Are You Getting the Best Out of Your MySQL Indexes?

Slides
http://bit.ly/mysqlindex2

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What is an index?

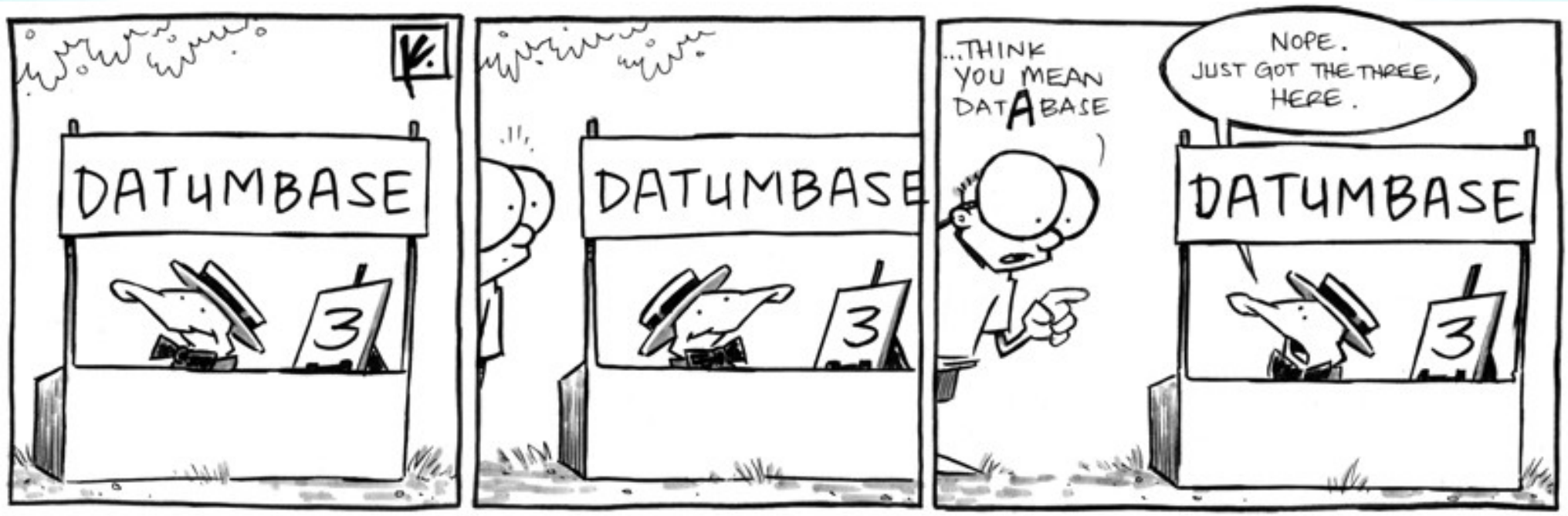
KEY vs. INDEX

KEY = KEY CONSTRAINT

PRIMARY, UNIQUE, FOREIGN

Everything else is an “implementation detail”

The plural of INDEX is....?



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More Lingo

Simple

(last_name)

Composite

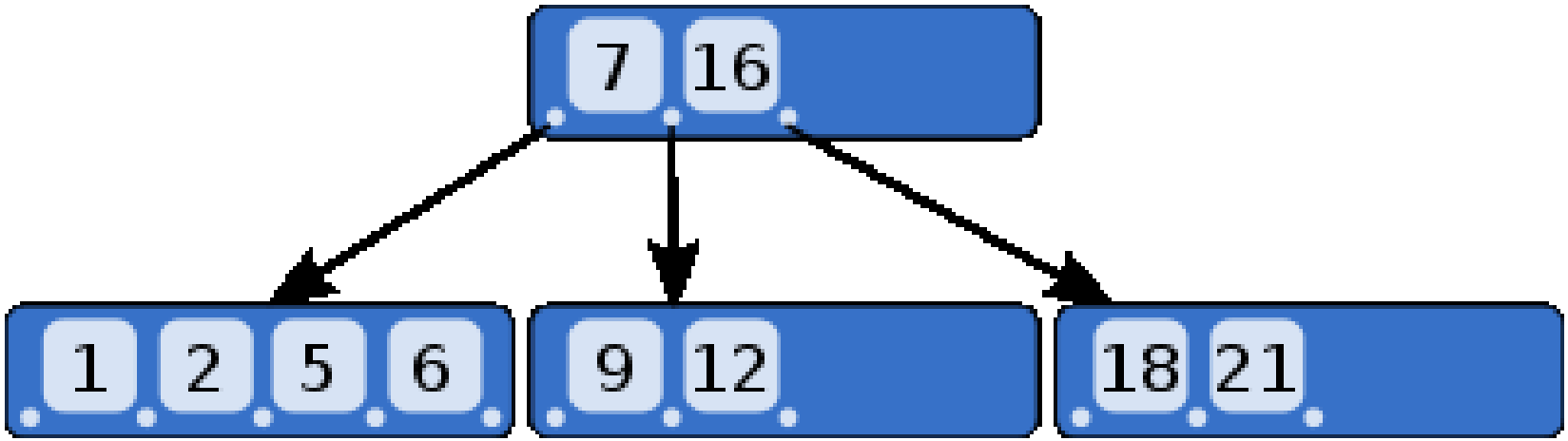
(last_name,first_name)

Data Structures

B-TREE for InnoDB, MyISAM

Can be HASH for MEMORY

B-tree



(Image from Wikipedia)

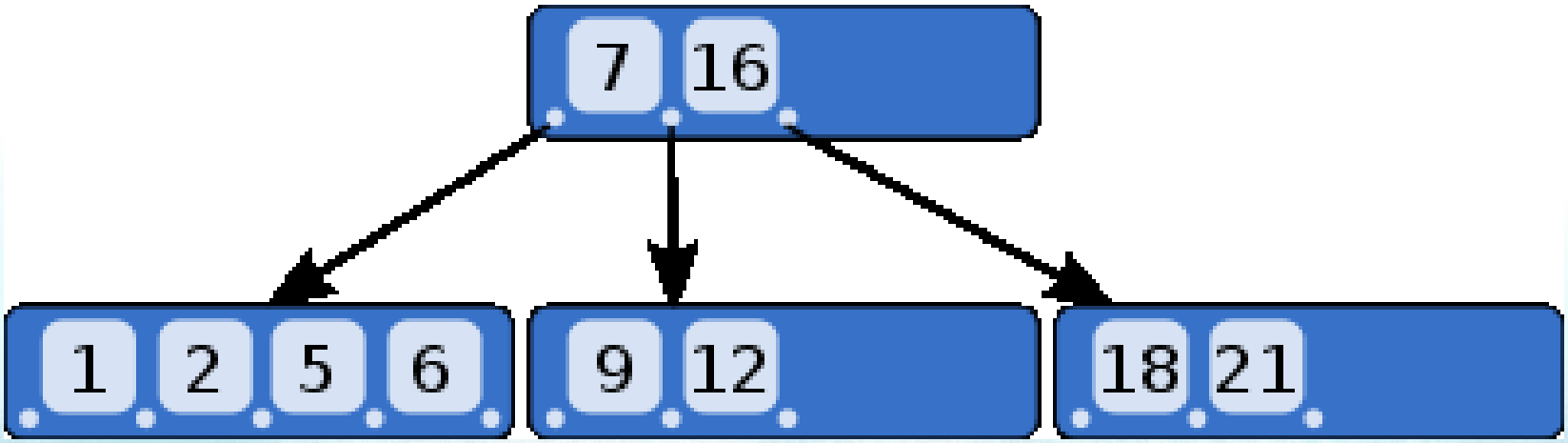
B-trees Are Excellent For...

A range search - foo BETWEEN 5 AND 10

One equality match - foo=11

A few equality matches - foo IN (5,10,11)

- How is it done?



(Image from Wikipedia)

Composite Indexes

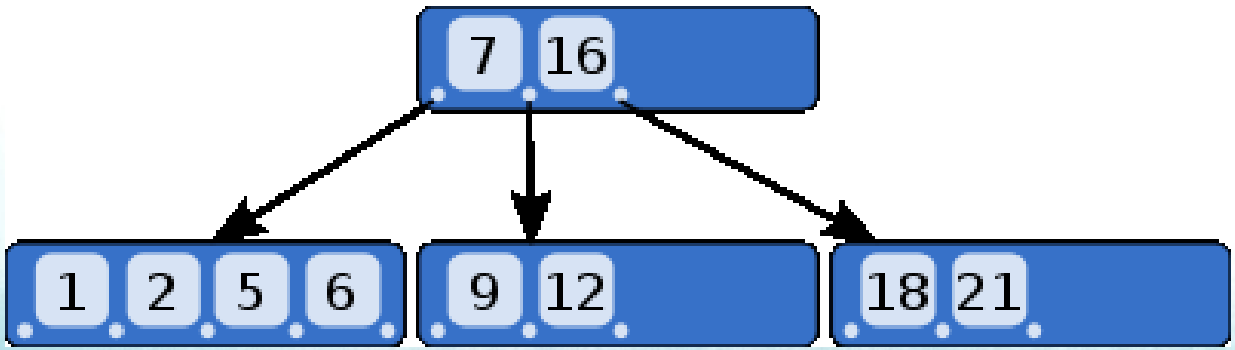
Index on (last_name,first_name)

Used find words beginning with “g” (last_name)

Not used to find words ending with “g” (first_name)

OK to have (last_name,first_name) and (first_name)

Like a dictionary index



(Image from Wikipedia)

MySQL Uses Indexes For...

Matching a WHERE clause

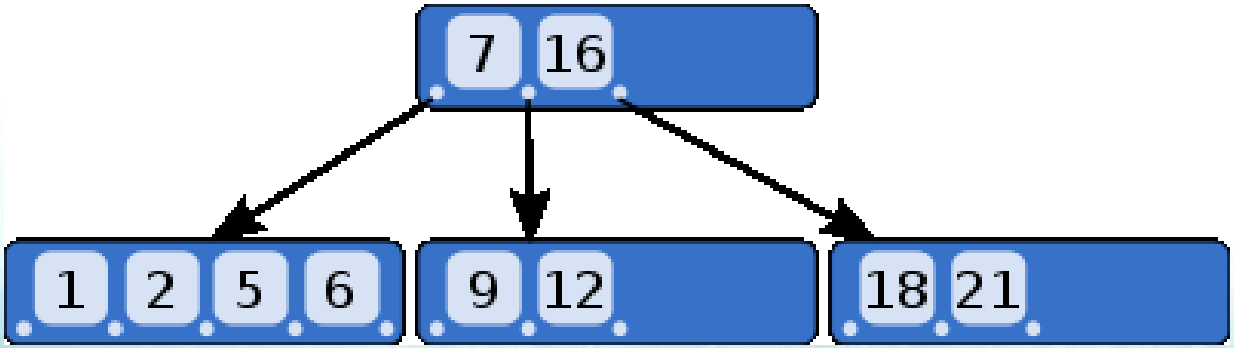
Eliminating rows

Resolving MIN() or MAX() values

Eliminating sorting

Helping with grouping

Everything – Covering index



(Image from Wikipedia)

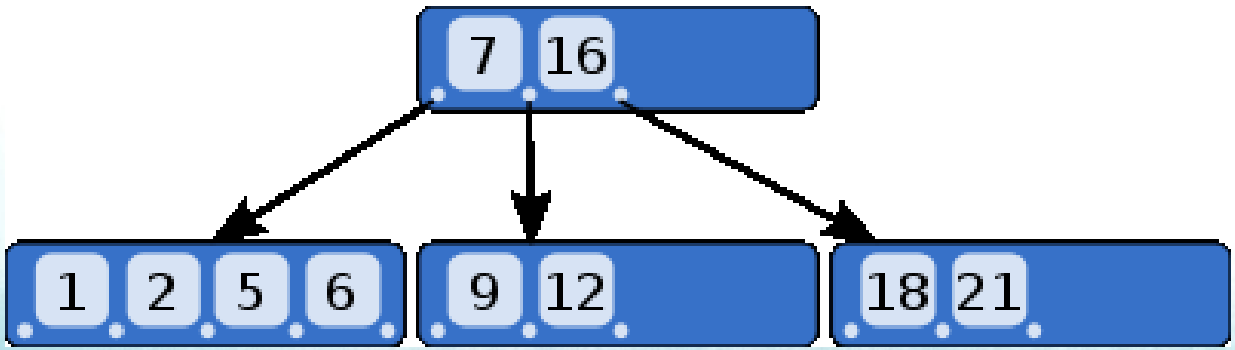
MySQL Ignores Indexes For...

Functions

DATE(ts_col)='2012_08_11'

JOINs if the fields are not similar

date_col='2012_08_11 00:00:00'



(Image from Wikipedia)

MySQL Ignores Indexes For...

Queries with multiple WHERE clauses

not all using the same index

joined by OR

For example, imagine a test table, with an index on (last_name,first_name)

test,(last_name,first_name)

Queries that use the index:

```
SELECT * FROM test WHERE last_name='Cabral';

SELECT * FROM test
  WHERE last_name='Cabral' AND first_name='Sheeri';

SELECT * FROM test
  WHERE last_name='Cabral'
  AND (first_name='Tony' OR first_name='Antonio');
```

test,(last_name,first_name)

Queries that DO NOT use the index:

```
SELECT * FROM test WHERE first_name='Sheeri';

SELECT * FROM test
  WHERE last_name='Cabral' OR first_name='Sheeri';
```

Composite Indexes

Index on (last_name,first_name,middle_name)

Functions as:

(last_name,first_name,middle_name)

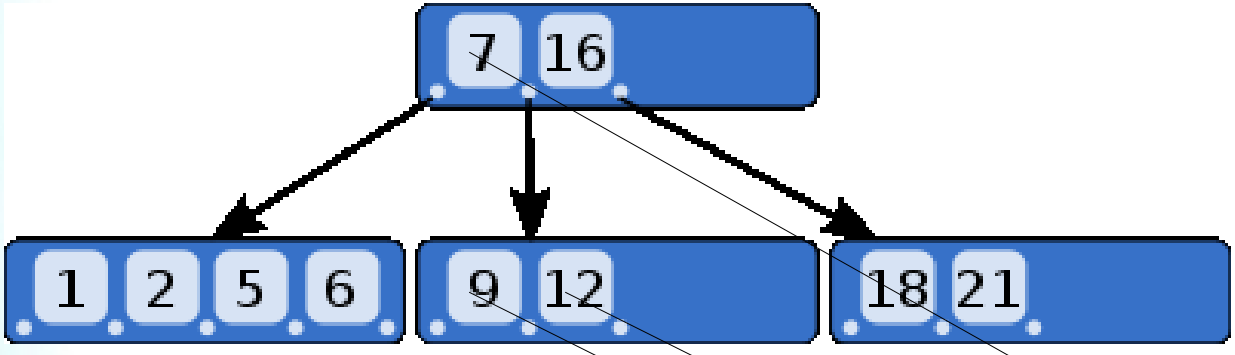
(last_name,first_name)

(last_name)

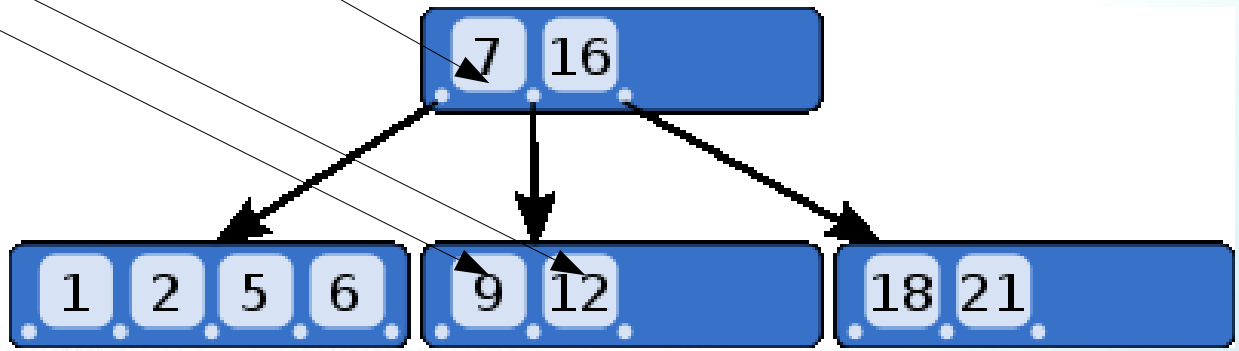
MySQL Ignores Indexes For...

"Too much" data, just do a full table scan (7,9,12)

6 lookups vs. walking the 10-node tree



(Image from Wikipedia)



(Image from Wikipedia)

“Too Much” Data

“Too much” is about 15-25%

How is that calculated?

Metadata!

Exact in MyISAM (writes are table-locking)

Approximate in InnoDB

“value group”

Average value group size

Used for approx rows for rows read, joins

Average Value Group Size

Body parts: 2 eyes, 10 fingers

Average value group size = 6

Not perfect optimization for either eyes or fingers

Estimate is longer than reality for eyes

Estimate is shorter than reality for fingers

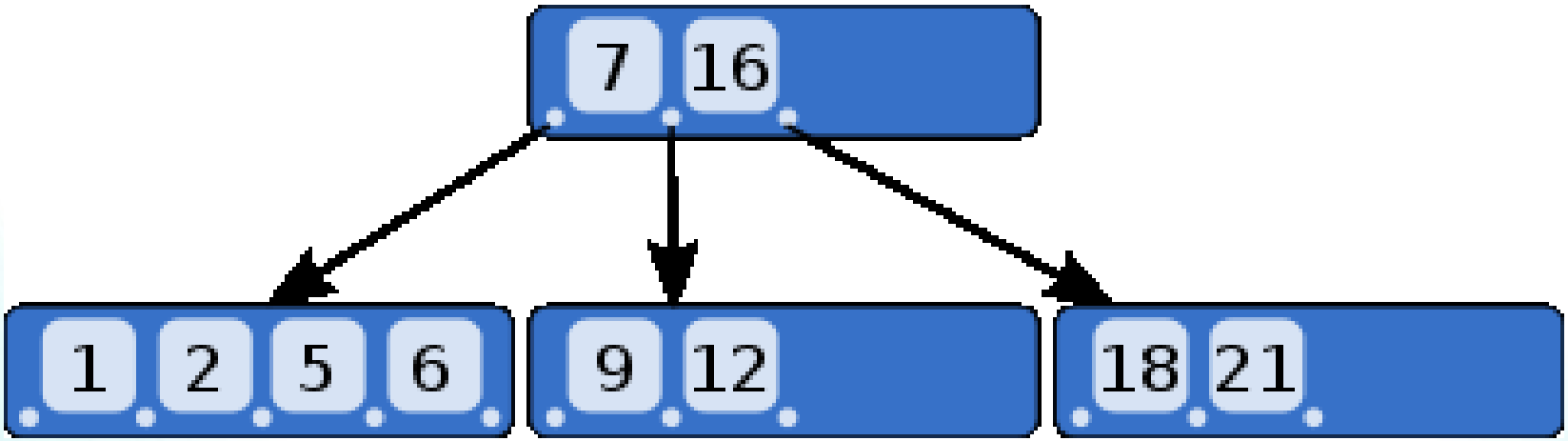
Remember the “too much data” feature/problem

Composite Index

Like a sorted array

Can be ASC or DESC

But not ASC,DESC or DESC, ASC



(Image from Wikipedia)

NULL and Equality

NULL = x is not true for ANY value of x

NULL = NULL is not true

If a referenced value in an equality is NULL

MySQL immediately returns false

NULL and Equality

NULL-safe operator is <=>

No NULL-safe inequality operator

!(foo <=> bar)

Remember the “too much data” feature/problem

NULL and Value Groups

Options - innodb_stats_method, myisam_stats_method

nulls_equal (default)

nulls_unequal

nulls_ignored

PRIMARY Keys

Row identifiers

Cannot be NULL

InnoDB orders on disk in PRIMARY KEY order

UNIQUE Keys

Row identifiers

Can be NULL

Both PRIMARY/UNIQUE can be composite index

FOREIGN Keys

Parent/child relationship

e.g. payment->customer_id

Cascading update/deletes

Numeric vs. Human-readable

customer_id	status_id
121	1
122	2
125	1

status_id	status
1	free
2	paid
3	disabled

customer_id	status
121	free
122	paid
125	free

status
free
paid
disabled

Prefix Indexing

For strings

Up to 767 **bytes** on InnoDB, 1000 on MyISAM

Beware of charset!

FULLTEXT Indexing

No prefix indexing

Only for CHAR, VARCHAR, TEXT

No prefix indexing

MyISAM only until MySQL 5.6

GROUP BY and Sorting

By default, GROUP BY also sorts

May cause 'filesort' in EXPLAIN

ORDER BY NULL

If you do not care about the return order

Knowing All This...

Use EXPLAIN

If you are not getting the index you expect

Check your expectations

Or file a bug: http://bugs.mysql.com

index_merge

On surface, looks good

Use more than one index

Better in MySQL 5.6

index_merge before 5.6

Indicates you could make a better index

Index merge not used when it should have been

- e.g. if range scan was possible

May have merged more indexes than necessary

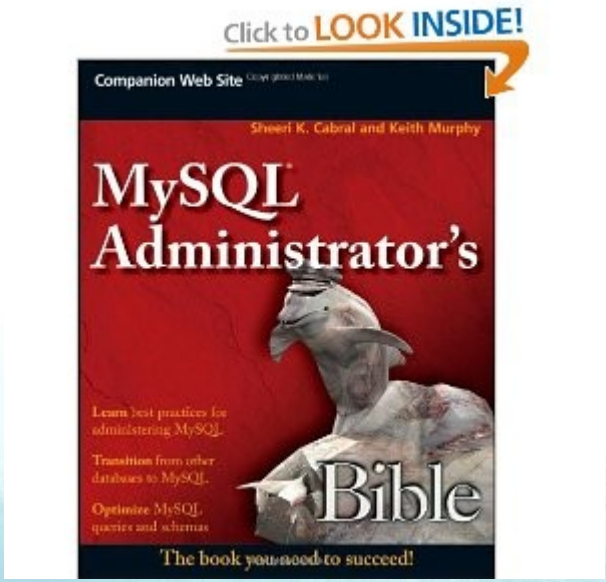
Questions? Comments?

OurSQL Podcast

www.oursql.com

MySQL Administrator's Bible

- tinyurl.com/mysqlbible



kimtag.com/mysql

planet.mysql.com