Care and Feeding of a MySQL Database for Linux Administrators

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Safe Harbor Statement

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Tuning to 80% efficiency is relatively easy (last 20% is tricky)

Session Overview

1. Basics of a database server
2. Hardware
3. MySQL Configuration
4. Monitoring Operations
5. Backups
6. Replication
7. Indexes
8. Tuning
9. Q/A

How does a Database server work

<u>Client</u> <u>Server</u>

SELECT phone

FROM friends

WHERE name = ‘Joe’;

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What was that about memory???

ORACLE

Rule #1

- Databases love data in memory

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Corollary #1 – getting data in/out of memory will cause you nightmares!

What if it is not in memory?

MySQL

Please give me the data from the city table

OS

What if it is not in memory?

MySQL

Please give me the data from the city table

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OS

Get inode

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← Hand buffer off

Load data into memory

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$\Leftarrow$

Load data i

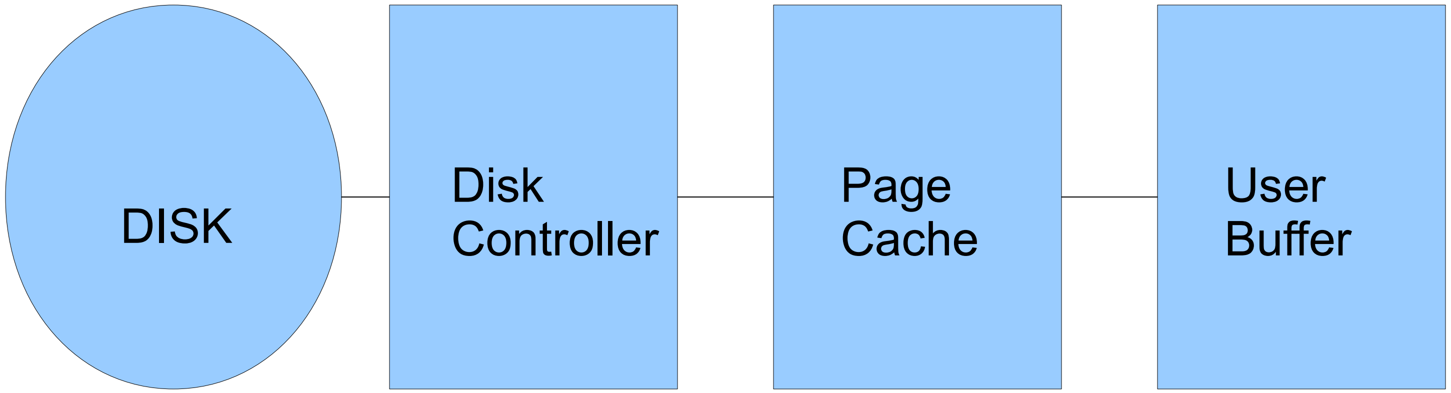
Much longer than just reading from memory

Rule #2

Databases have to do unpredictable queries, random I/O, and sequential scans so slow I/O kills performance

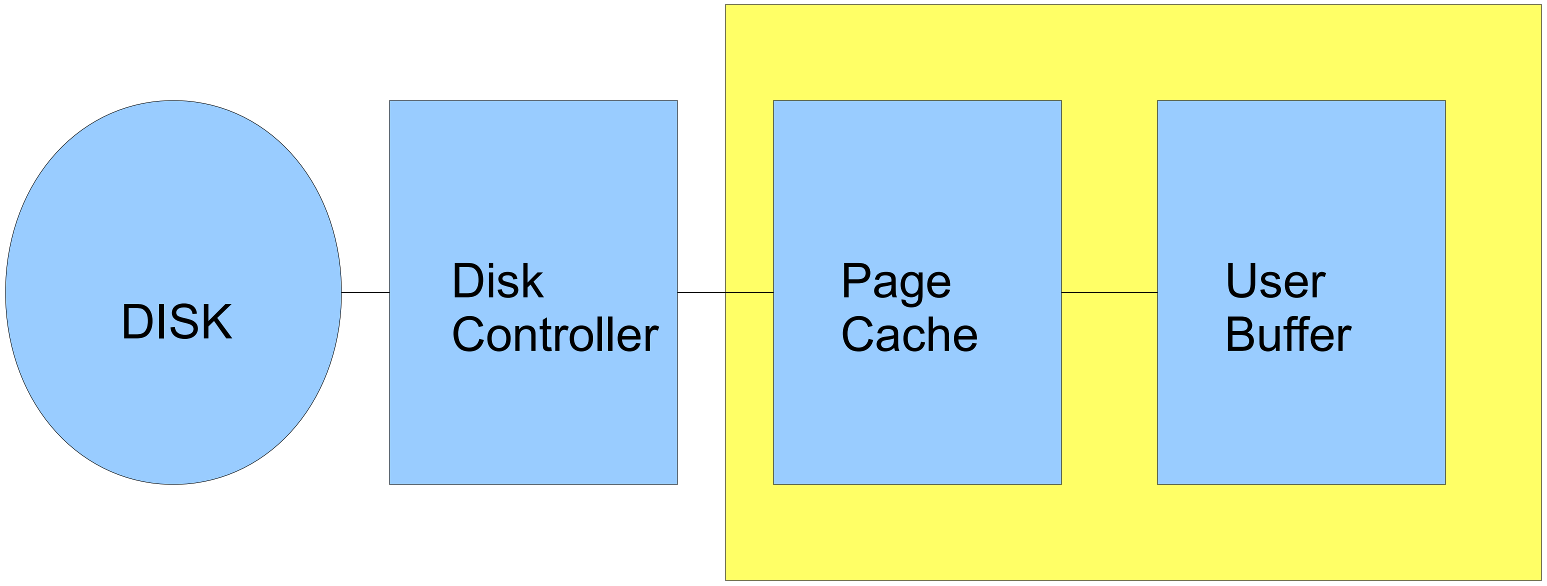
Buffers

What happens when you read a file into memory



Buffers

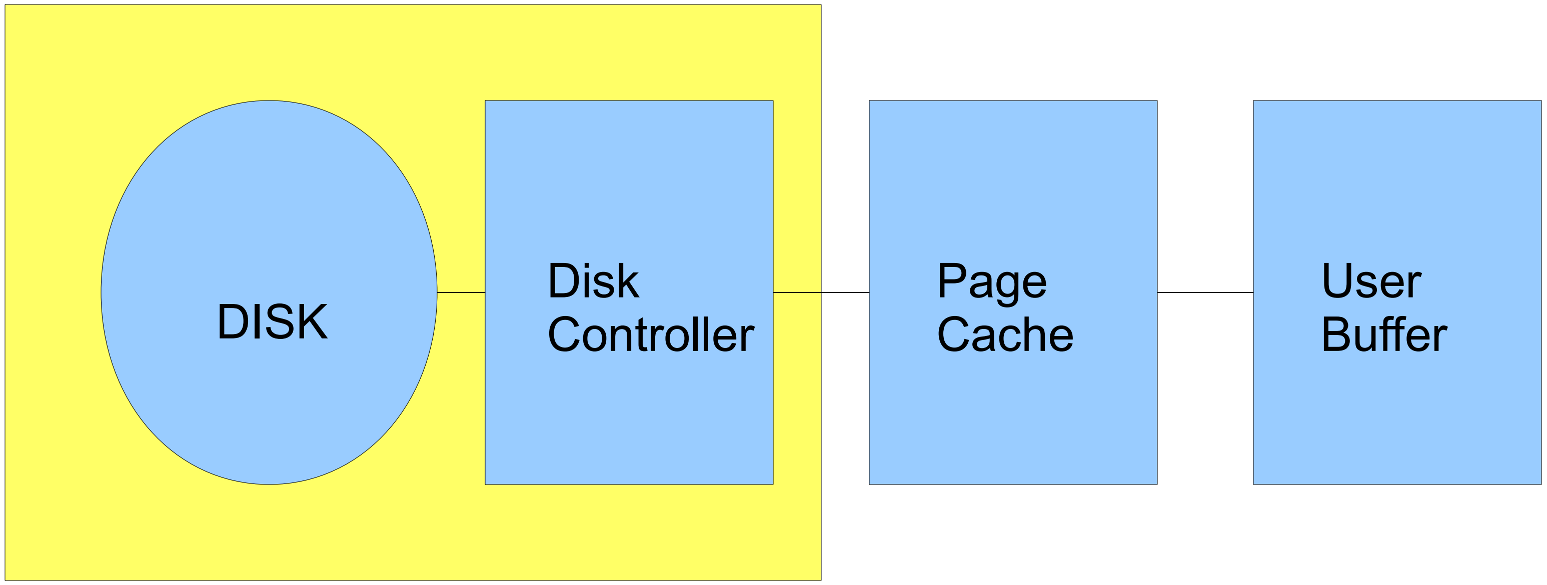
Memory Lookup – 100 nanoseconds, 12GB/sec



Buffers

Memory Lookup – 100 nanoseconds, 12GB/sec

DISK seek – 10 milliseconds, 760MB/sec



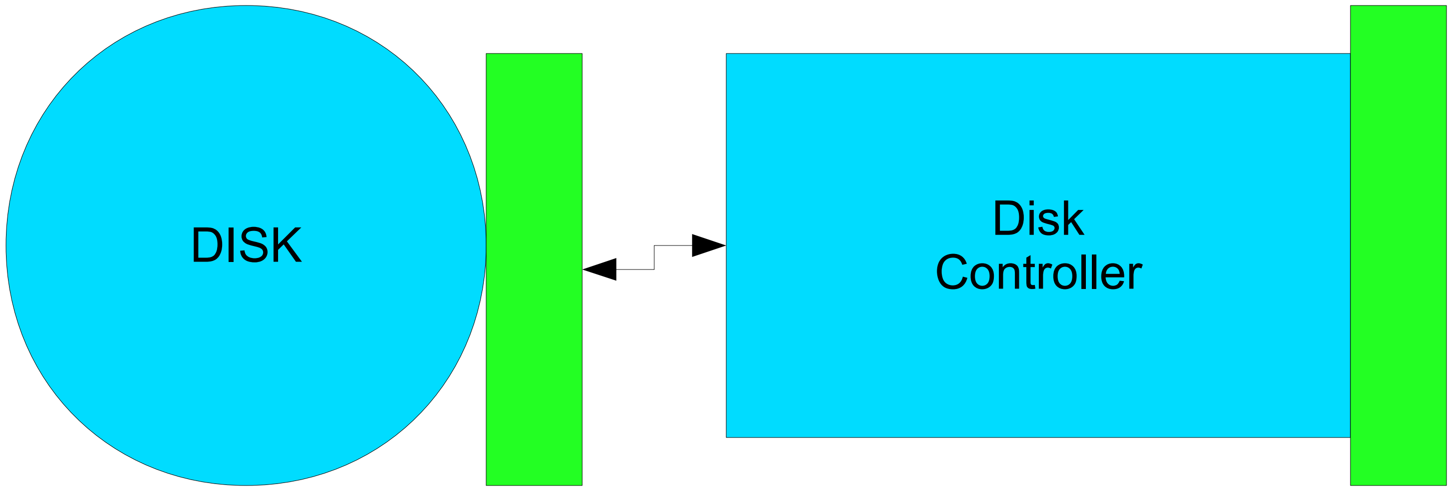
Disk Reads

A disk read is 100,000 slower than reading memory

- For comparison
  - 100,000 minutes is about 69.5 days
  - 100,000 feet is about 19 miles
  - 100,000 kilometers is 15.7 times around Earth's equator

Cache

Write*back* and write*through* caches

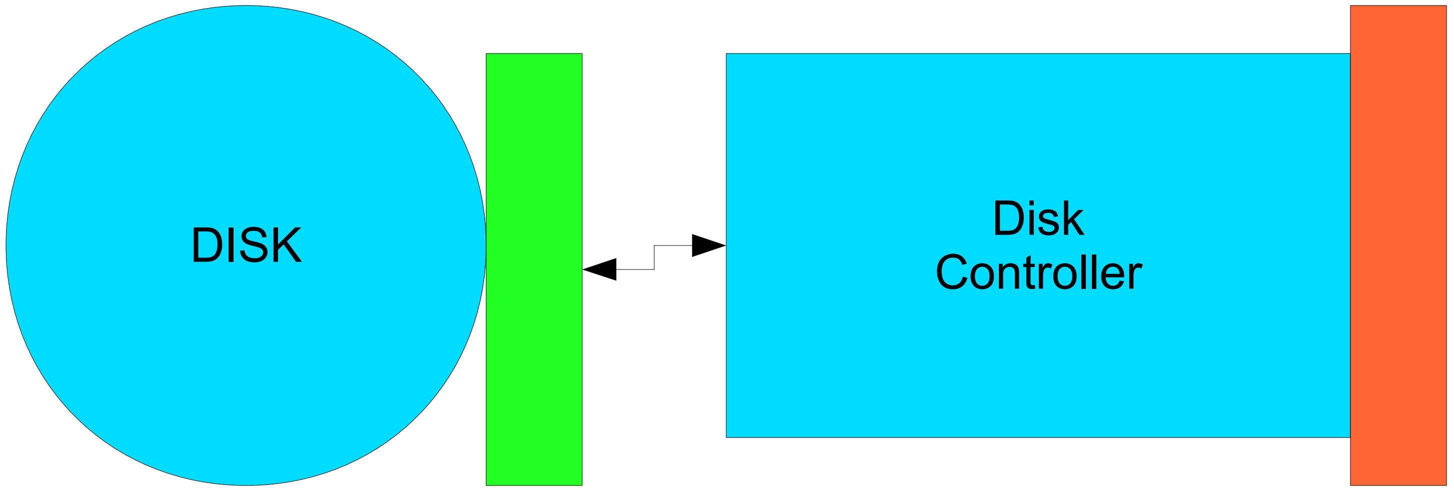


Writethrough on disk

Writethrough on controller

Cache

Recommended setup



Writethrough on disk

Writeback on controller

SSD

Use standard RAID controller

- SSD as writeback cache
- Battery backed
- $2.5/GB verses .075/GB
- Very fast seek time
- Density

Hardware recommendations

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4. CPUs, Core less important (spend money on Memory and IO)

Quick Security Warning!

MySQL login security is primitive.

- Database *mysql* has *users* table
- 'jsmith'@'co.com' or 'fred'@'10.10.%'
  - Matches *host*, then *user*, then *password* fields
    - Be explicit
- Proxy and Pluggable logins on the way

MySQL privilege security

- GRANT functions or access
- Can get Byzantine quickly
- Use a GUI

When *root* is the root of your *root* problem OR stingy is your best friend

Linux server has root

- Highly privileged
- Dangerous

MySQL daemon has root

- Highly privileged
- Dangerous
- Understand MySQL priv system and be stingy
- Proxy and plug-in adapters soon
- Really limit access, not just play at it

Linux root is not the same as MySQL root
but **both can be dangerous to you!!!**

ORACLE

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5. Spread data over different drives
6. Backups are necessary – and practice recovery!

Monitoring Operations

1. Slow query log -- not all long running queries are bad

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4. More in tuning ….

Backups

Backups are usually some sort of disk snap shot or serializing data to a file

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Use data replication to a slave and then backup slave

Be paranoid!!!!!

Replication

Replication for MySQL is the binary log for the master being copied to a slave. The slave then updates its copy of the data

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Two types:

1. Asynchronous – server does not check changes sent to slave before proceeding
2. Semi Synchronous – server checks that slave received changes before proceeding

Replication -- threads

Currently single threaded – 5.6 will fix that

Replication -- network

Network latency will affect MySQL replication. So plan network topology to minimize bandwidth competition with other systems/services.

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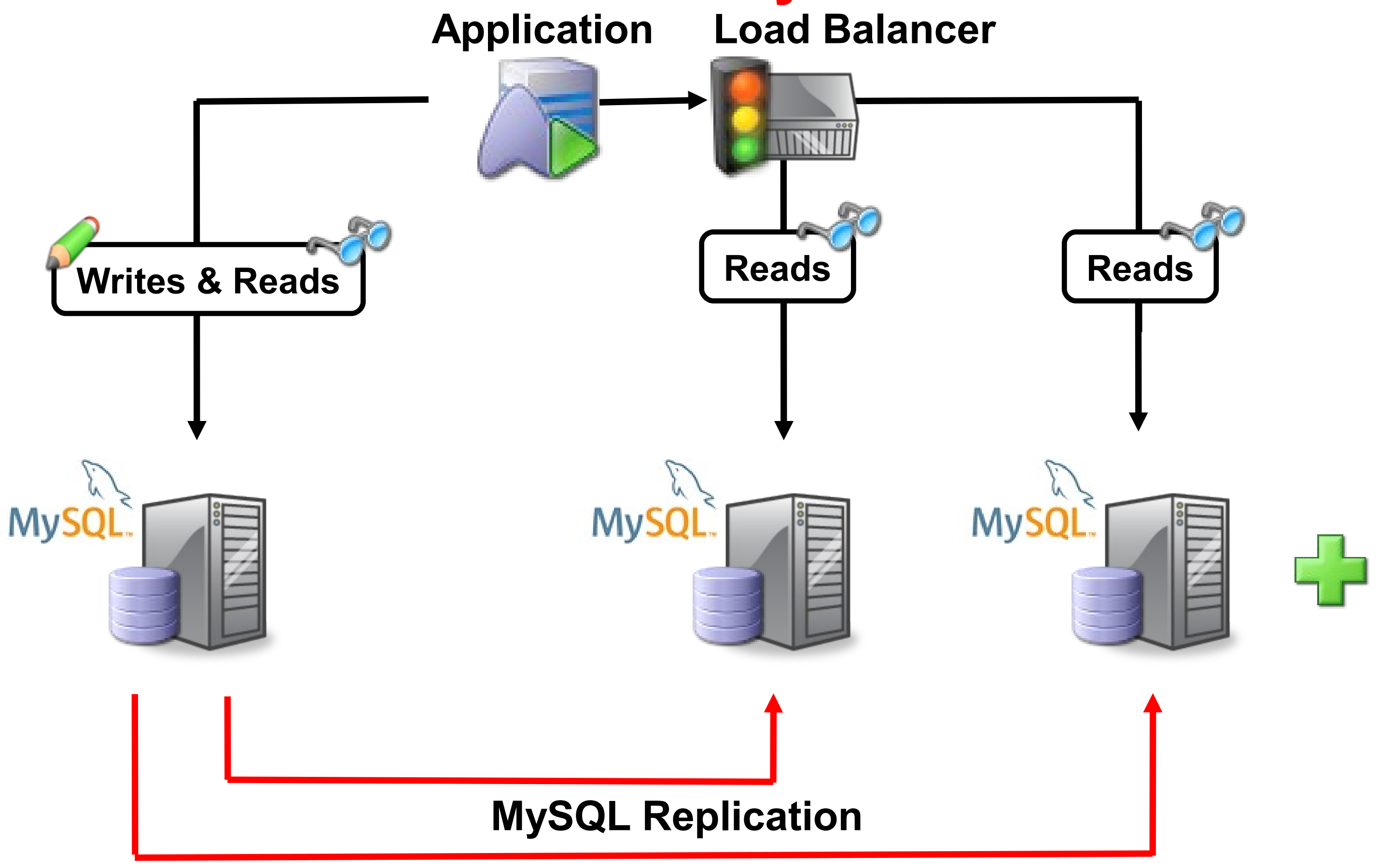
Slaves do not need to be as fast as the master but try to keep things reasonably close

Do not have to replicate all tables/databases to all slaves. Cut down on traffic by replicating what is needed!

MySQL Database

Replication Enables Scalability

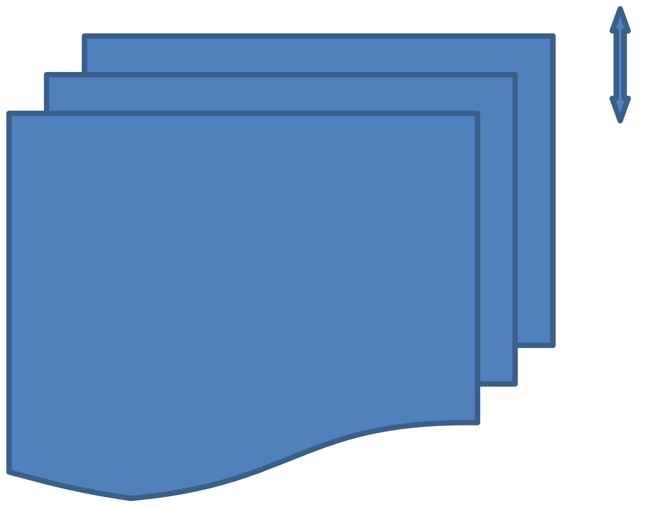


- Write to one master
- Read from many slaves, easily add more as needed
- Perfect for read/write intensive apps

Indexes are good

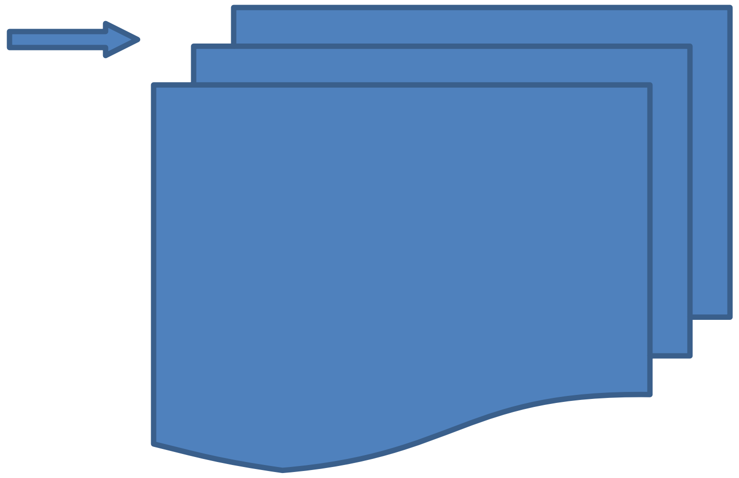
Without Index

DB needs to scan entire table or table scan



With Index

DB can go right to record



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- Overhead -- space, speed, maintenance
- Not a panacea – does not cure all problems
- Will not help if you need to perform a table scan
- Composite indexes can be tricky – YearMonthDay usually better than DayMonthYear

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- Partition data -- divide and conquer
- Architect your data
- Review your SQL statements

Don't hurt yourself

Some RAID controllers have a battery learning cycle when BBU goes write-back. Schedule during off-time!

Minimize time for most frequent queries

Keep on top of upgrades

- 5.5 20% faster than 5.1

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Skilled DBA

- Defined as obsessive professional looking to save nanoseconds off queries, possess current backups, helps developers rewrite queries, plans for future, and watches buffer hits rates compulsively.

Big hint

Seek to optimize the system as a whole. Often the database is blamed for systemic slowness when other components are at fault.

General Last hints

SQL

- Fetch needed data only, no **SELECT ***
- Use EXPLAIN
- Think in data sets, not nested loops
- Set benchmark times
- Use smallest data type possible
- Rewrite subqueries to joins

Mysqld

- Pay attention to new technologies, updates
- Know which buffers are per-session, global
- Do not ignore log files

Q&A

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