MySQL High-Availability and Scale-Out architectures

Oli Sennhauser

Senior Consultant

osennhauser@mysql.com

Introduction

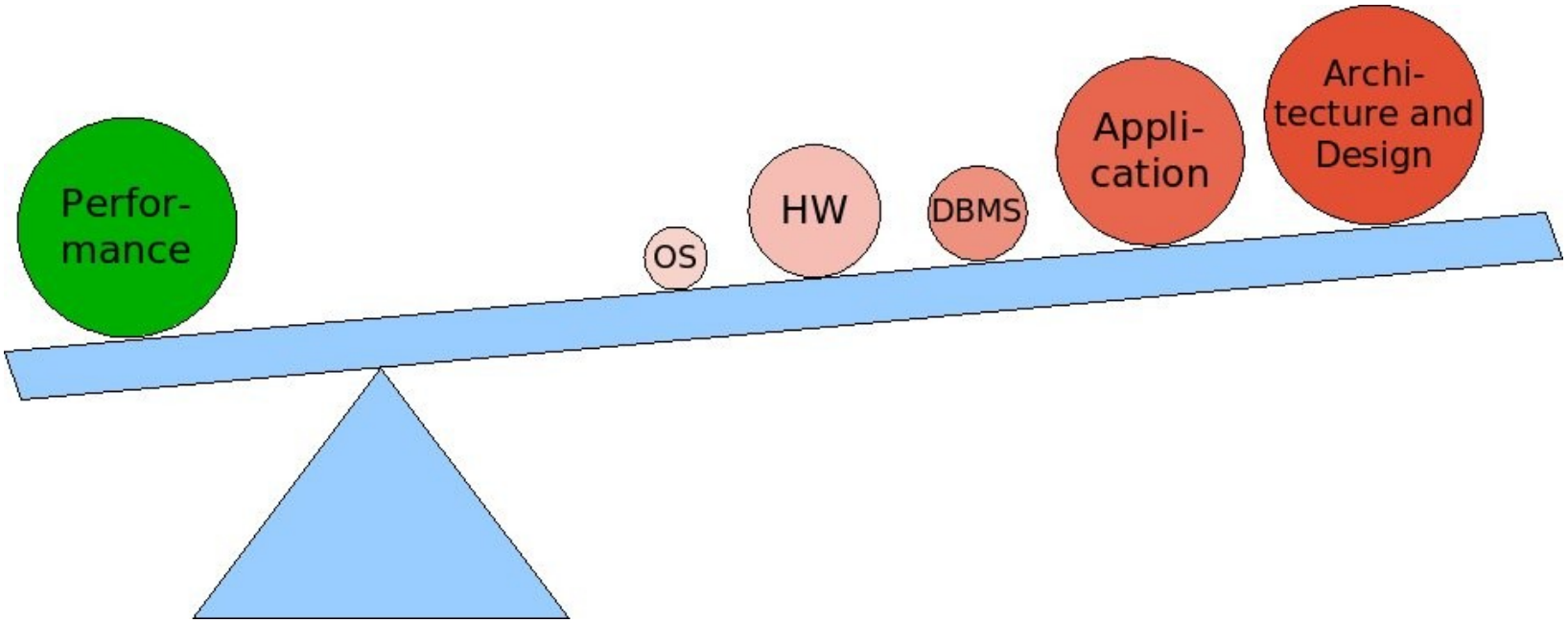
- Who we are?
- What we want?

Table of Contents

- Scale-Up vs. Scale-Out
- MySQL Replication
- MySQL HA solution
- MySQL Cluster
- Application architectural solutions
- Other architectural stuff
- It's your turn...
- Let us build a replication

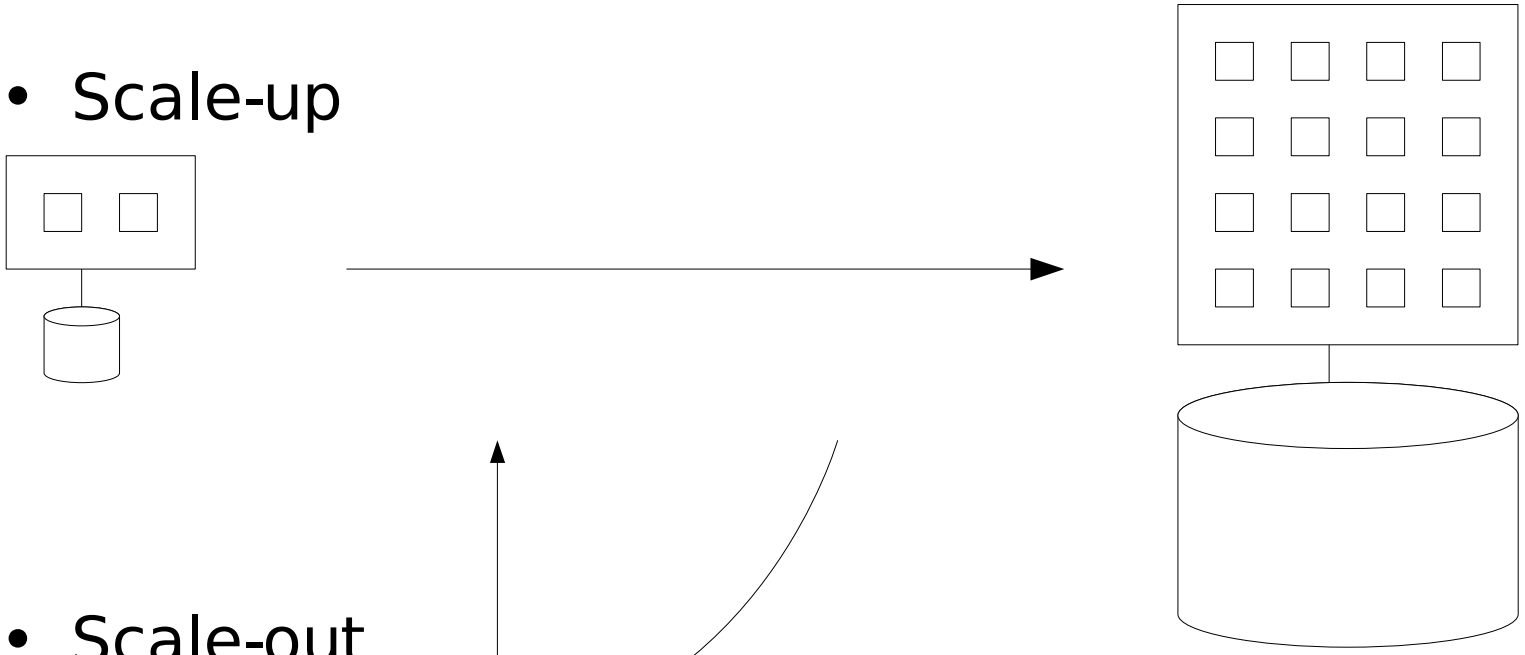
When do we think about architecture?

- Performance problems
- HA requirements

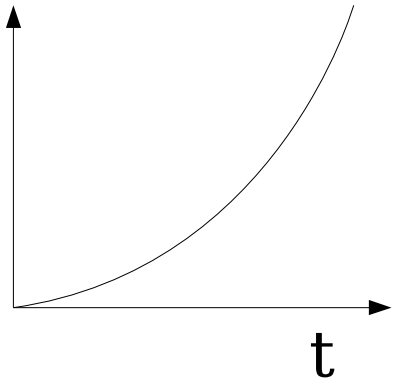


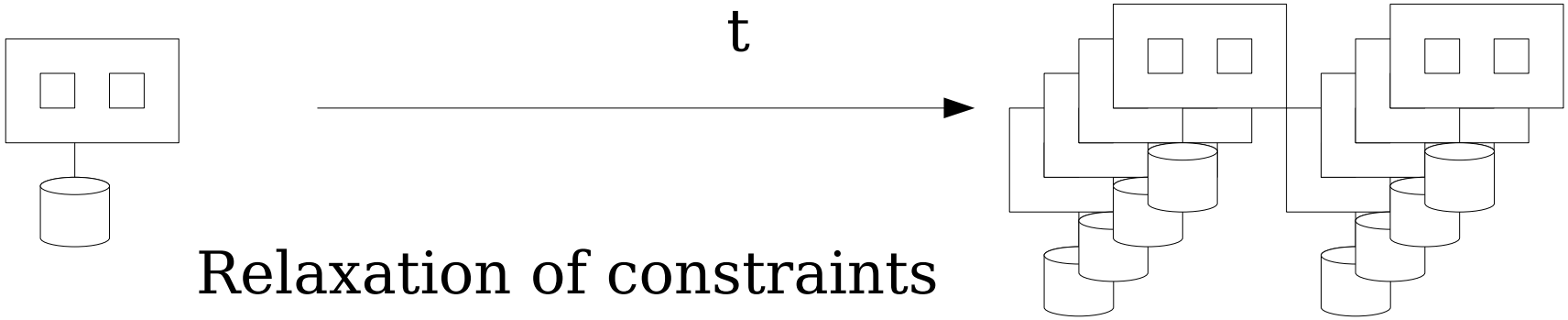
Scale-up vs. Scale-Out

- Scale-up



- Scale-out

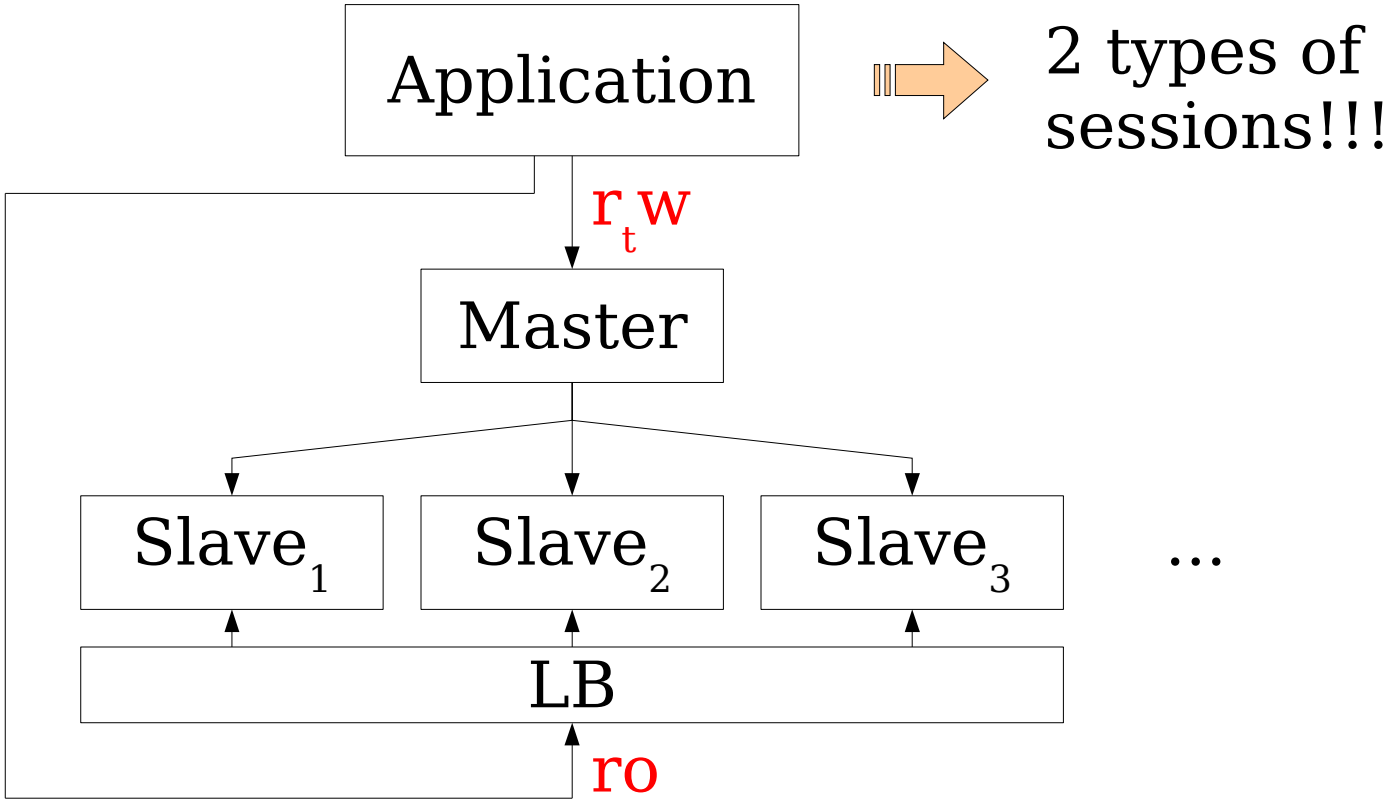




Relaxation of constraints

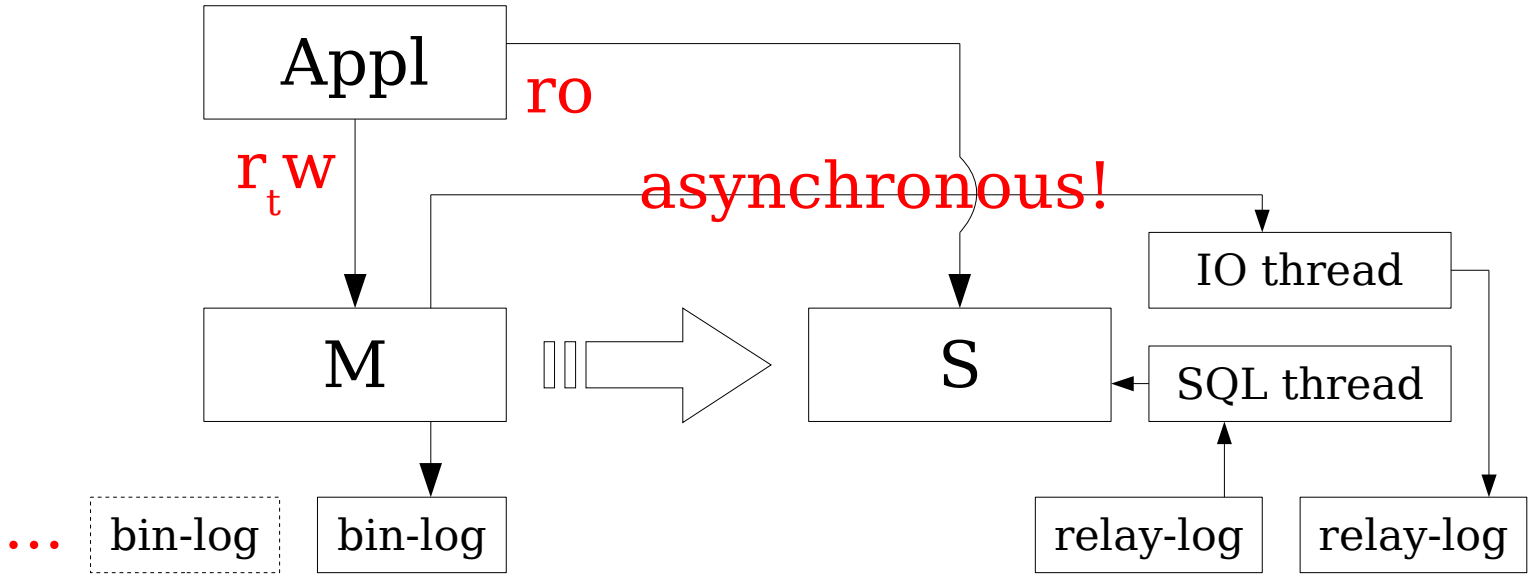
MySQL Replication

- The MySQL answer: Master-Slave-Replication:



Even Oracle uses the expression “scale-out” now!

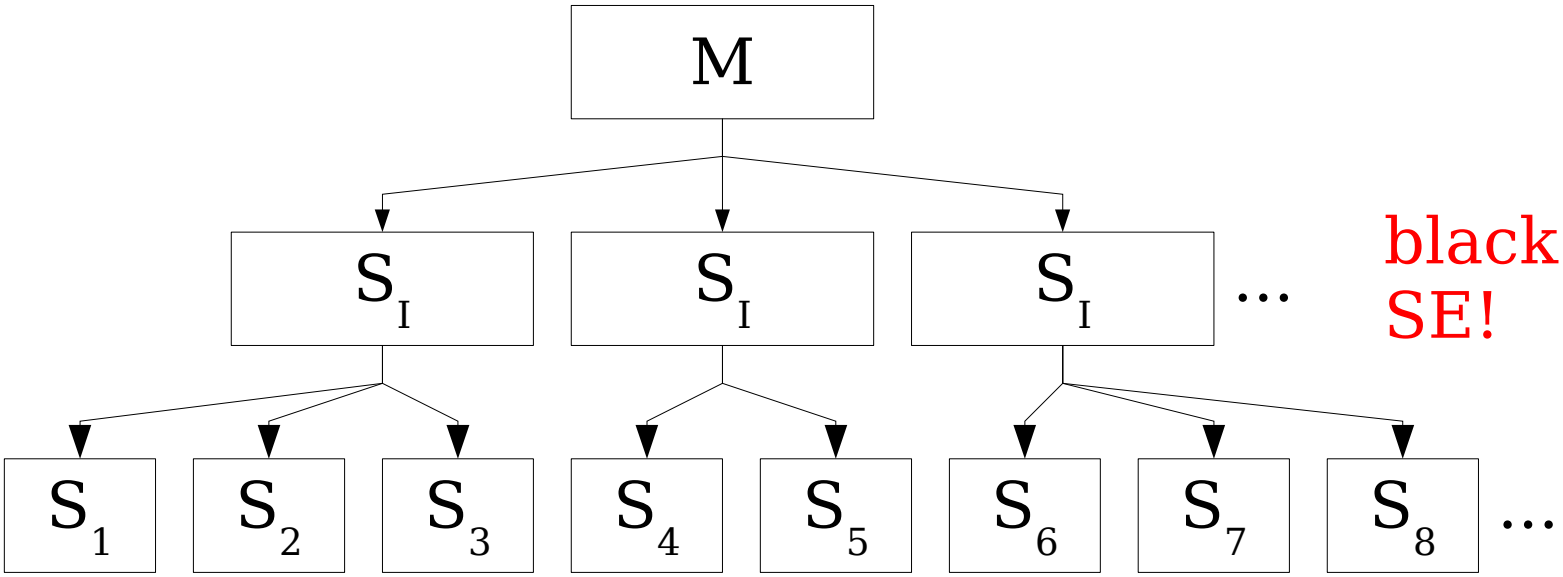
MySQL Replication in detail



- wide distance possible!
- thin line possible!

MySQL Replication varieties

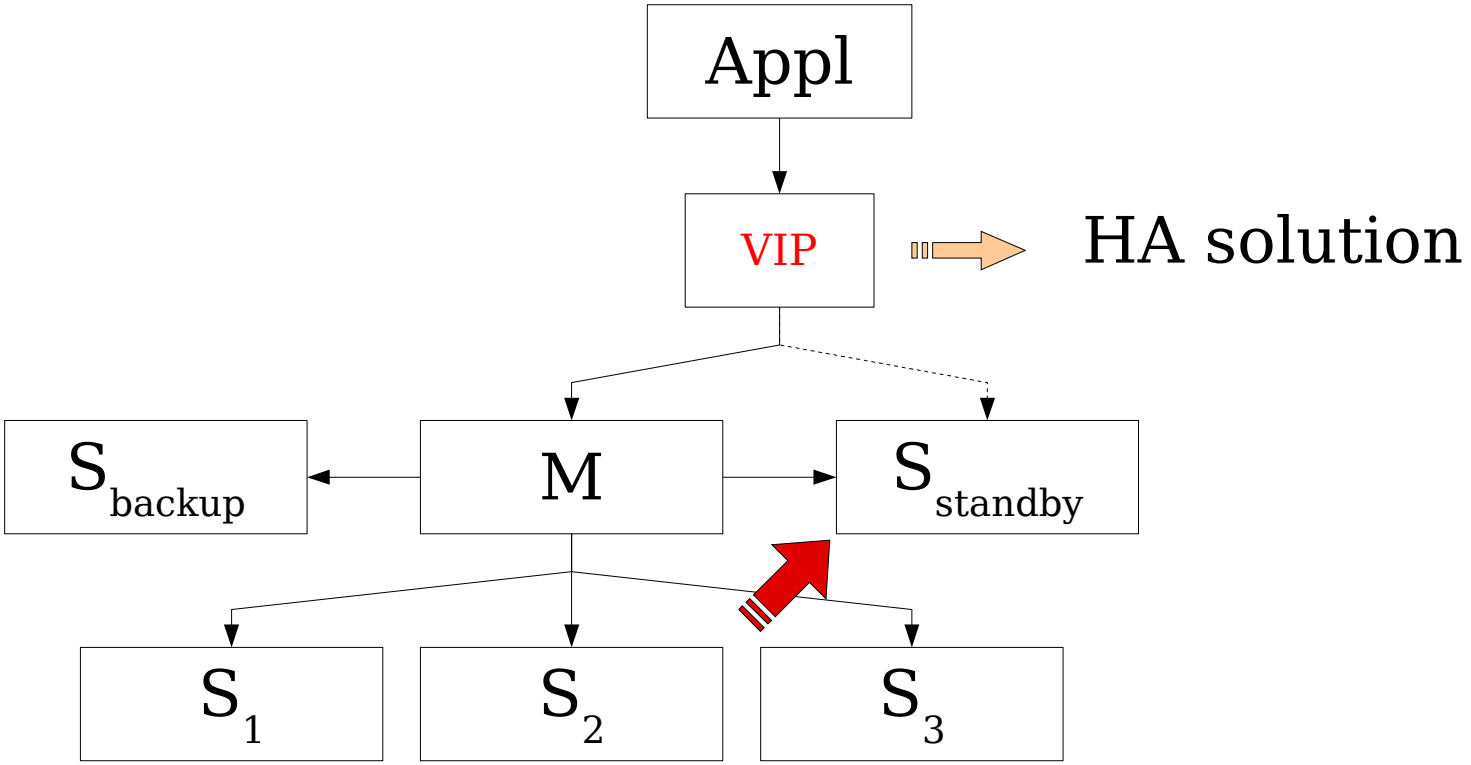
- Cascaded replication:



for example Yahoo!

MySQL Replication varieties

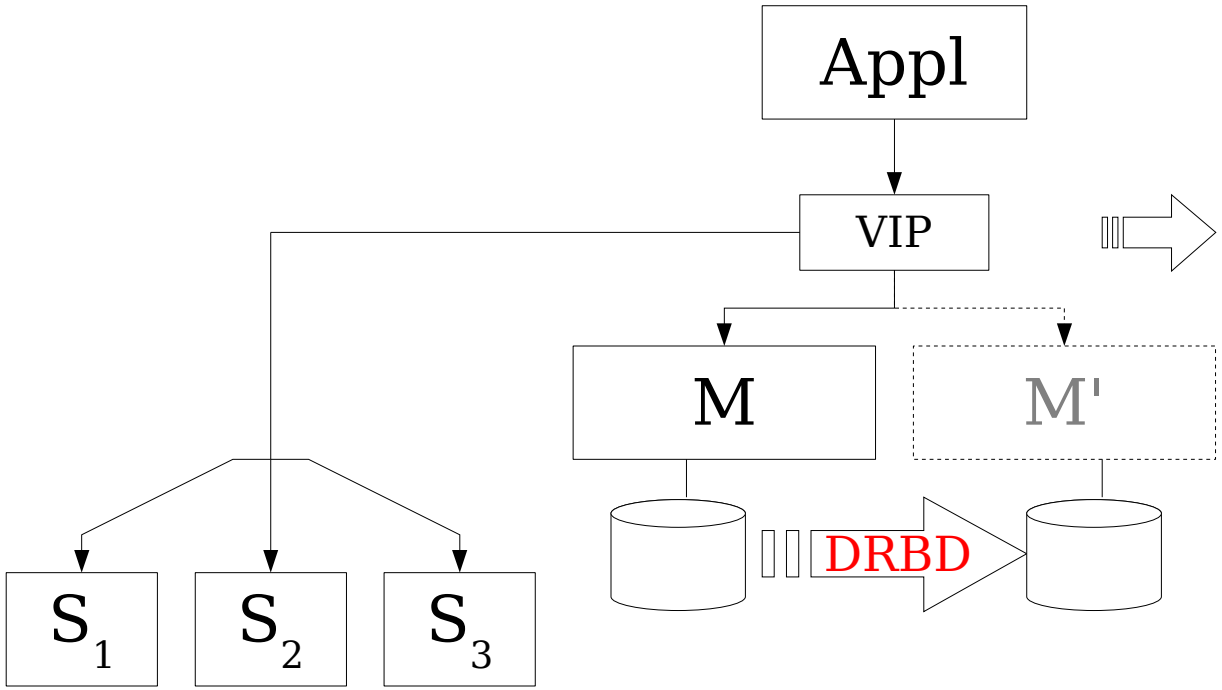
- HA with “hot standby” Slave:



- active – active fail over!

MySQL HA solution

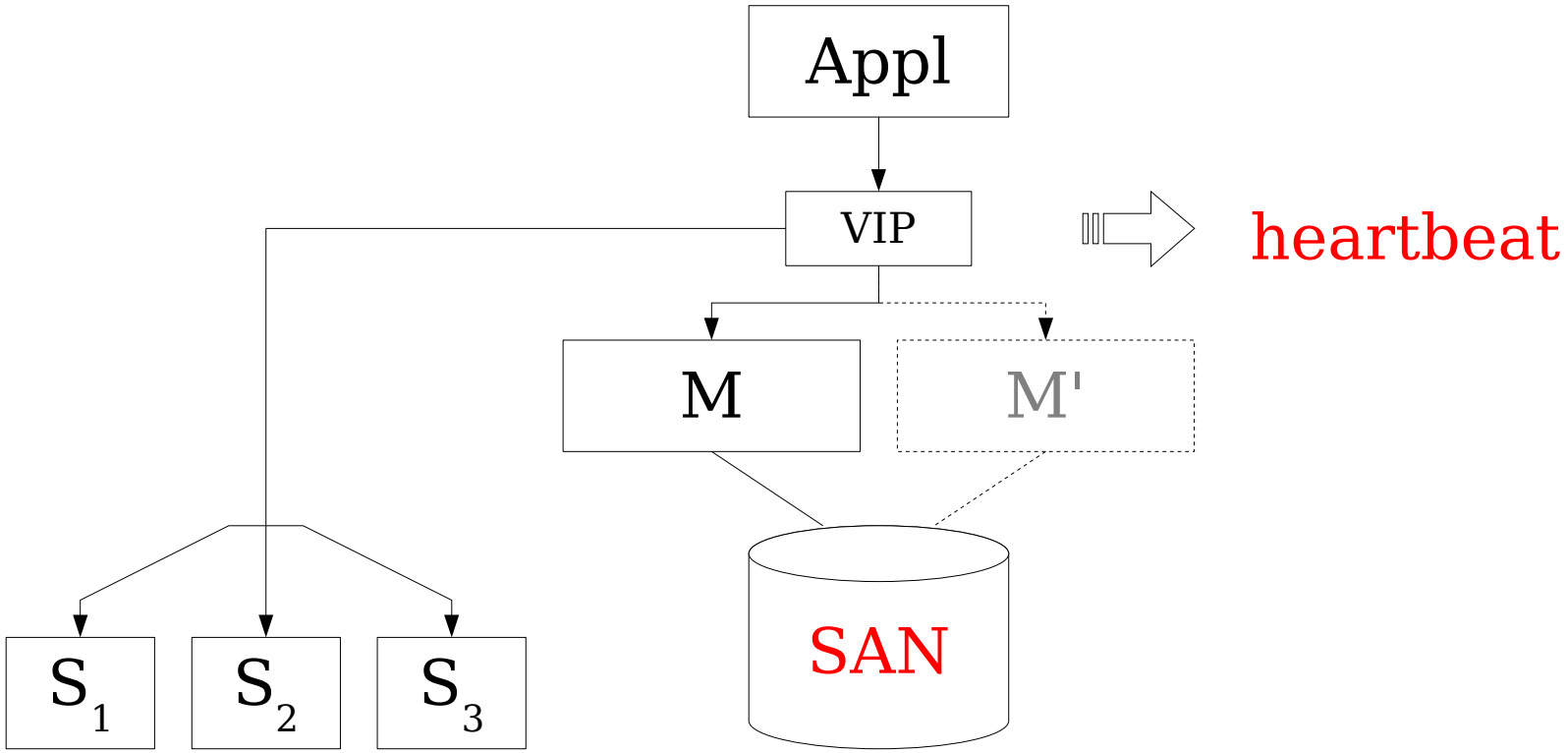
- HA with MySQL:



- 99.99% HA (four nine)
- active – passive fail over!

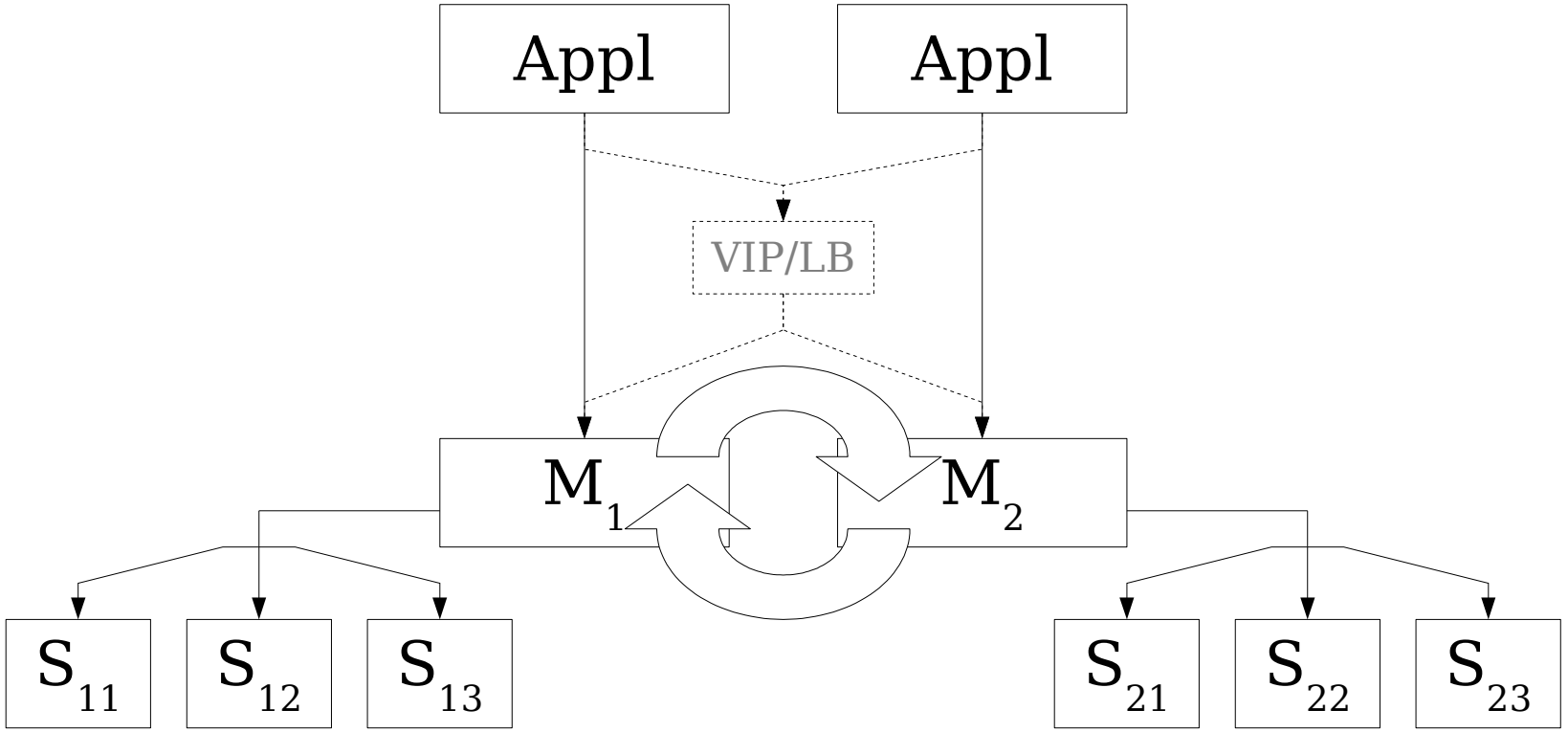
MySQL HA solution

- HA with MySQL and SAN:



Multi-Master Replication

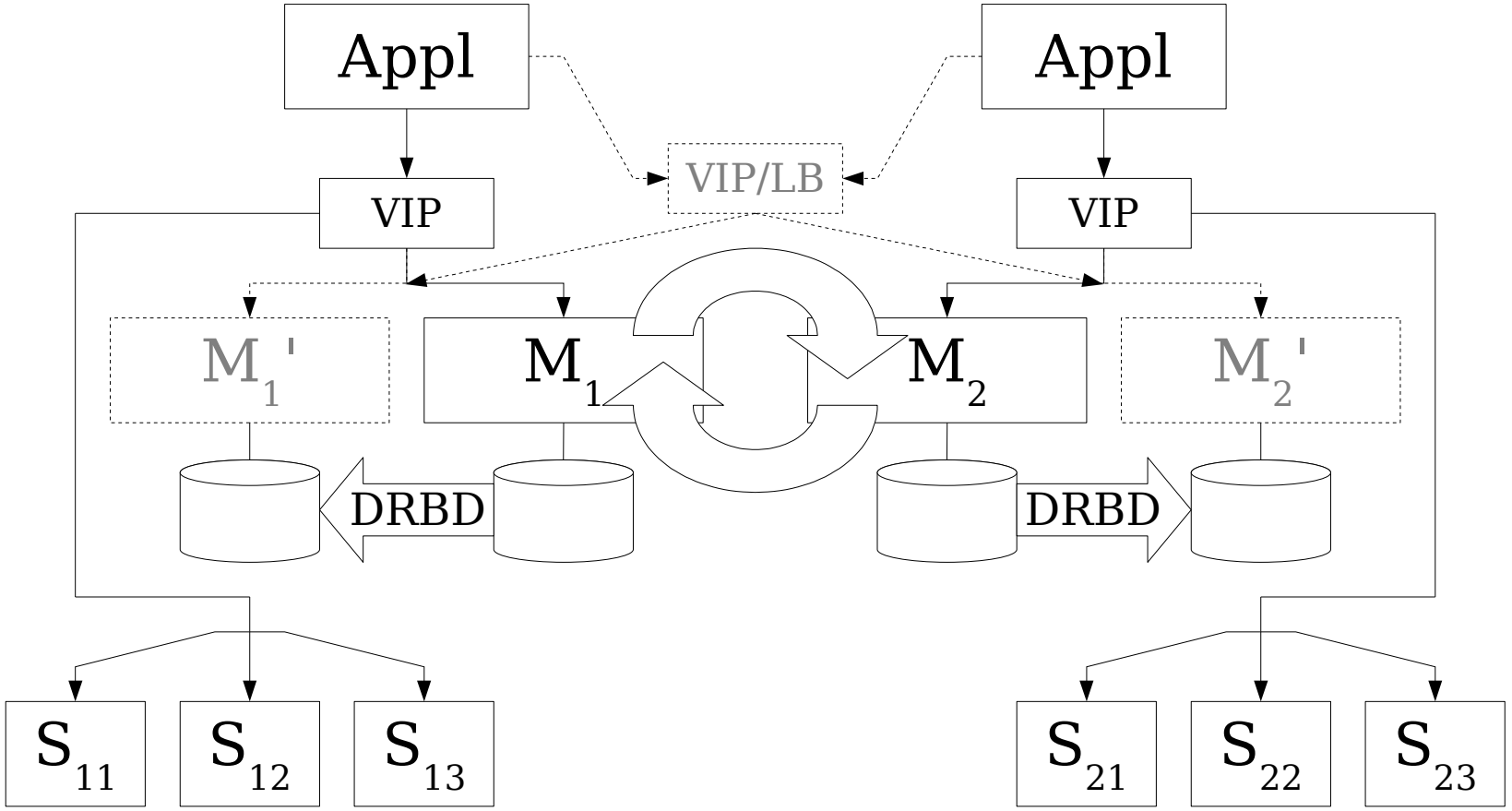
- actually Master-Master Replication



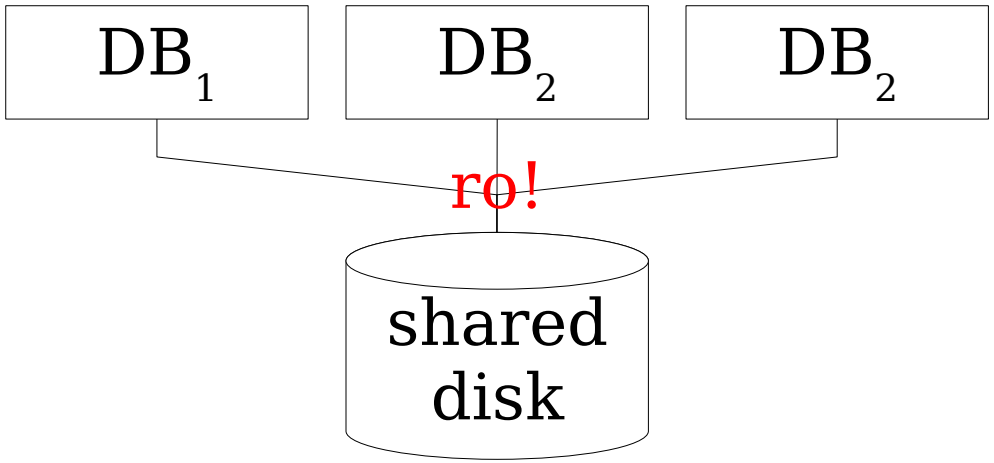
- This architecture does NOT solve your write problems!!!

Multi-Master Replication

- HA Multi-Master Replication



Shared disk cluster



- This is in 99.9% of the cases NOT your solution!!!
- It looks like Oracle RAC but MySQL does NOT (yet) have the instruments needed!
- Can be useful in some special kinds of reporting.

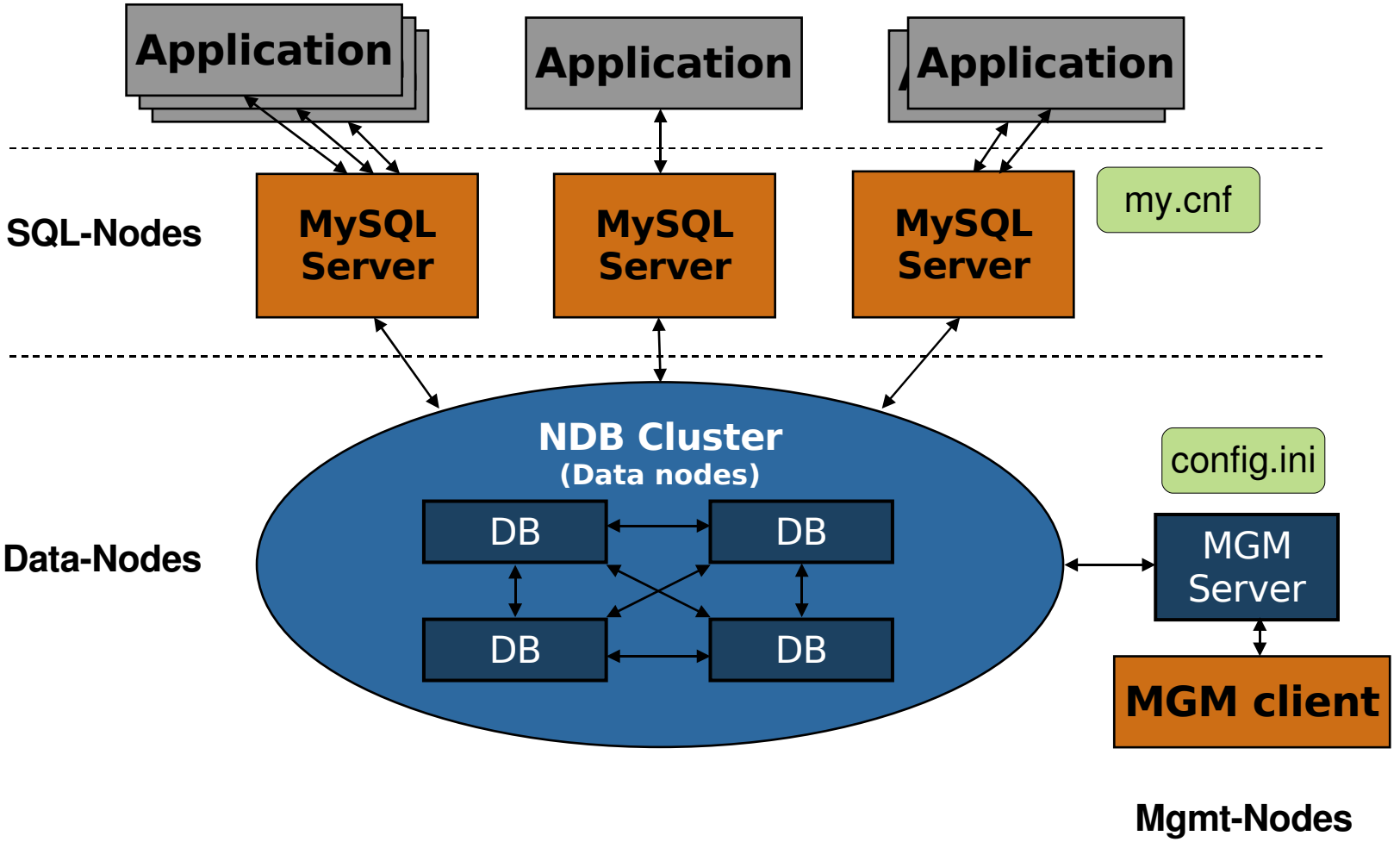
Where are we now?

- The architectures above solved:
  - your read problems.
  - some HA requirements.
- But they did not solve:
  - your write problems!
- And what when we need:
  - higher HA?
  - synchronous replication?
  - more write speed?

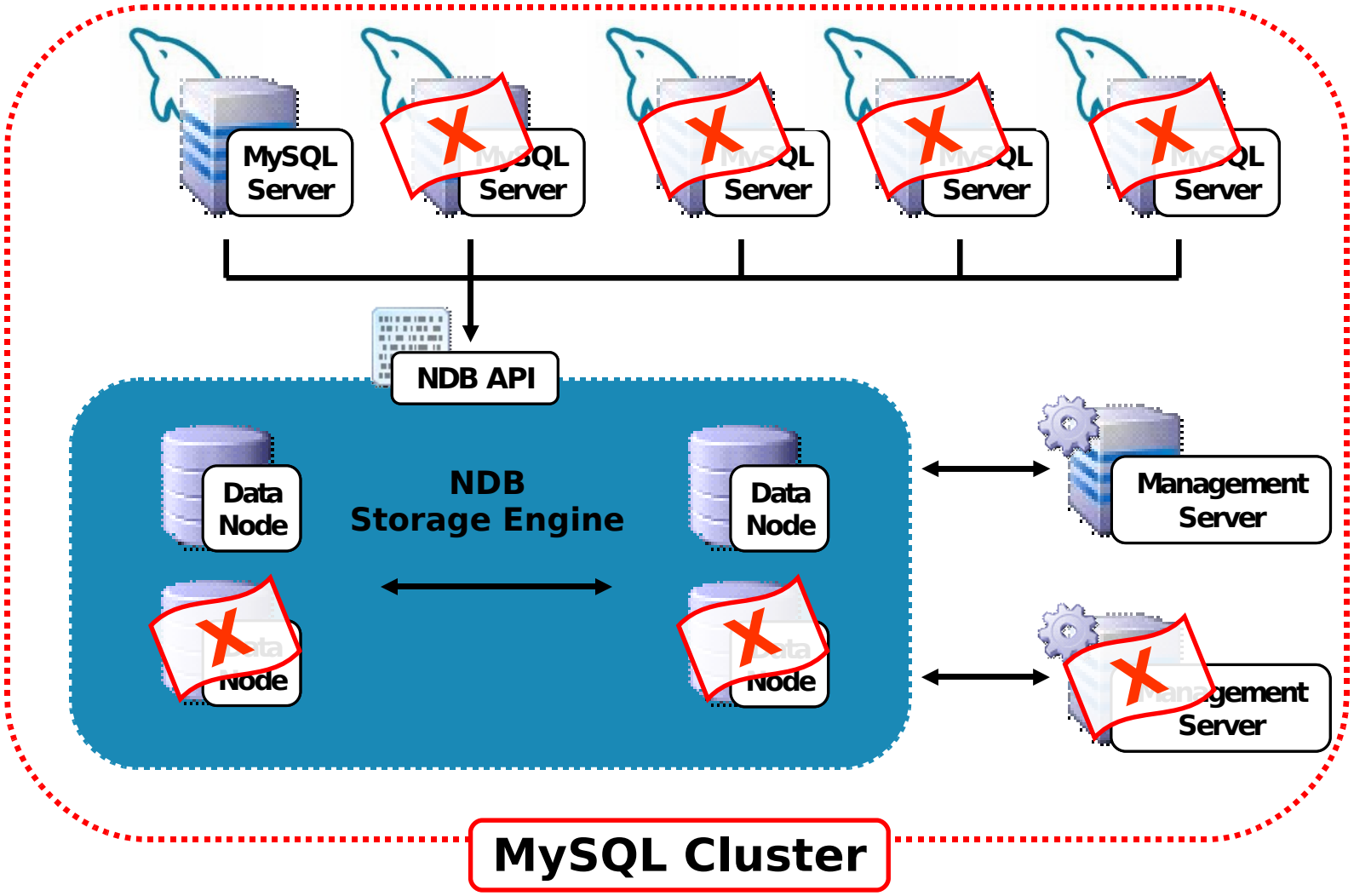
MySQL Cluster

- Shared-nothing architecture
- Synchronous replication (2-Phase commit)
- Fast automatic fail over
- High performance (also writing)
- High transactional throughput
- No special components required
- In-Memory database (in 5.1 also disk support)
- Scalable, 1000's of transactions per second
- 99.999% HA (five nine)
- On-line upgrade path (at least on GA within same version)

MySQL Cluster architecture

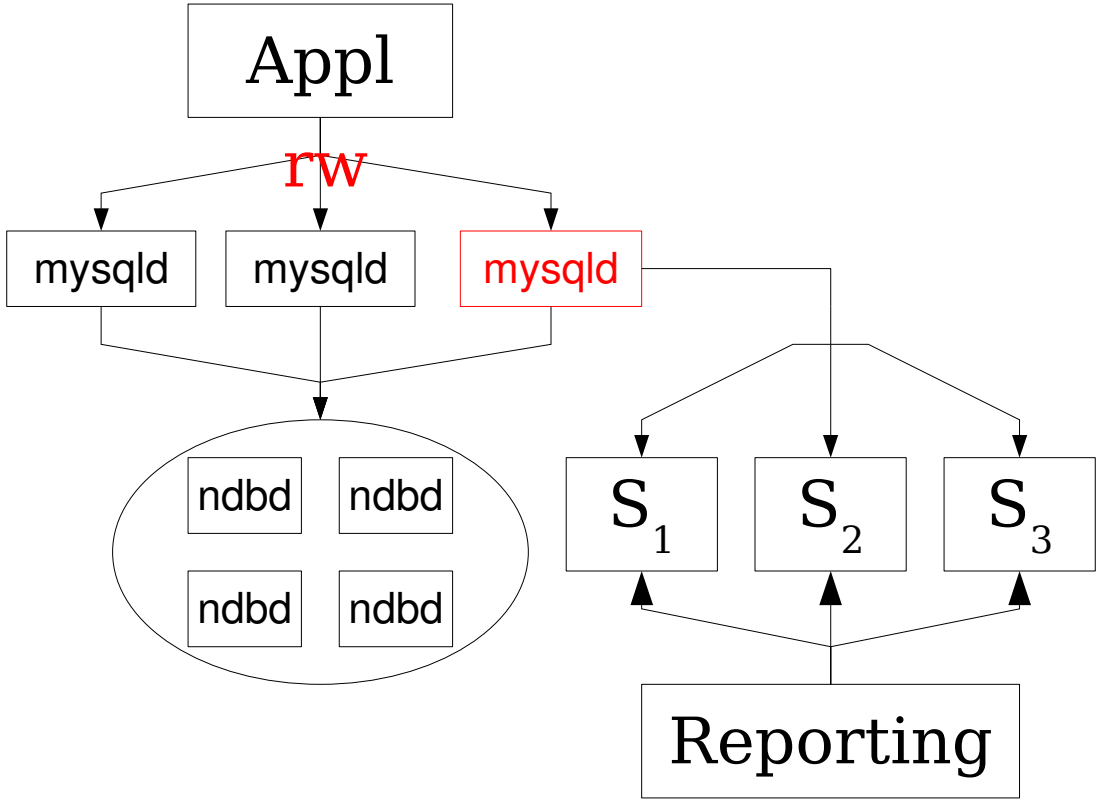


MySQL Cluster HA features



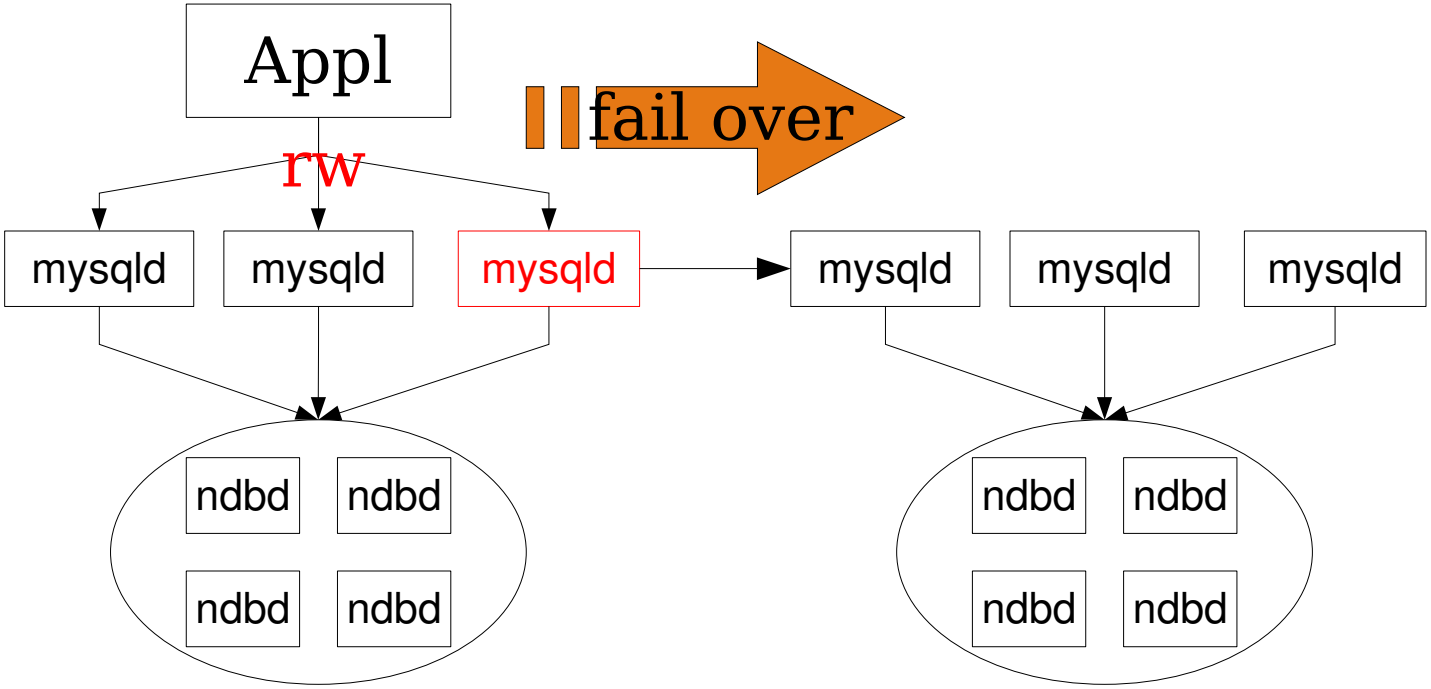
Cluster with Replication

- for read scale-out (Reporting):



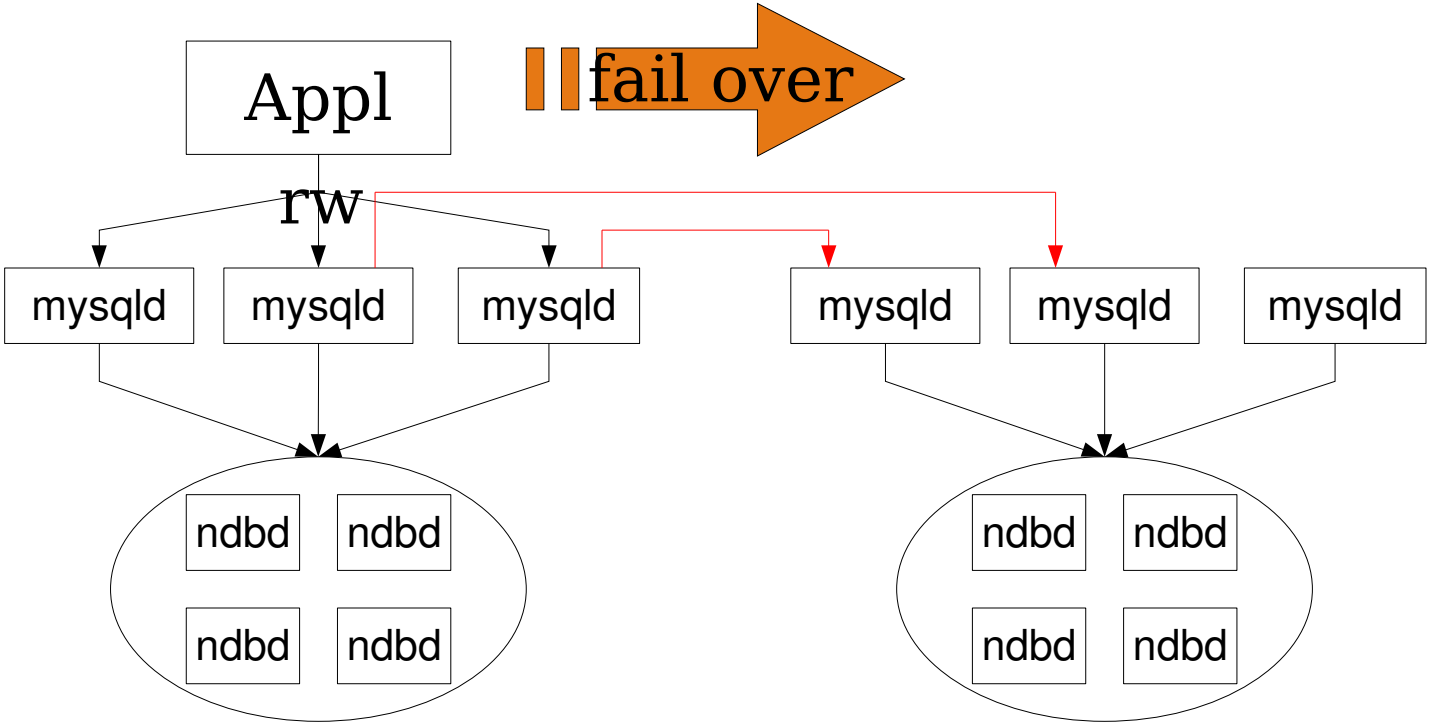
Cluster with Replication

- Cluster-Cluster replication for disaster fail over (MySQL 5.0):



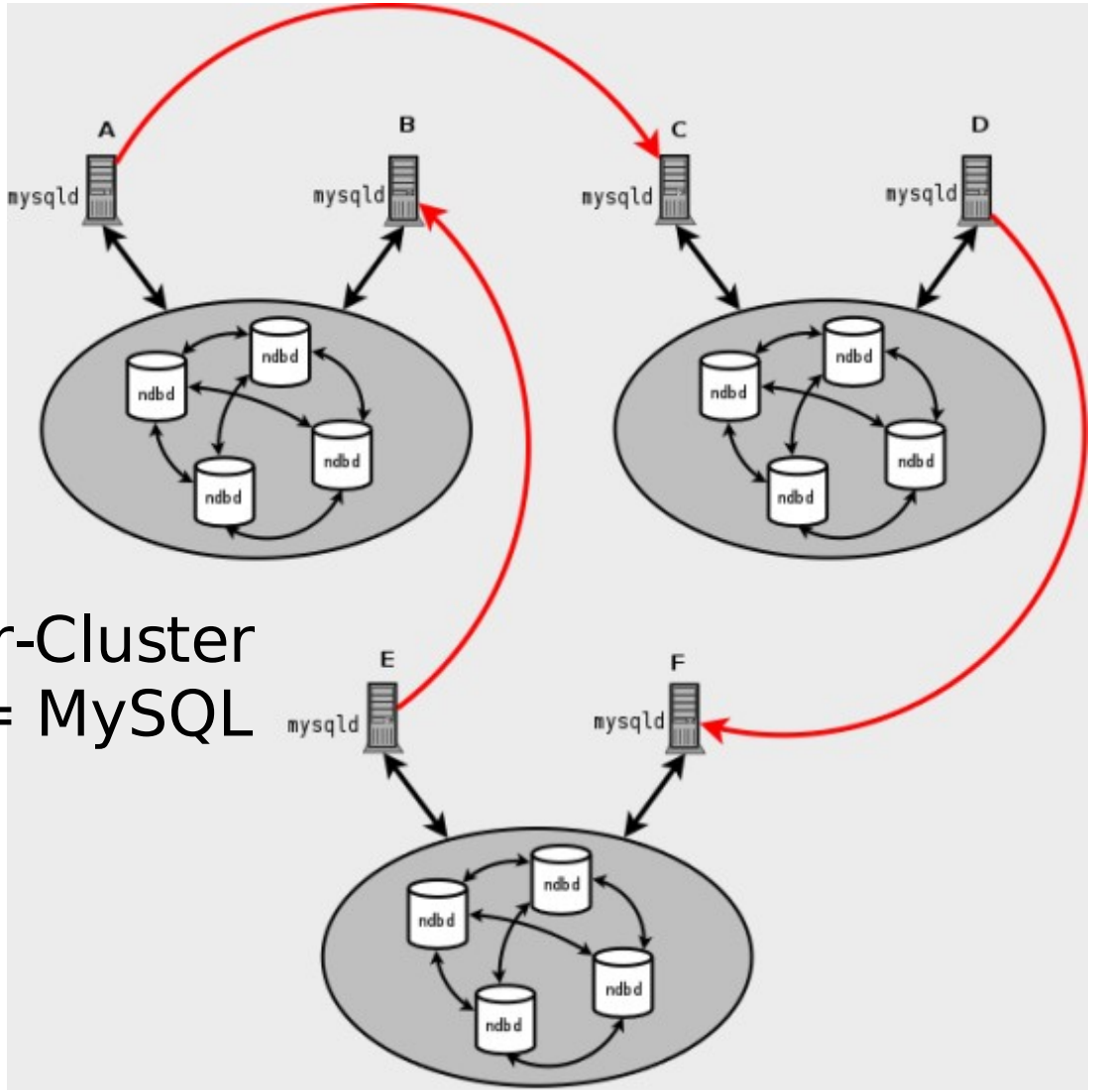
Cluster with Replication

- Cluster-Cluster replication for disaster fail over (MySQL 5.1):



Cluster with Replication

- circular Cluster-Cluster replication (>= MySQL 5.1.18?):



Cluster examples

- Session handling
- Telecom (Mobile)
- VoIP
- RSS-Feed aggregation
- Mail
- On-line Games

- Use cluster where
  - you need HA
  - you have high write load
  - you do little Joins and Grouping

How to go on?

- Read is a caching problem!
  - More RAM or scale-out.
- Write is a batching problem!
  - Batch your load,
  - Buy stronger I/O system.
  - Use MySQL Cluster.
  - SSD!
- What then?

SSD disruption

- I/O system without any movable parts!
- SSD = Solid State disk (Flash memory, NAND, NOR chips, RAM-SAN).
- During the last year(s)
- Price from 15'000 USD / 160 Gbyte -> 100 USD / 32 Gbyte
- 10-50 times faster than mechanical I/O systems
- 1 Mio write cycles dead :-((special FS!)

- RAM: Huge amount of memory is cheap!

→ This will disrupt the database world!

What then?

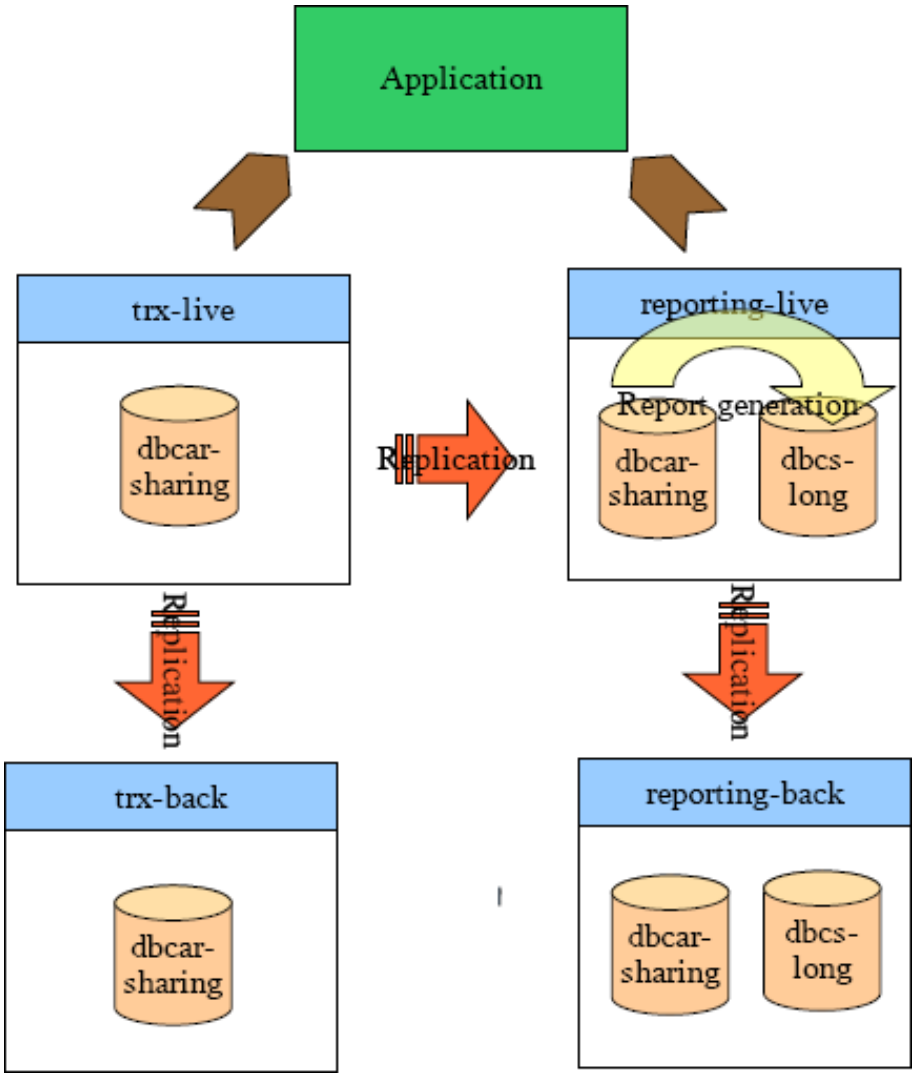
- With or without SSD we will reach a physical limit. What then?

- Application partitioning:
  - Split applications
    - OLTP vs. OLAP
    - all in one
  - Segment your application

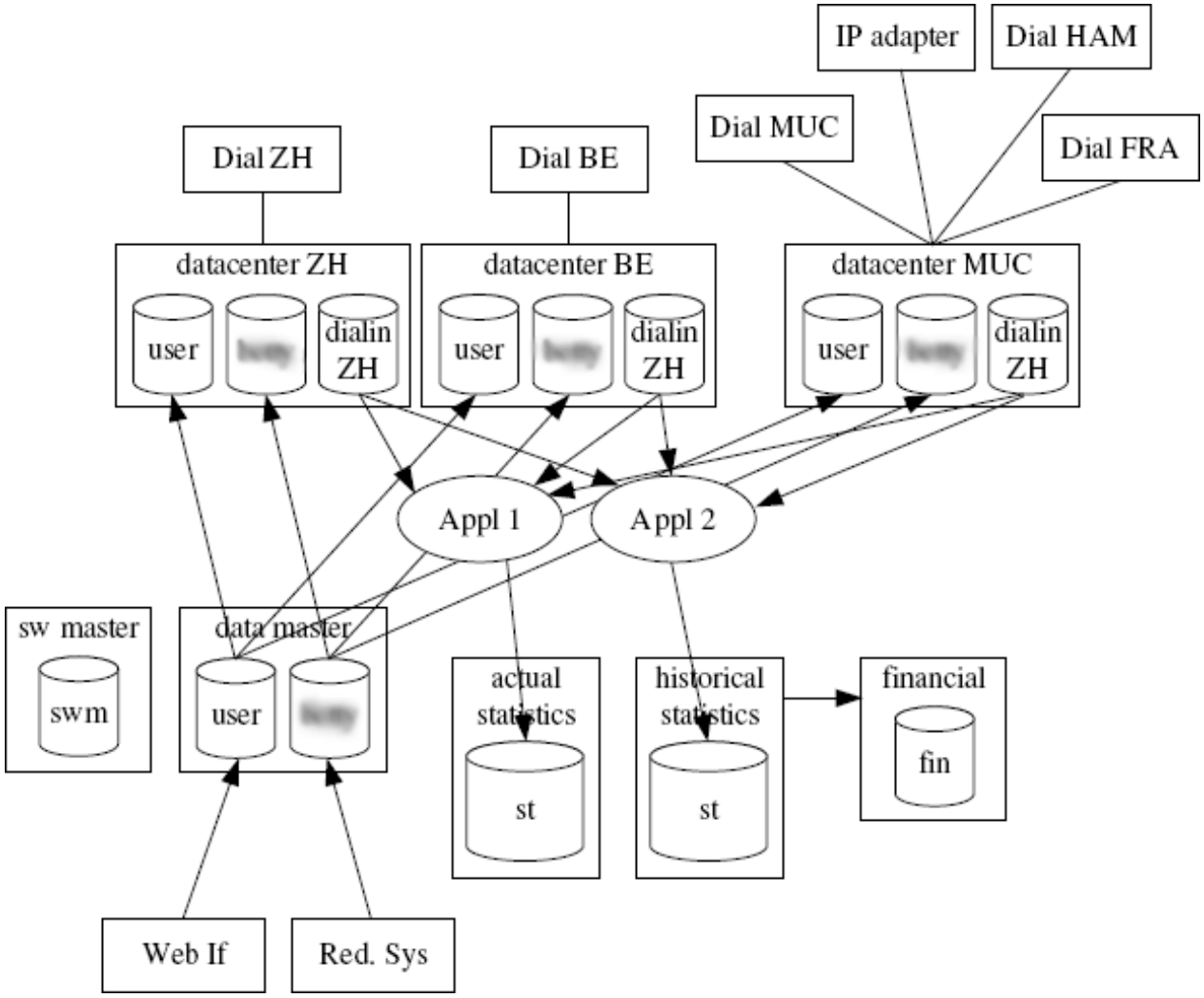
Application partitioning

- OLTP vs. OLAP
  - hot business data (trx) vs. “old” reporting data
- “All in one”
  - Sessions, user tracking, ads, chat, booking
- Segment
  - split by for example 1 Mio users (split by user_id).

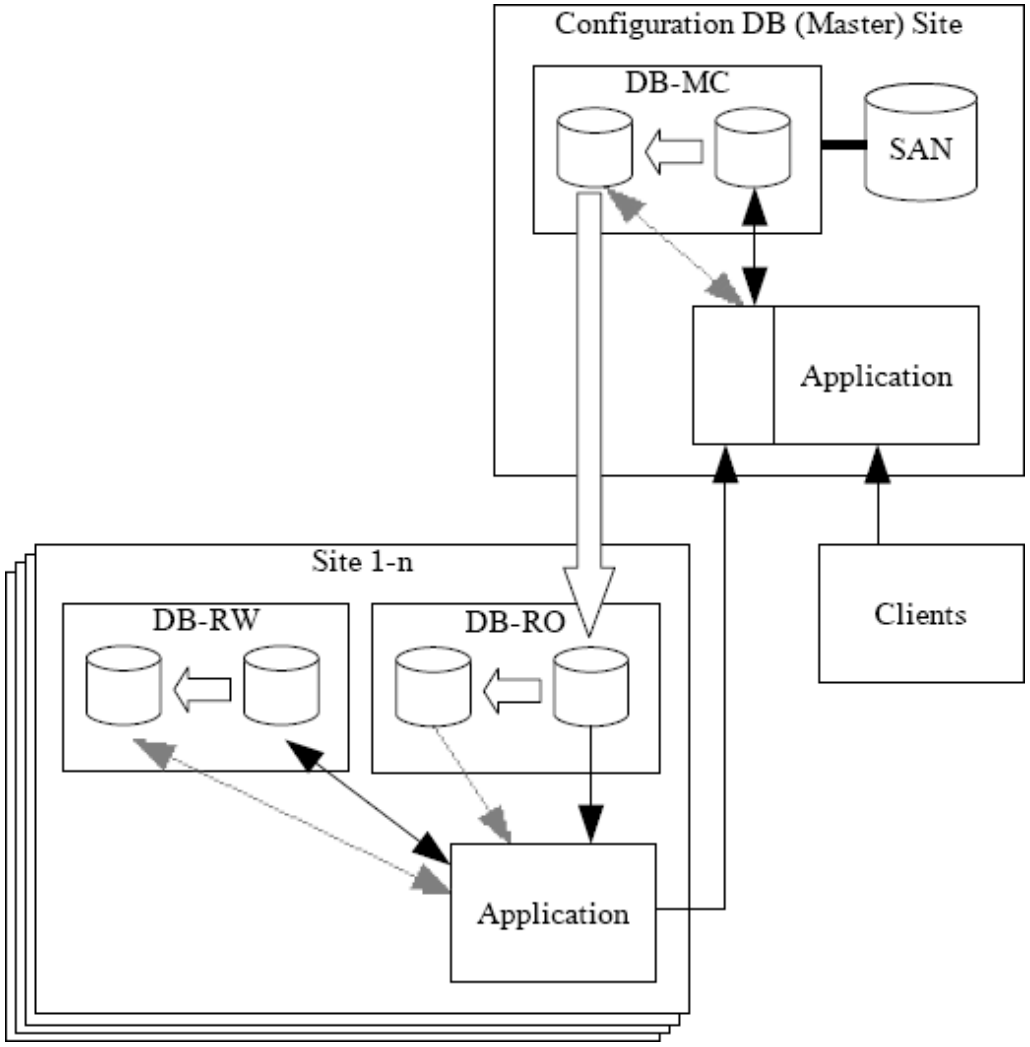
Architecture examples



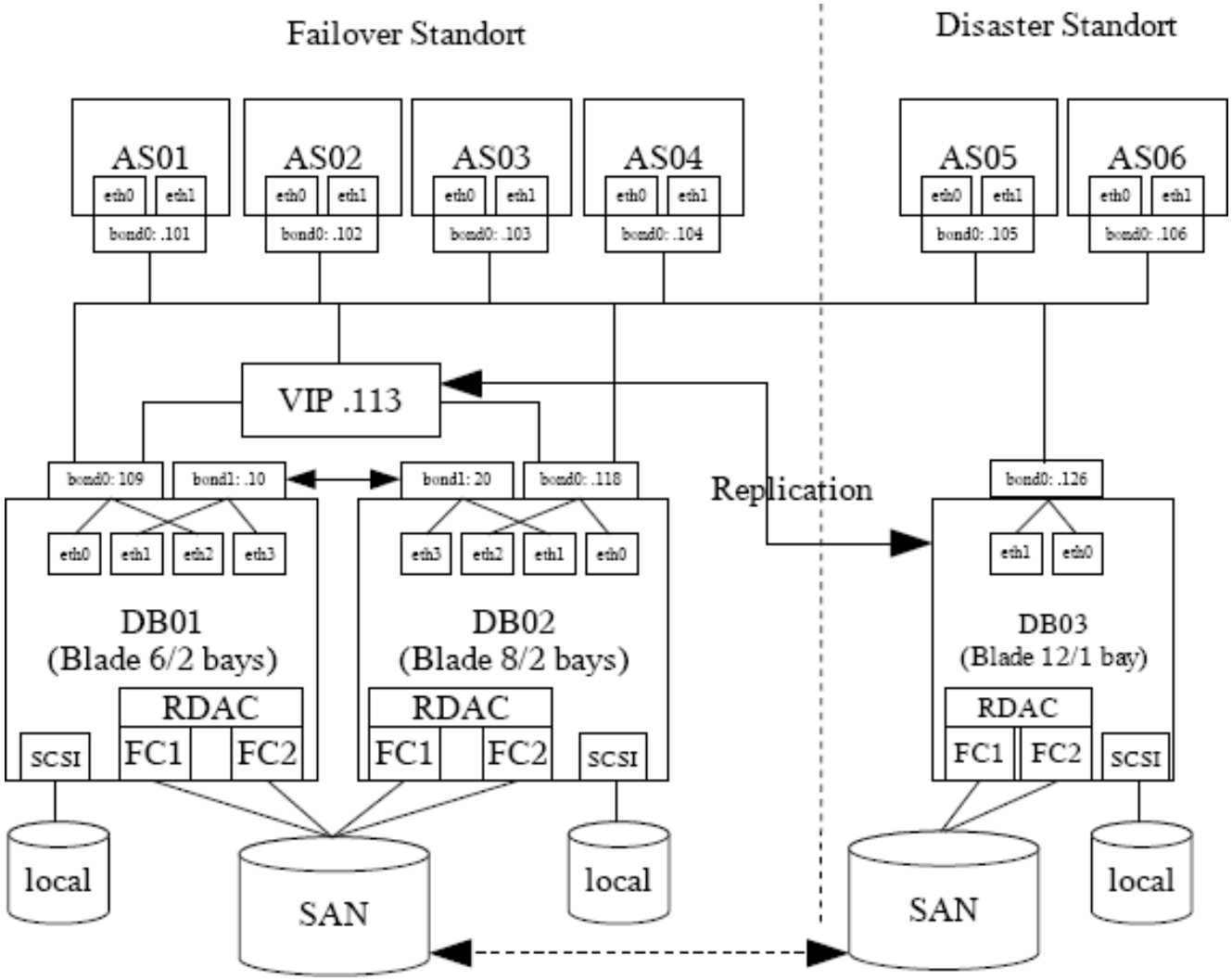
Architecture examples



Architecture examples



Architecture examples



Some more architecture stuff?

- Databases are slow!!!
  - Whenever possible try to avoid databases! Use memcached for example.
- The SP trap.
  - Stored Procedures are a lock in! Try to avoid SP!
- Use Materialized Views (MV) and/or shadow tables.
- VM/SAN is nice for consolidation but not for performance/scale-out!
- Backup and Staging
- MySQL – Proxy

Now it's your turn...

- Your problems?
- Let us build a replication...