# MySQL性能优化概述

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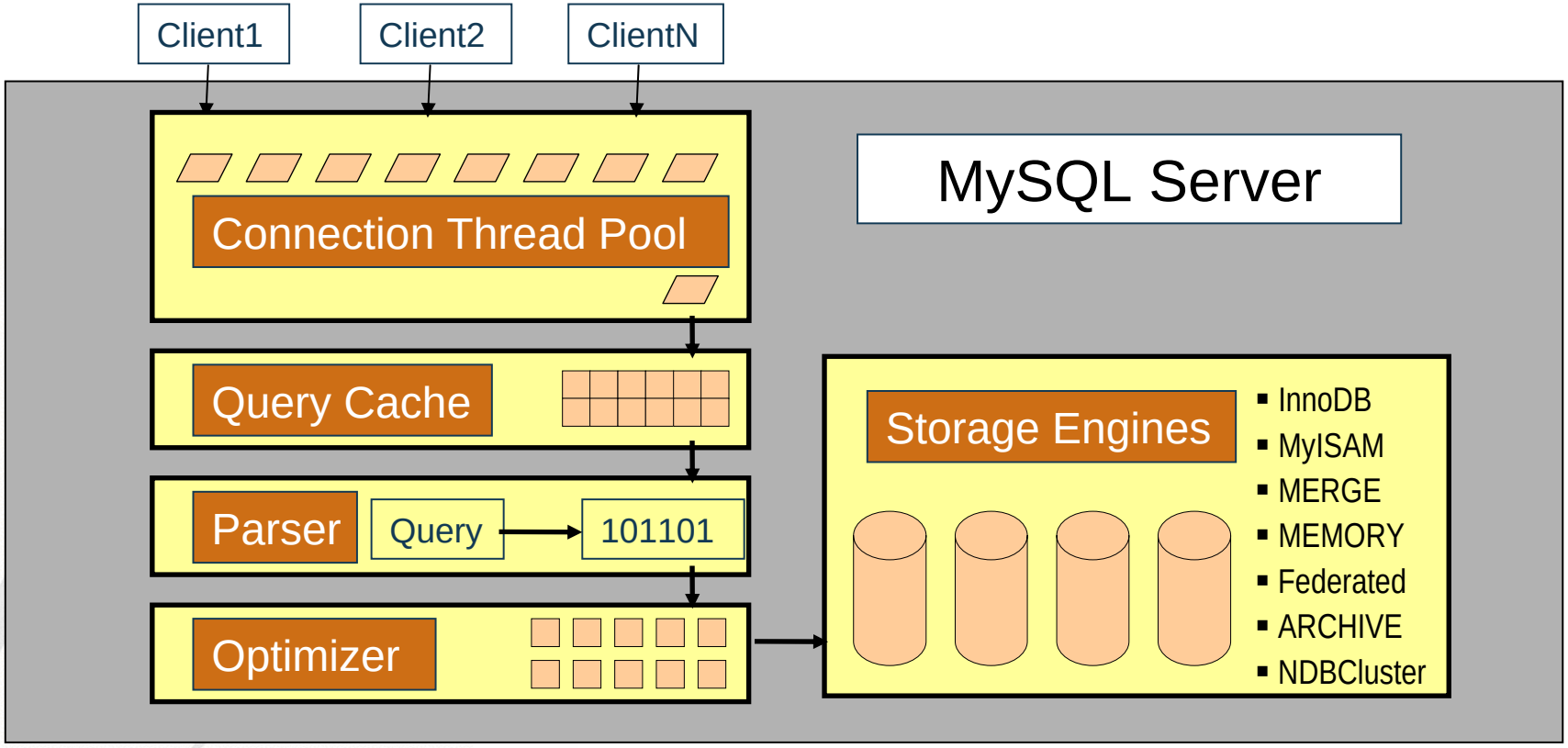
# 内 容

- MySQL调优概述
- 如何定位性能瓶颈
- 存储引擎和调优
- MySQL Cluster

# MySQL调优概述

- 硬件 软件 网络环境
- 数据表结构
- 索引
- SQL语句
- 参数
- 存储引擎

# MySQL调优概述

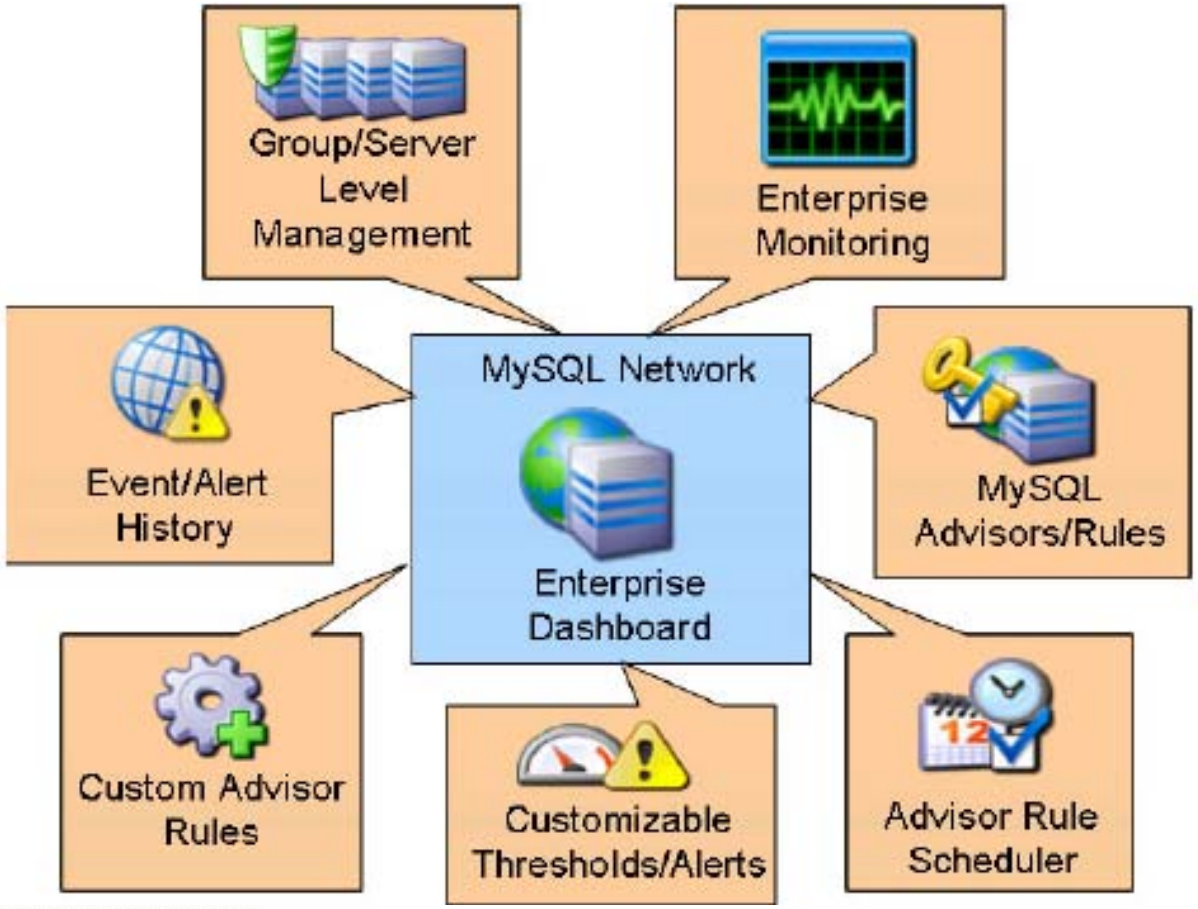


# 如何定位性能瓶颈

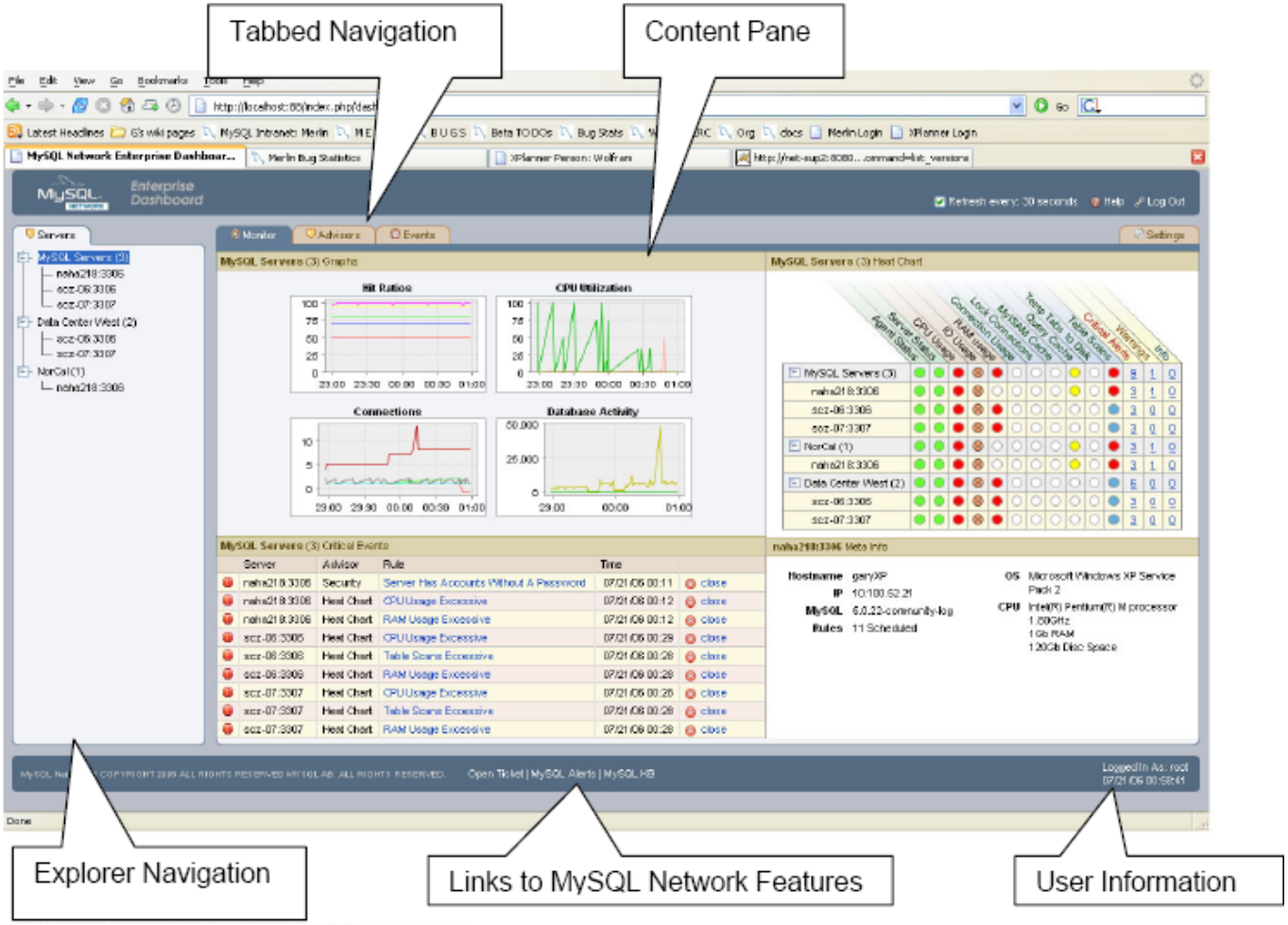
# 定位性能问题

- MySQL Monitor & Advisor
- Explain
- Profiling

# MySQL Monitor & Advisor



# MySQL Monitor & Advisor



# Query Execution Plan (EXPLAIN)

- **`EXPLAIN`** 模拟优化器执行查询,返回执行计划
- **`EXPLAIN`** tells you:
  - In which order the tables are read
  - What types of read operations that are made
  - Which indexes could have been used
  - Which indexes are used
  - How the tables refer to each other
  - How many rows the optimizer estimates to retrieve from each table

# Query Execution Plan (EXPLAIN)

```
mysql> EXPLAIN SELECT Country.Name FROM Country JOIN CountryLanguage
-> ON Code=CountryCode WHERE Language = 'Russian' \G
*************************** 1. row ***************************
id: 1
select_type: SIMPLE
table: Country
type: ALL
possible_keys: PRIMARY
key: NULL
key_len: NULL
ref: NULL
rows: 239
Extra:
*************************** 2. row ***************************
id: 1
select_type: SIMPLE
table: CountryLanguage
type: eq_ref
possible_keys: PRIMARY
key: PRIMARY
key_len: 33
ref: world_test.Country.Code,const
rows: 1
Extra: Using where; Using index
2 rows in set (0.00 sec)
```

# Query Execution Plan (EXPLAIN)

```
mysql> ALTER TABLE CountryLanguage ADD INDEX (Language);
Query OK, 984 rows affected (0.24 sec)
Records: 984 Duplicates: 0 Warnings: 0

mysql> EXPLAIN SELECT Country.Name FROM Country JOIN CountryLanguage
-> ON Code=CountryCode WHERE Language = 'Russian' \G
*************************** 1. row ***************************
id: 1
select_type: SIMPLE
table: CountryLanguage
type: ref
possible_keys: PRIMARY,Language
key: Language
key_len: 30
ref: const
rows: 15
Extra: Using where
*************************** 2. row ***************************
id: 1
select_type: SIMPLE
table: Country
type: eq_ref
possible_keys: PRIMARY
key: PRIMARY
key_len: 3
ref: world_test.CountryLanguage.CountryCode
rows: 1
Extra:
2 rows in set (0.00 sec)
```

# Profiling

```
mysql> set @@profiling=1;
Query OK, 0 rows affected (0.00 sec)

mysql> select city.name, country.name from city, country where countrycode=code
and continent='Asia' order by city.name limit 5;
+-----------+--------------+
| name      | name         |
+-----------+--------------+
| Abadan    | Iran         |
| Abha      | Saudi Arabia |
| Abiko     | Japan        |
| Abohar    | India        |
| Abottabad | Pakistan     |
+-----------+--------------+
5 rows in set (0.00 sec)
```

# Profiling

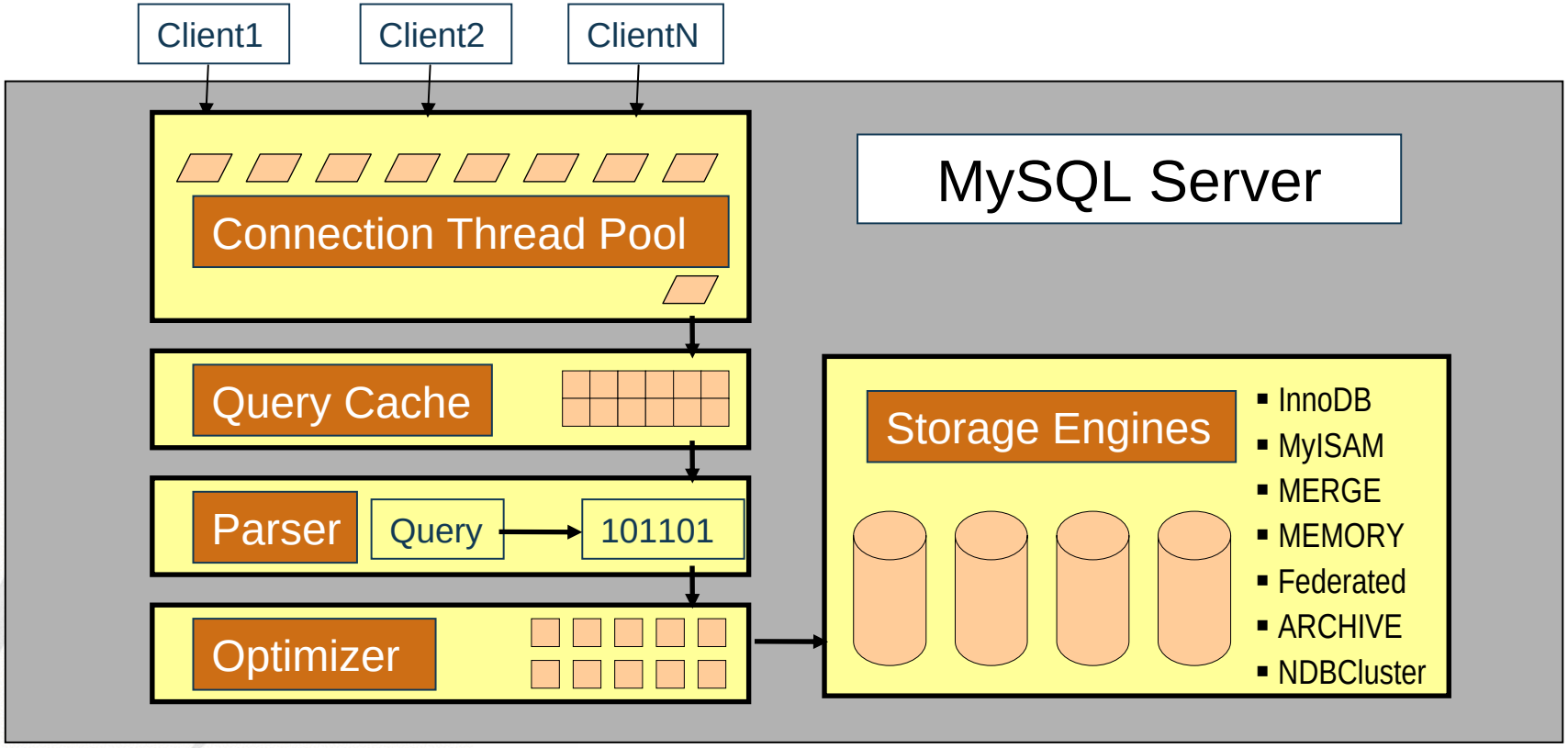
```
mysql> show profiles;
+----------+------------+-------------------------------------------------------------
-------------------------------------------------------------+
| Query_ID | Duration   | Query
                                                                                      |
+----------+------------+-------------------------------------------------------------
-------------------------------------------------------------+
|        1 | 0.00785400 | select city.name, country.name from city, country wher
e countrycode=code and continent='Asia' order by city.name limit 5 |
+----------+------------+-------------------------------------------------------------
-------------------------------------------------------------+
```

# Profiling

```
mysql> show profile for query 1;
+----------------------+------------+
| Status               | Duration   |
+----------------------+------------+
| (initialization)     | 0.00010875 |
| Opening tables       | 0.00001975 |
| System lock          | 0.00004675 |
| Table lock           | 0.00001450 |
| init                 | 0.00004500 |
| optimizing           | 0.00002175 |
| statistics           | 0.00009025 |
| preparing            | 0.00003200 |
| executing            | 0.00000500 |
| Sorting result       | 0.00000475 |
| Sending data         | 0.00045700 |
| end                  | 0.00000700 |
| query end            | 0.00000600 |
| freeing items        | 0.00697600 |
| closing tables       | 0.00001550 |
| logging slow query   | 0.00000400 |
+----------------------+------------+
16 rows in set (0.00 sec)
```

# 存储引擎和调优

# MySQL的存储引擎



# 可插存储引擎结构

- MySQL 支持许多存储引擎，它们处理不同类型的表
- 通过选择，创建或扩展存储引擎来更好的适应应用的特殊要求
- 对你来说最重要的是什么?
  - 集中读
  - OLTP（联机事务处理）
  - 事务处理
  - 性能
  - 可伸缩性
  - 并发级别
  - 索引类型
  - 存储利用
  - 高可靠性
  - 复制
  - 在线备份
  - 数据仓库
  - 不相关关键字
  - 占用空间小
  - 行级别锁
  - 嵌入式
  - 表级别锁
  - 集群

# 存储引擎特点

- **MyISAM**
  - 特点: 非常有效率的存储, 易于处理高速数据加载
  - 适用于: 高流量网站 数据仓库
- **InnoDB**
  - 特点: 提供ACID 事务处理支持
  - 适用于: 在线事务处理应用
- **Archive**
  - 特点: 自动数据压缩
  - 适用于: 历史数据仓库,数据存档, 数据审计
- **NDB**
  - 特点: 支持事务处理 提供高可靠机制
  - 适用于: 高可靠 不停顿业务, 快速目录/关键字查找应用

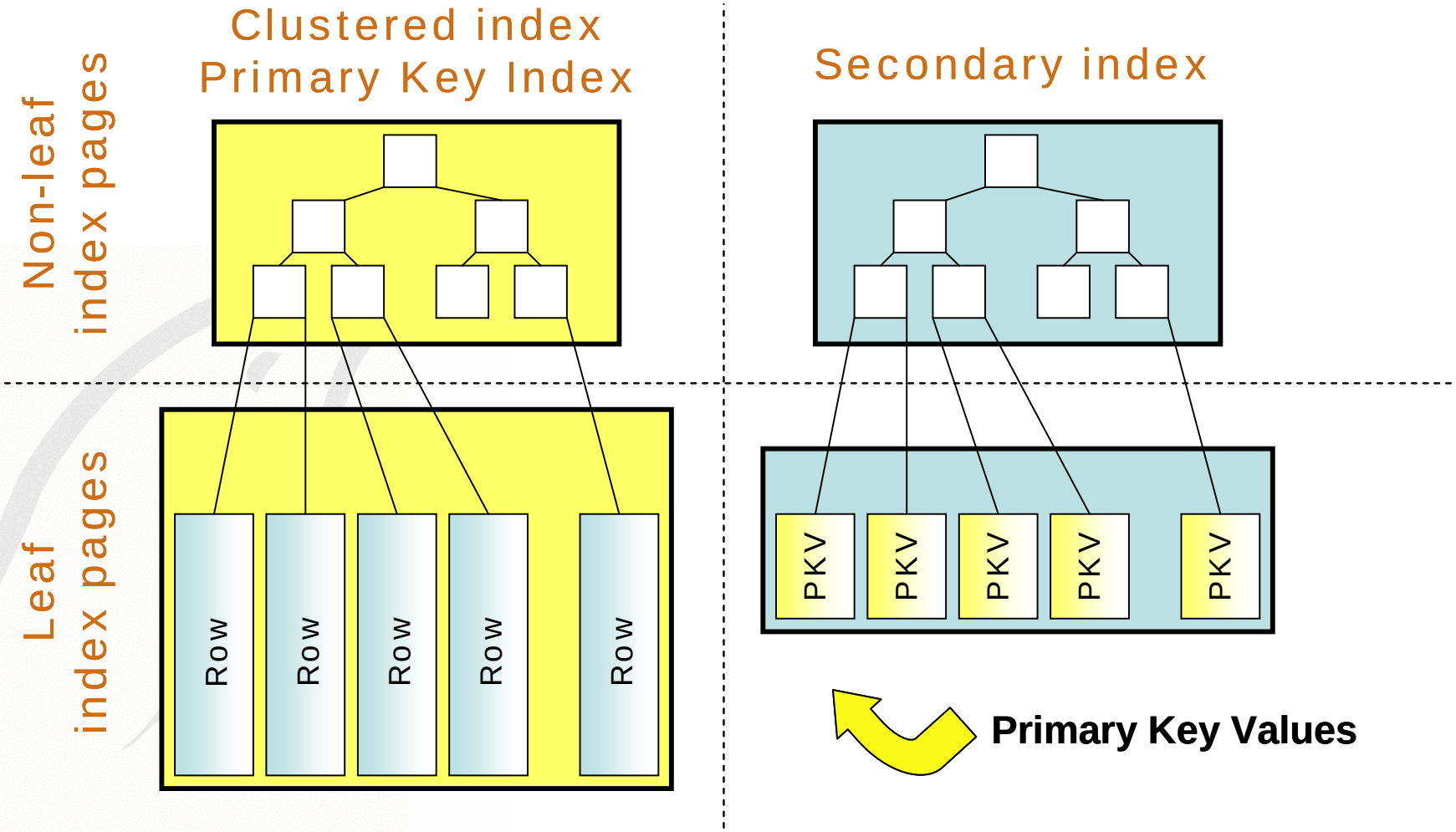
# 存储引擎的特点

- 锁的机制
- 索引
- 对事务的支持
- 参数
- 备份机制

# 锁

- **InnoDB** 支持
  - 行级锁
    - Finest level of lock granularity
    - Only the row that is read or updated is locked
    - Allows other concurrent transactions to access other rows on the same page
  - 表级锁
    - Only used when there are  changes to the table structure itself (as is the case with Alter table)
    - Ensures the utmost integrity of the data it contains when doing direct changes to the table structure itself
    - Controlled by the --InnoDB-table-locks server setting

# 索引



# 参数

```
[mysqld]
# You can write your other MySQL server options here
# ...
# Data files must be able to hold your data and indexes.
# Make sure that you have enough free disk space.
innodb_data_file_path = ibdata1:10M:autoextend
#
# Set buffer pool size to 50-80% of your computer's memory
innodb_buffer_pool_size=1024M
innodb_additional_mem_pool_size=10M
#
# Set the log file size to about 25% of the buffer pool size
innodb_log_file_size=250M
innodb_log_buffer_size=8M
#
innodb_flush_log_at_trx_commit=1
```

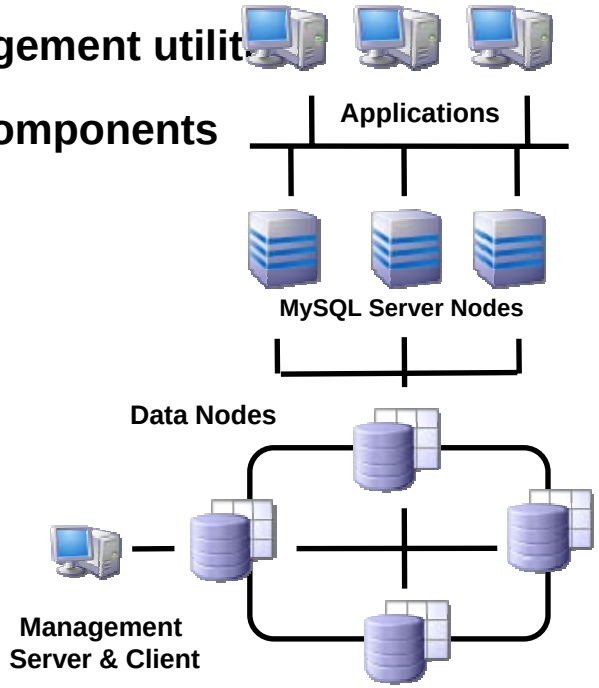
# InnoDB调优窍门

- 尽量使用短的,整型主键
- Load/Insert 数据时尽量用主键的顺序
- 增加日志文件大小
- 避免大的事务回滚
- 避免大量插入
- 尽量使用前缀索引

# MySQL Cluster

# 高可靠性解决方案: 集群

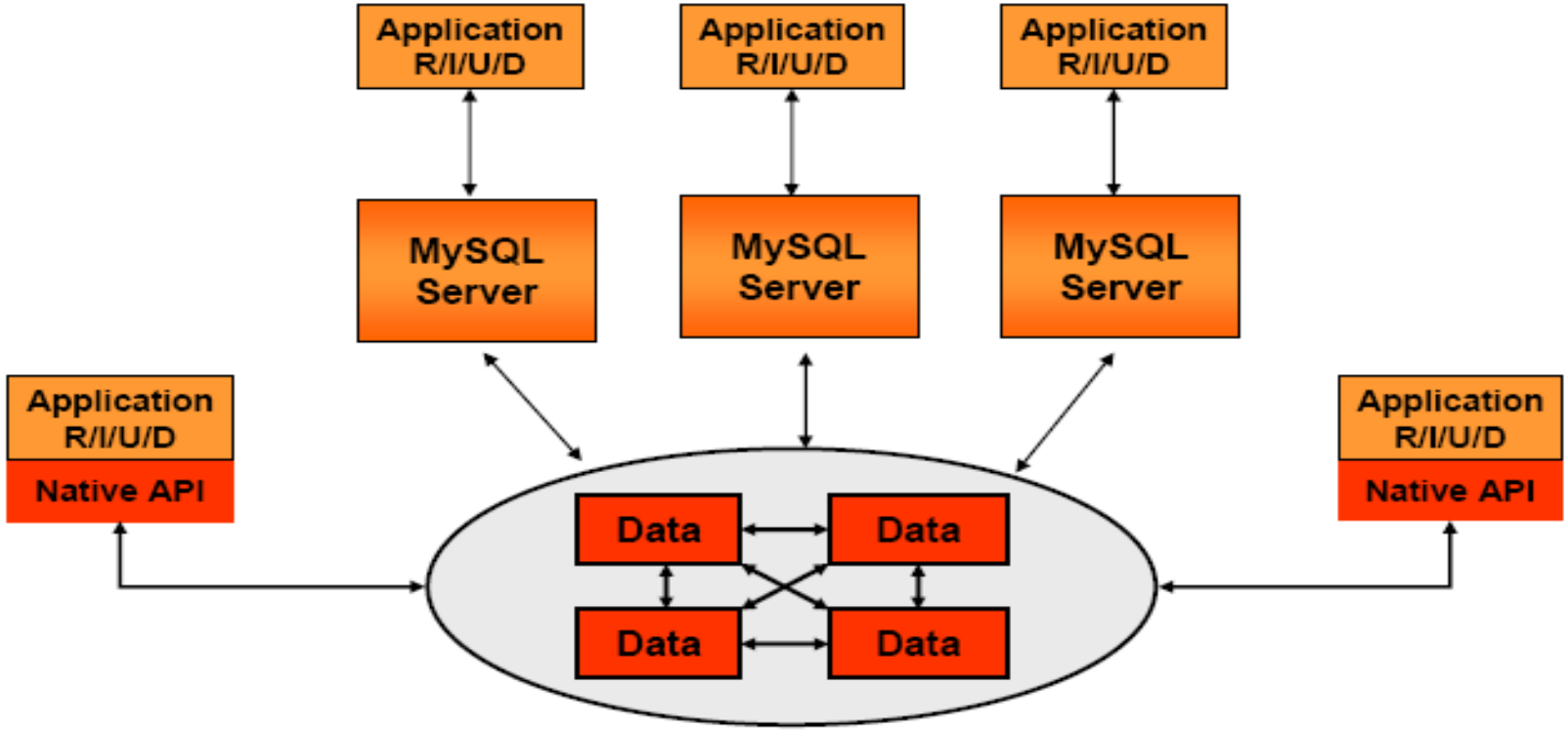
- 成本
  - Use commodity hardware to accommodate the growth of users, traffic, and data
- 容错
  - No single point of failure
- 高可靠性
  - Data is replicated across nodes and always available
  - Automatic fail-over
- 可扩展性
  - Distributes large workloads
  - Replicas for Read
  - Partitions for Write
  - Supports “Scale Out”
- 高性能
  - Load balanced
  - Memory based storage engine
  - Designed to handle thousands of requests per second
- 简化管理
  - Cluster management utilit
  - Commodity components



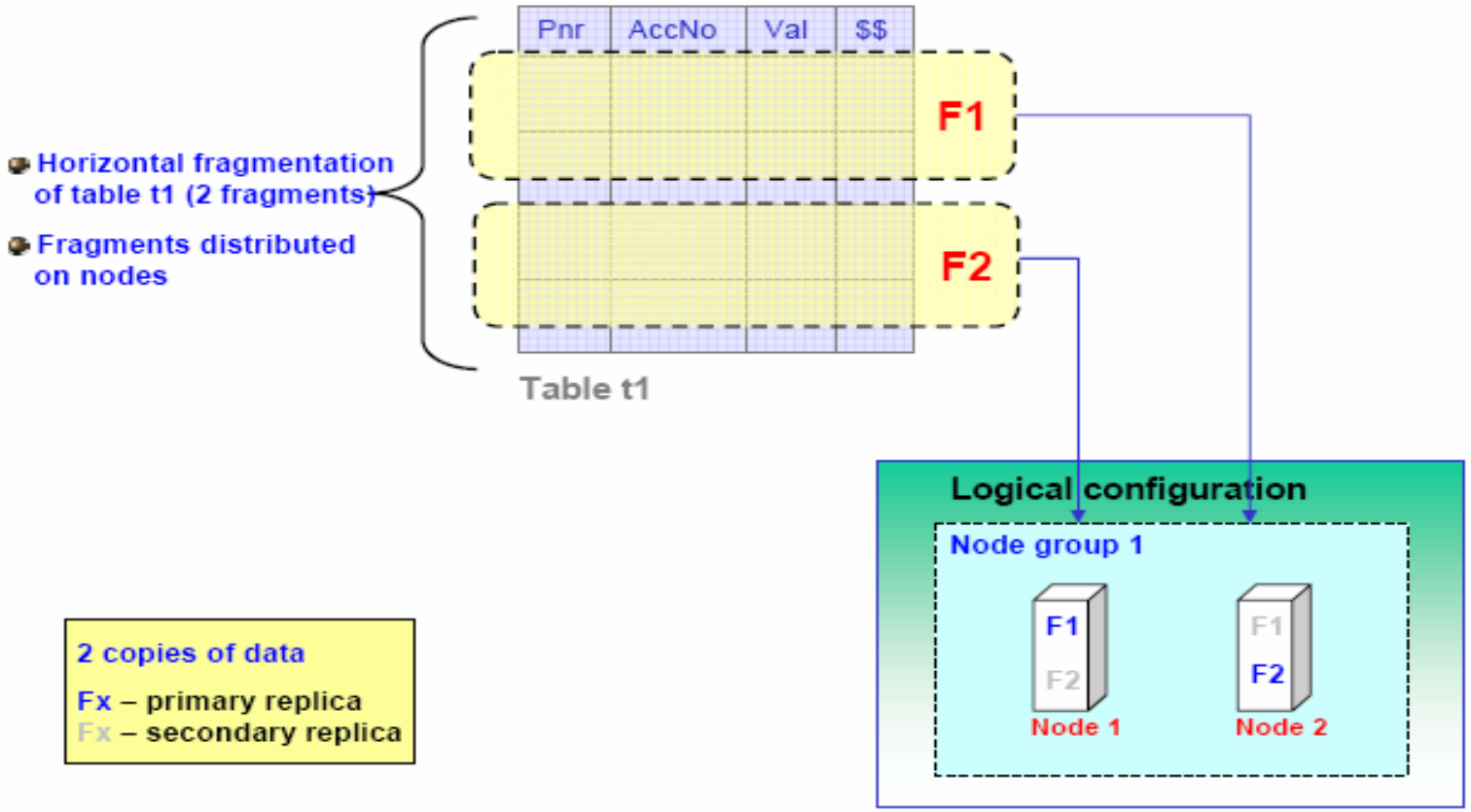
# MySQL Cluster 概述

- 并行数据库
  - Shared-nothing architecture
- 数据在节点上分散存储
  - In a RAID10 fashion
- 冗余
  - Synchronous replication
  - Automatic fail over and recovery
- 性能
  - Ability to mix and match disk and memory tables
  - Different access methods (SQL or native NDB API)

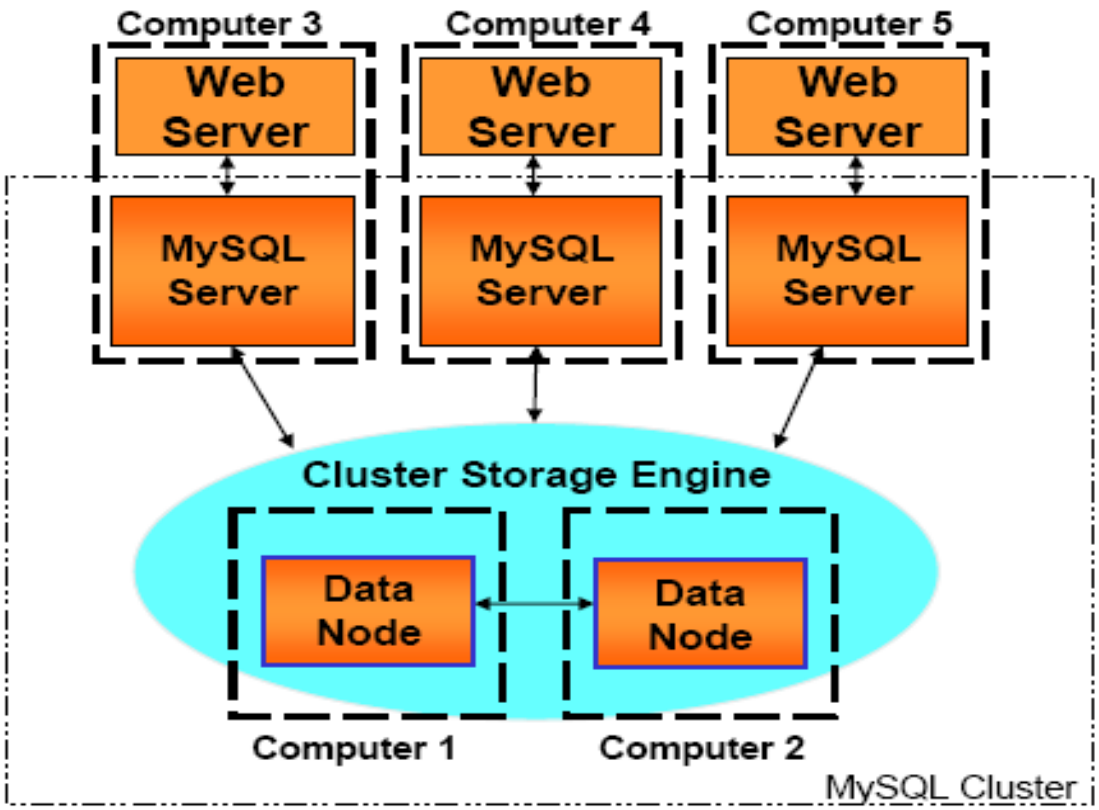
# 高可靠性解决方案: MySQL 集群



# 2节点集群的数据分布



# 高性能配置



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