?


Clustered Index
Page 140 - Root
Akers
…
Martin
Page 141
Akers
Ganio
…
Page 145
Martin
Smith
…
Page 100
Akers 2334 ...
Barr 5678 ...
Con 2534 ...
Funk 1334 ...
Funk 1534 ...
... ...
Page 110
Ganio 7678 ...
Hall 8078 ...
Jones 2434 ...
Jones 5978 ...
Jones 2634 ...
... ...
Page 120
Martin 1234 ...
Martin 7778 ...
Owen 5878 ...
Pica 7878 ...
Russo 6078 ...
... ...
Page 130
Smith 1434 ...
Smith 5778 ...
Smith 7978 ...
Woods 2234 ...
Woods 1634 ...
... ...


How do I find rows
in a clustered index with a
non-clustered index ?


Nonclustered Index on First Name
Non-Leaf Level
Aaron
...
Jose
Aaron
Diane
...
Jose
Nina
...
Leaf Level (Clustered Key Value)
Aaron Nicholls
Adam Barr
Amy Strande
... ...
Diane Glimp
Don Hall
Douglas Groncki
... ...
Jose Lugo
Judy Lew
Mike Nash
... ...
Clustered Index On Last Name
Barr
Kim
Narp
O'Donnell
Barr Adam ...
Cox Brian ...
Dawson Matt ...
... ...
Kim Shane ...
Kocak Haluk ...
LaMee Brian ...
... ...
Narp Sylvie ...
Nash Mike ...
Nicholls Aaron ...
... ...

clustered index

sorted

clustered index

ARE NOT

primary keys

demo

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