



# PAINFUL SUCCESS

Jesper Richter-Reichhelm (@jrrei) / session 4853

# Pain



# Monster World



+ mehr Münzen

+ mehr WooGoo

10 2197218



23:59:05

	Pflanzen	Produkte	Deko
#1 Jędrzej 0600140	78	35	20
#2 Raimund 2231099	41	182	31
#3 Jesper 2197218			207
#4 Anna 1889835			
#5 Sebastian 1374027			



mehr Münzen

mehr WooGoo

10 2197218

15:54

23:56:13

#1	#2	#3	#4	#5
Jędrzej	Jesper	Anna	Raimund	Sebastian
109	100	98	94	94
8600140	2197218	1889835	1424278	1374027

Pflanzen	Produkte	Deko
78	35	20
41	182	31
		207

# Flash client



# Backend





**7M players / month**



**7M players / month**

**10K API calls / second**



**7M players / month**

**10K API calls / second**

**200K DB operations / second**



**7M players / month**

**10K API calls / second**

**200K DB operations / second**

**100K DB writes / second**



**7M players / month**

**10K API calls / second**

**200K DB operations / second**

**100K DB writes / second**

**2 devops since 2009**

**Success**



Monday, 18 March 13



Monday, 18 March 13

# Painful Success

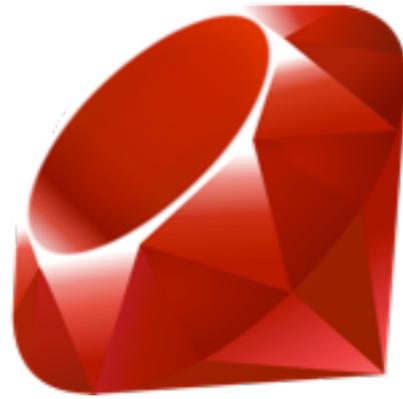
# Painful Success

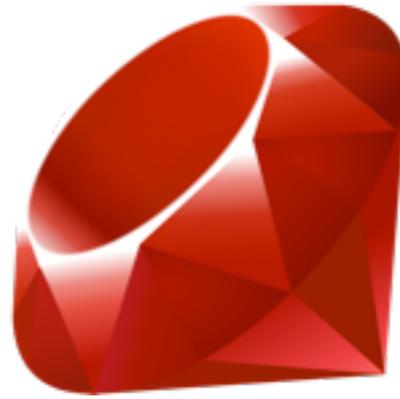
# 2009 Decisions

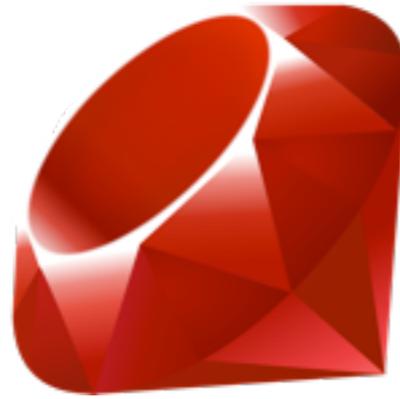




**What is the right  
software stack?**







Browser

lb

ap

ap

ap

SQL

SQL

sql

sql

# 2010 Scaling Up





Monday, 18 March 13

100%

80%

60%

40%

20%

0%

0

5

10

15

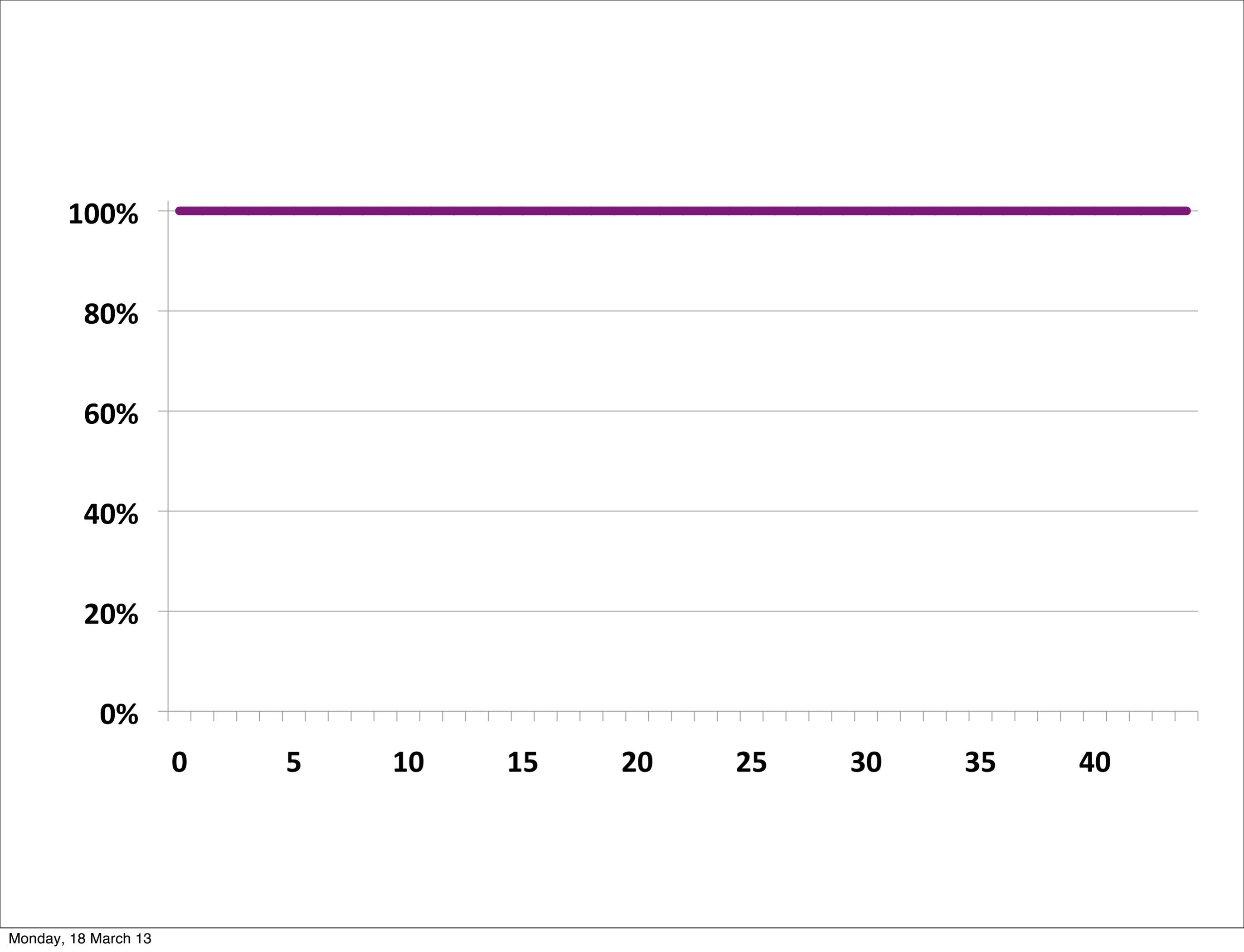
20

25

30

35

40



100%

80%

60%

40%

20%

0%

0

5

10

15

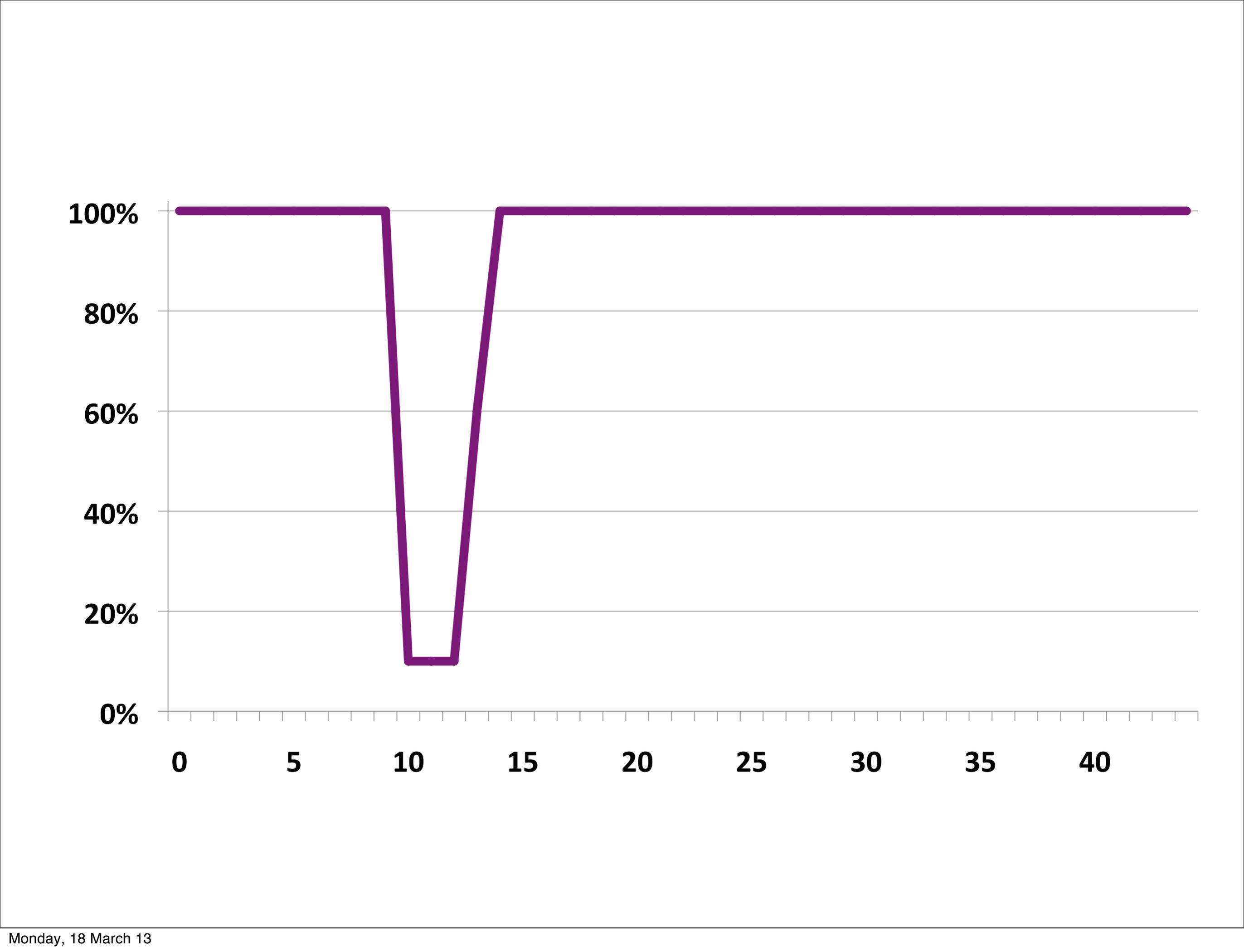
20

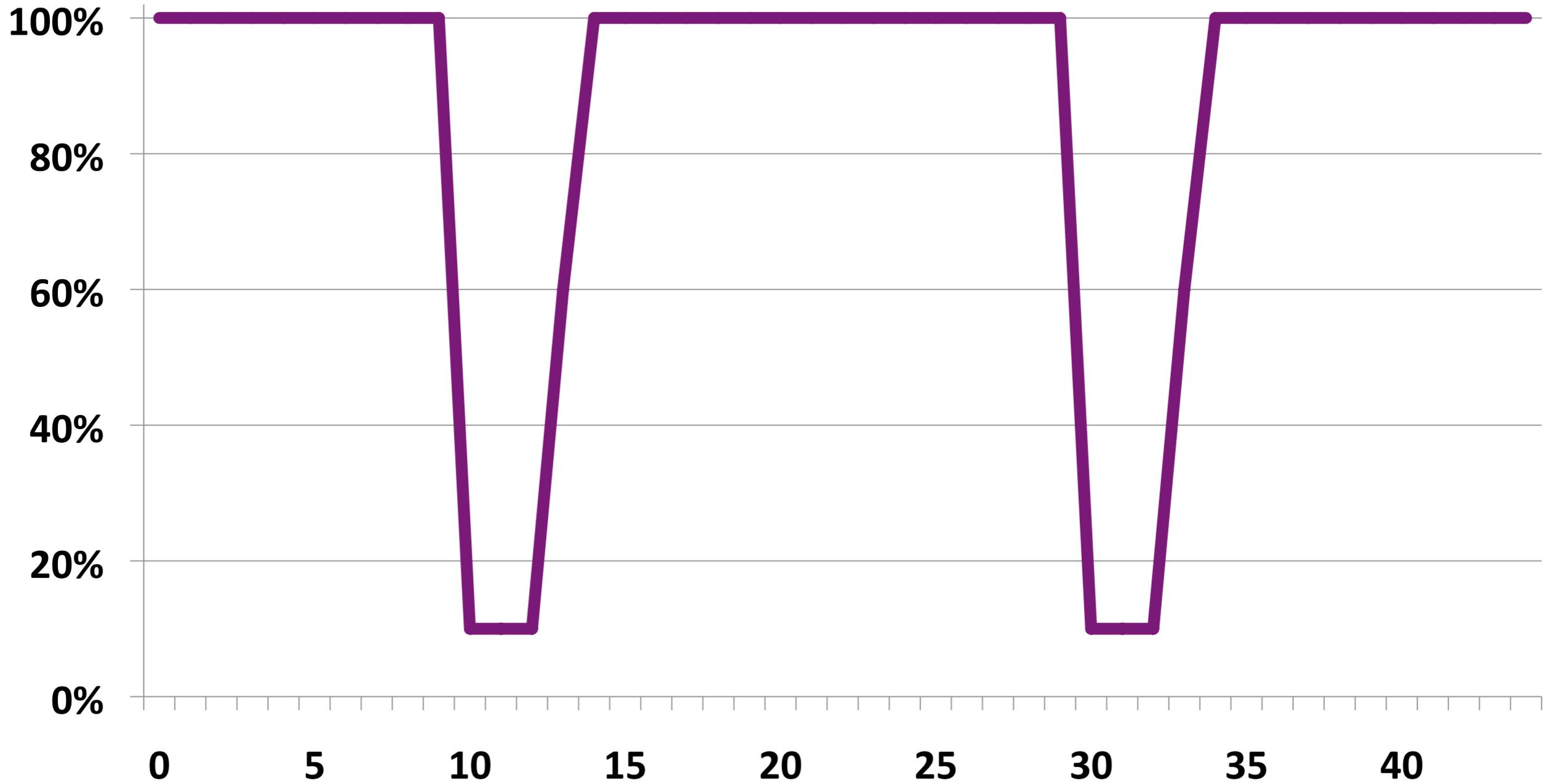
25

30

35

40





**Small things...**

# AMF responses

# Checking connection 'status'

# ActiveRecord caching

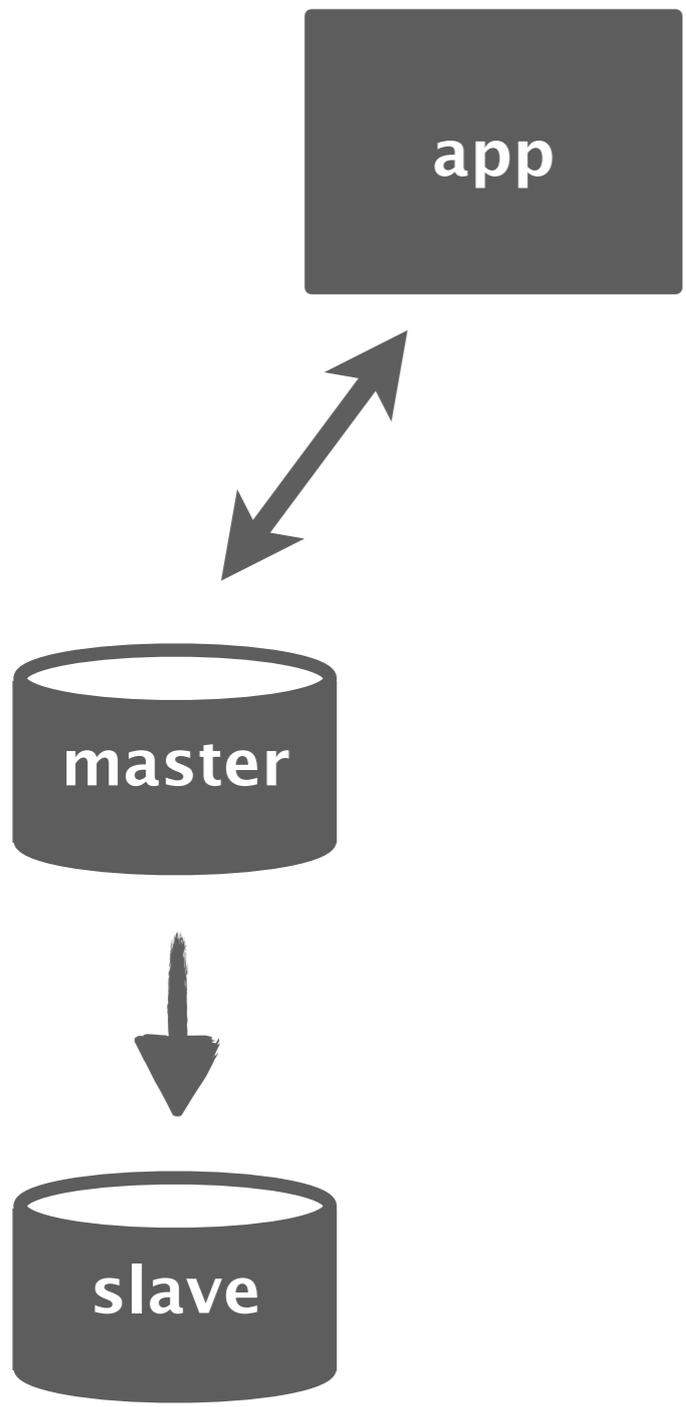
## Lesson 1:

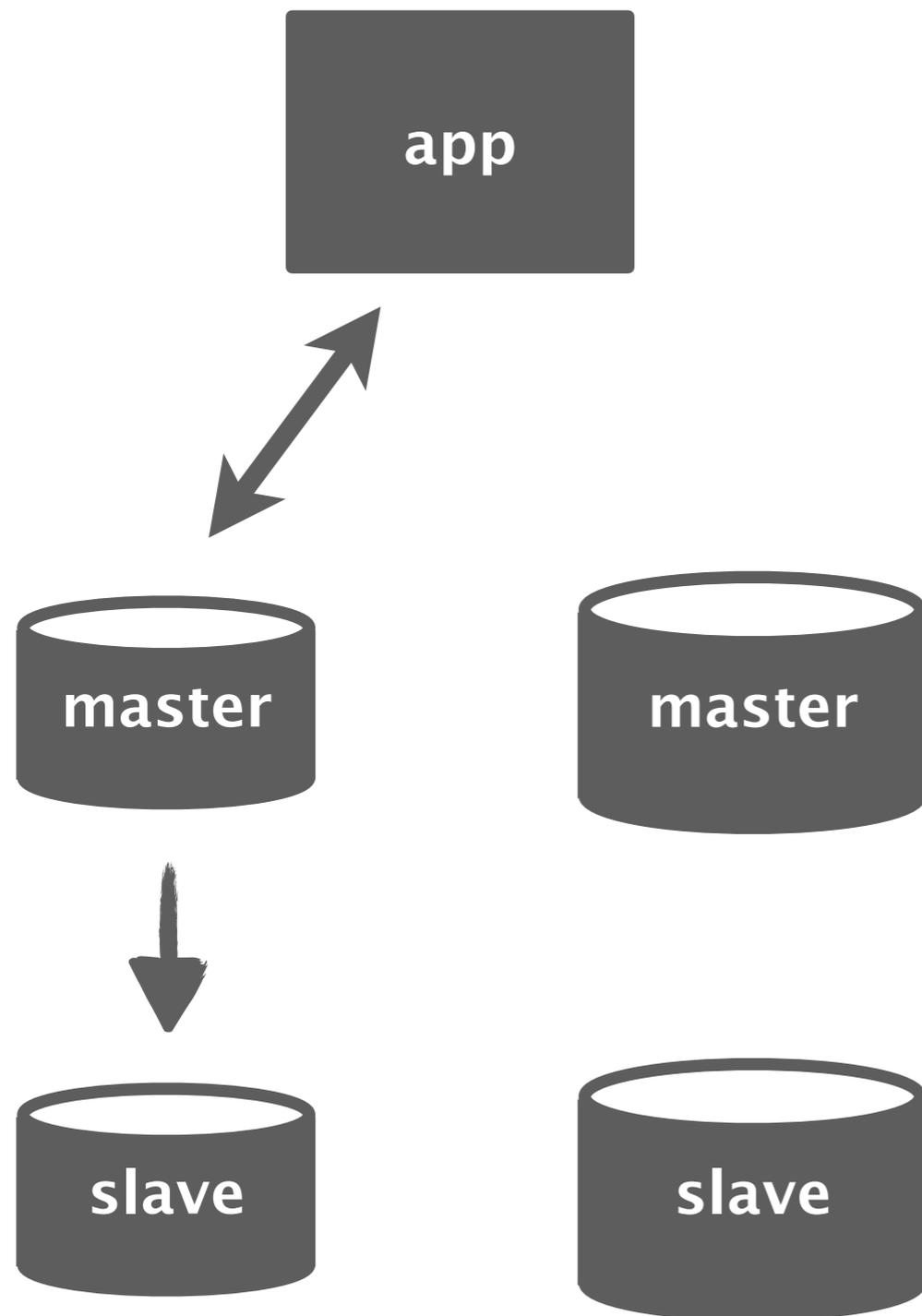
**Always check back  
on reality!**

**Big Things...**

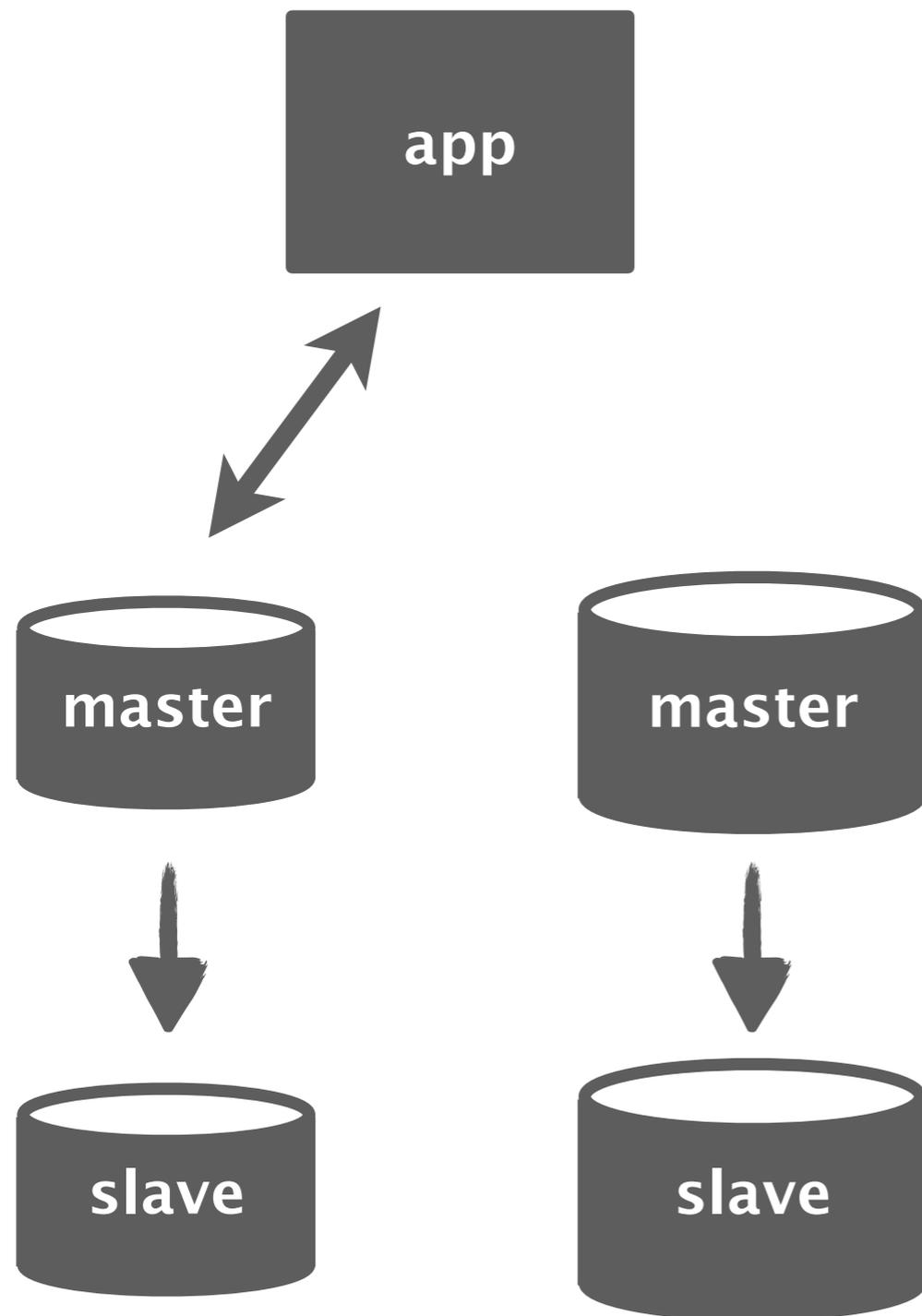
**Lot's of tuning**

**Lot's of tuning  
and more memory**

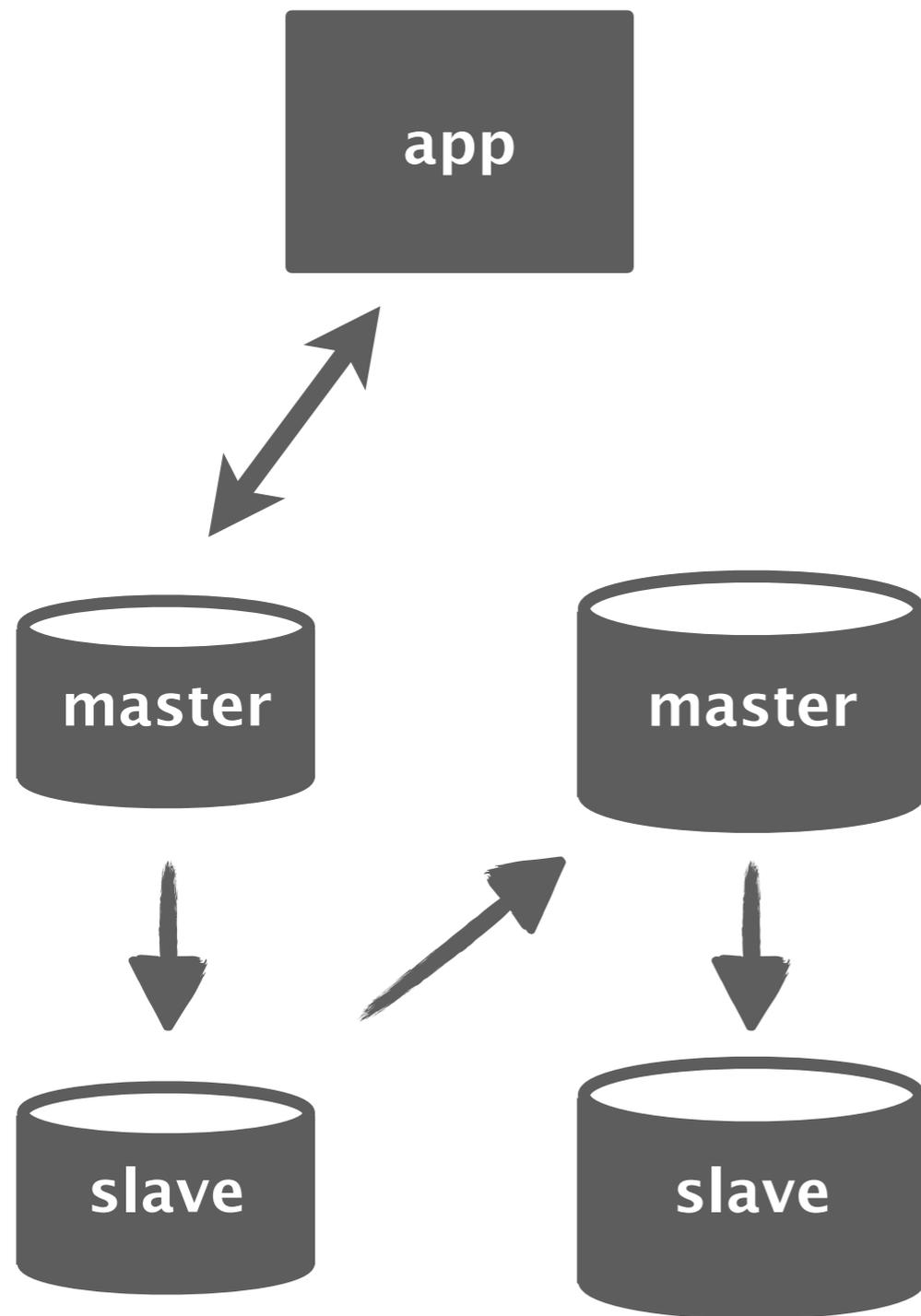




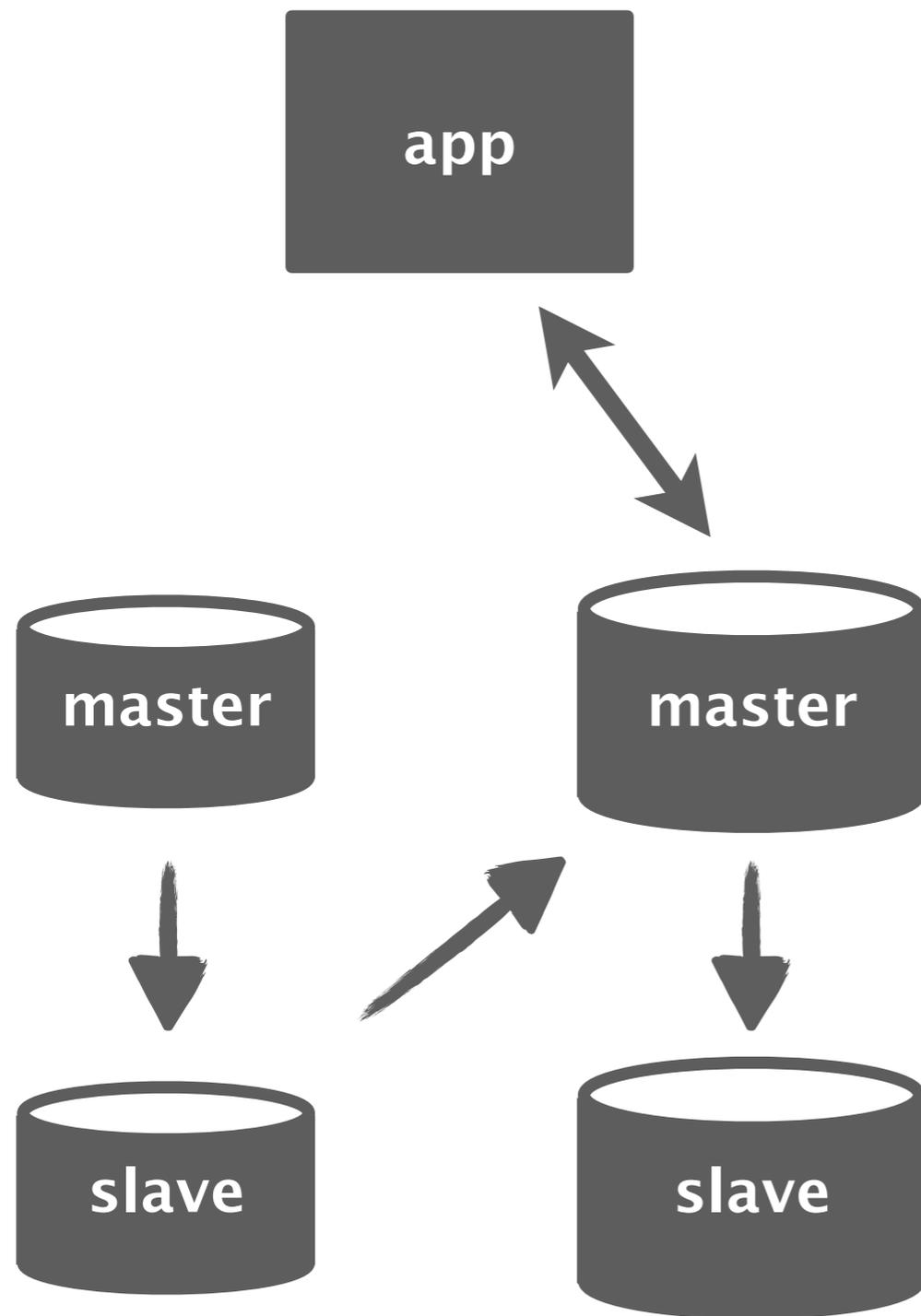
**1. create new DBs**



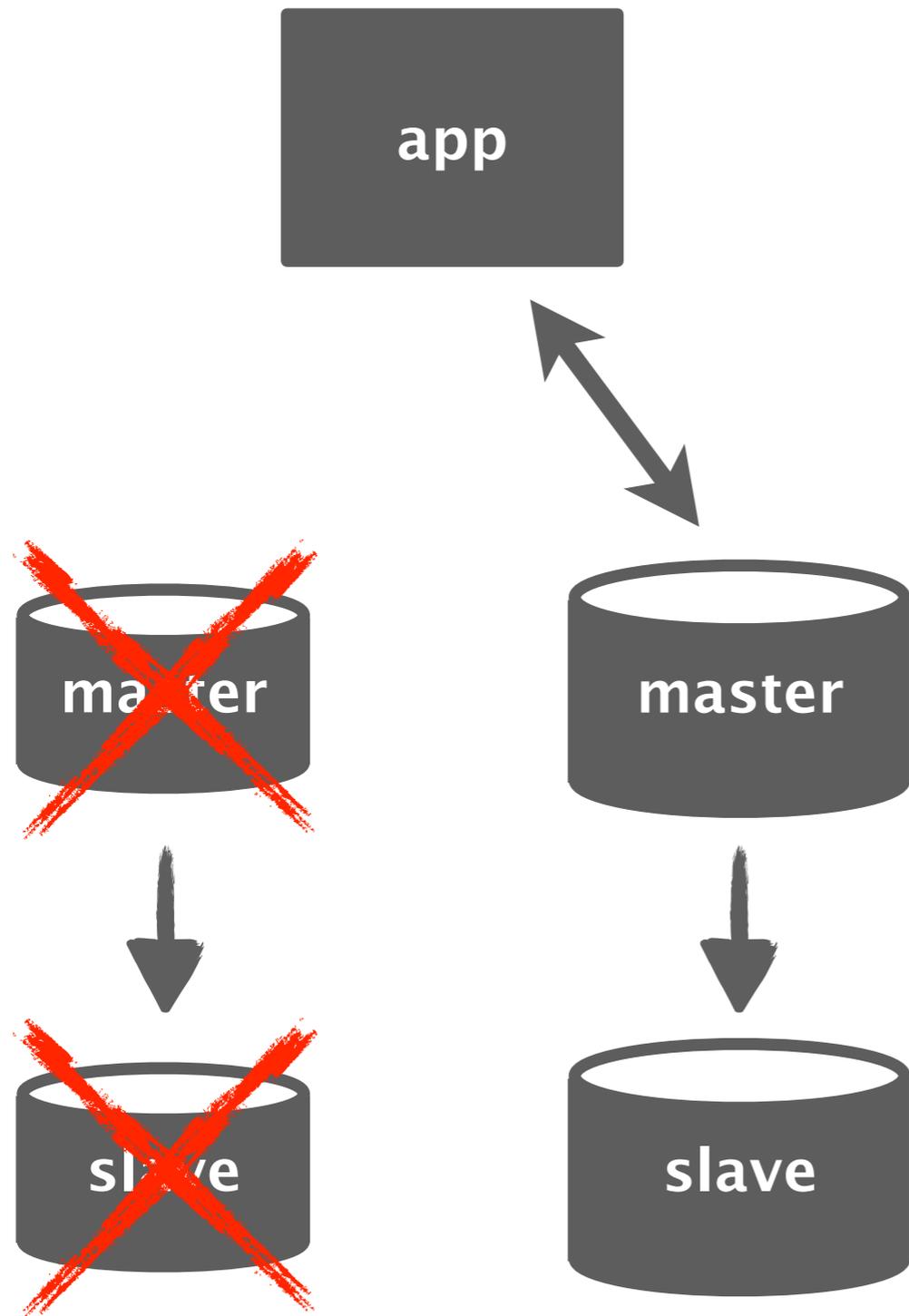
- 1. create new DBs**
- 2. setup replication**



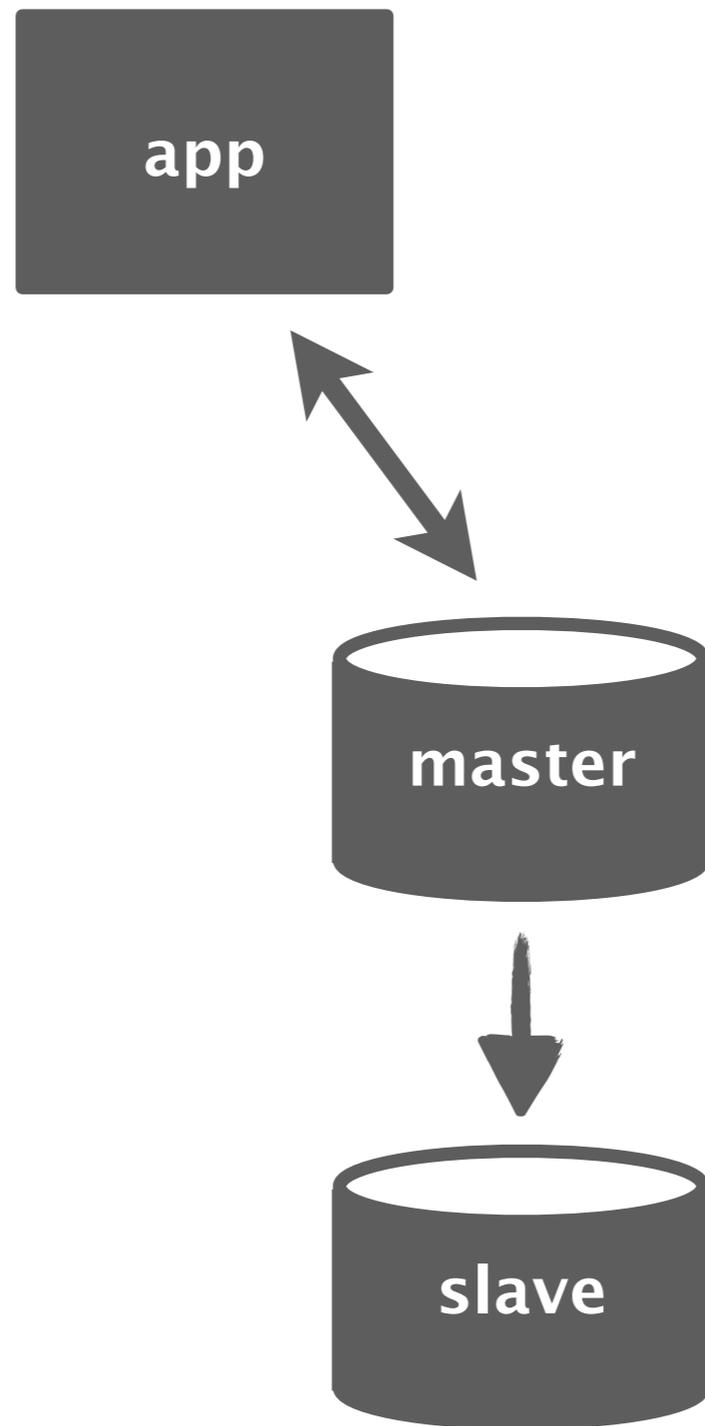
- 1. create new DBs**
- 2. setup replication**



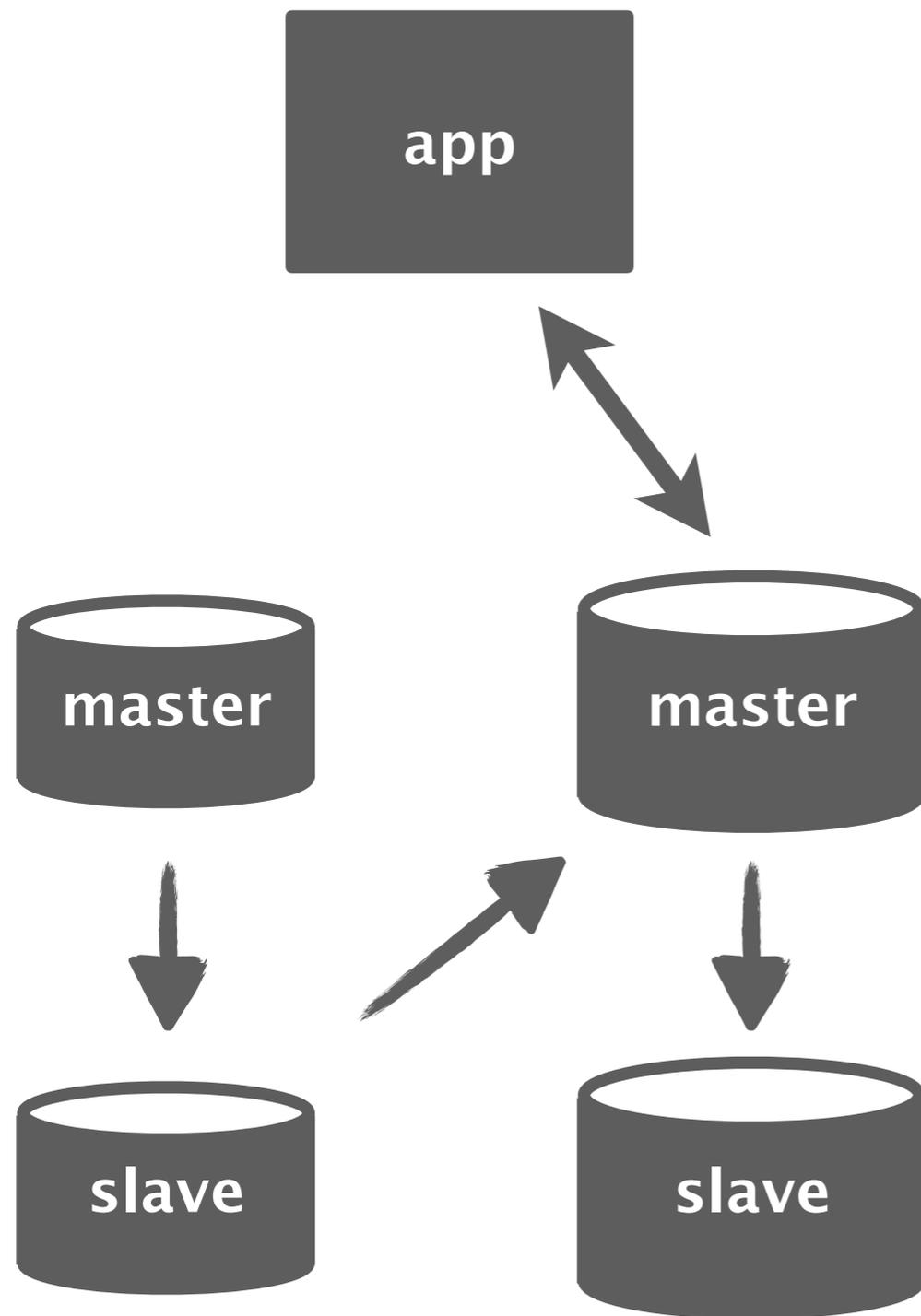
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**



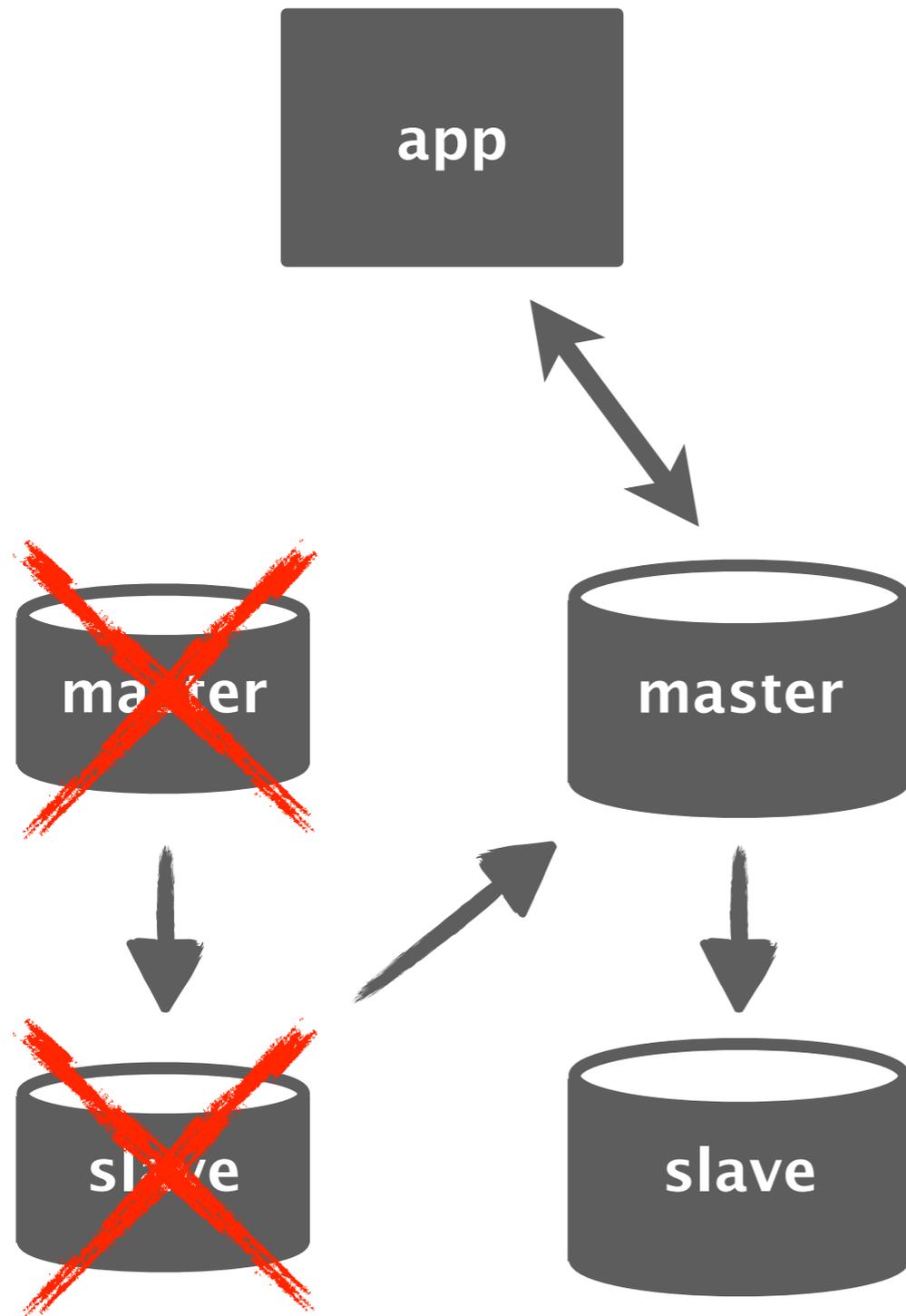
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. cut replication**



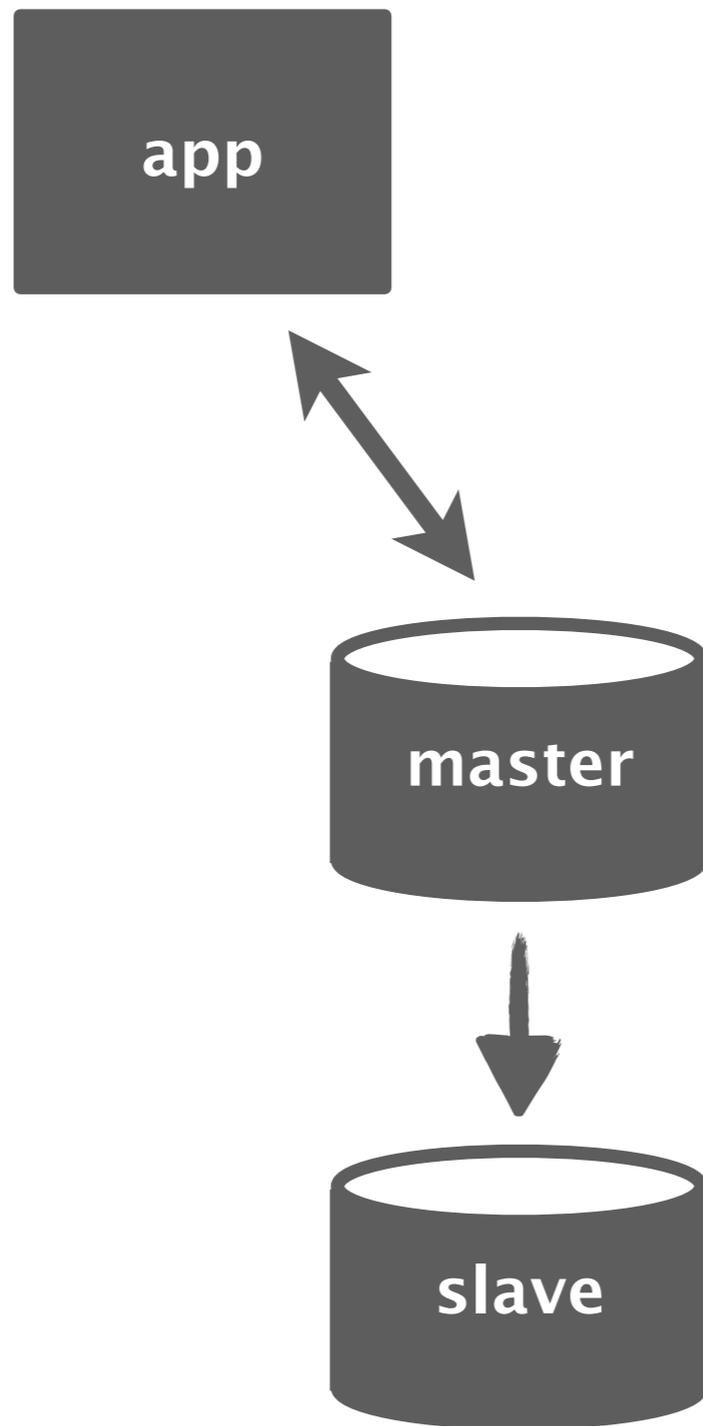
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. cut replication**



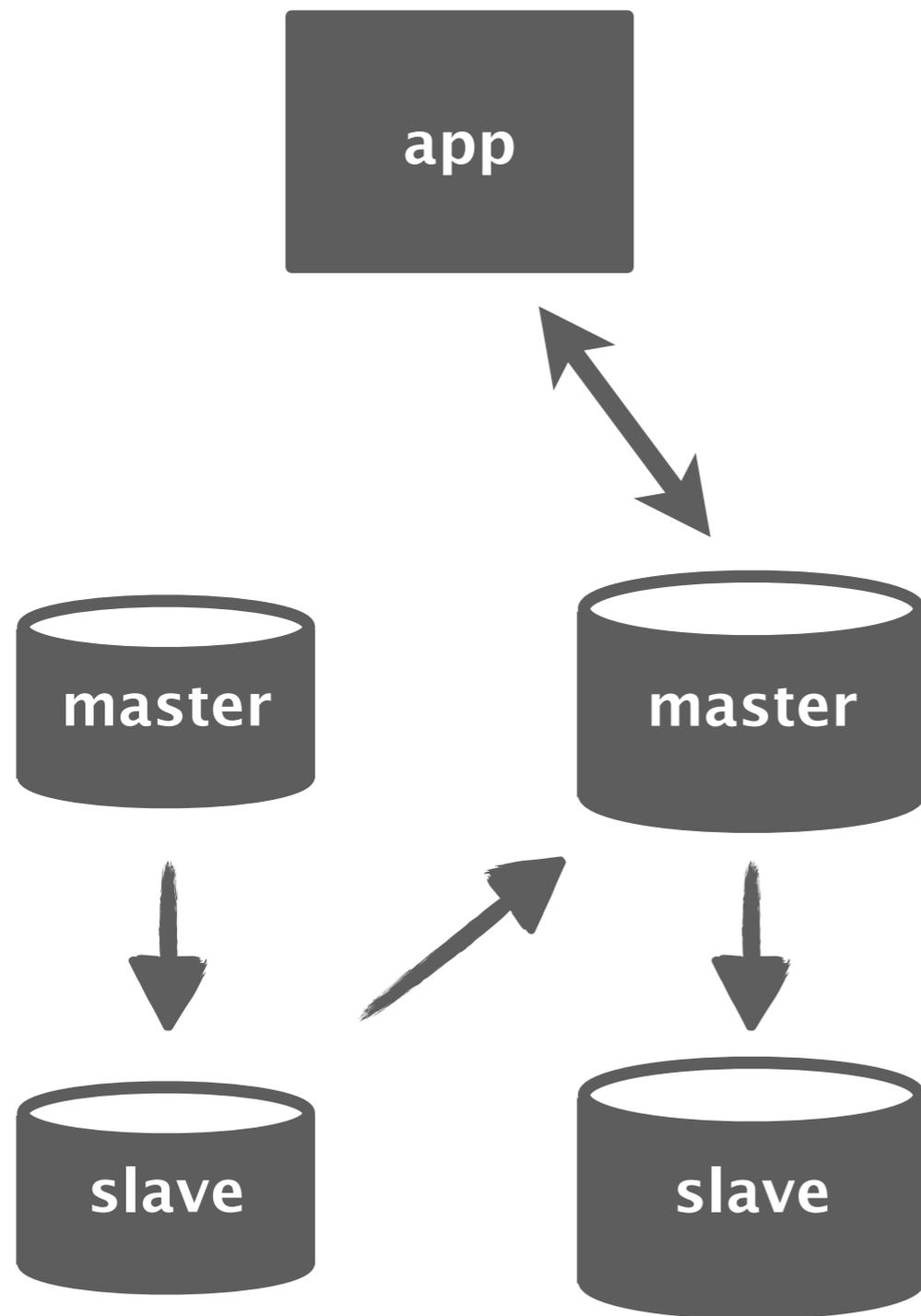
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**



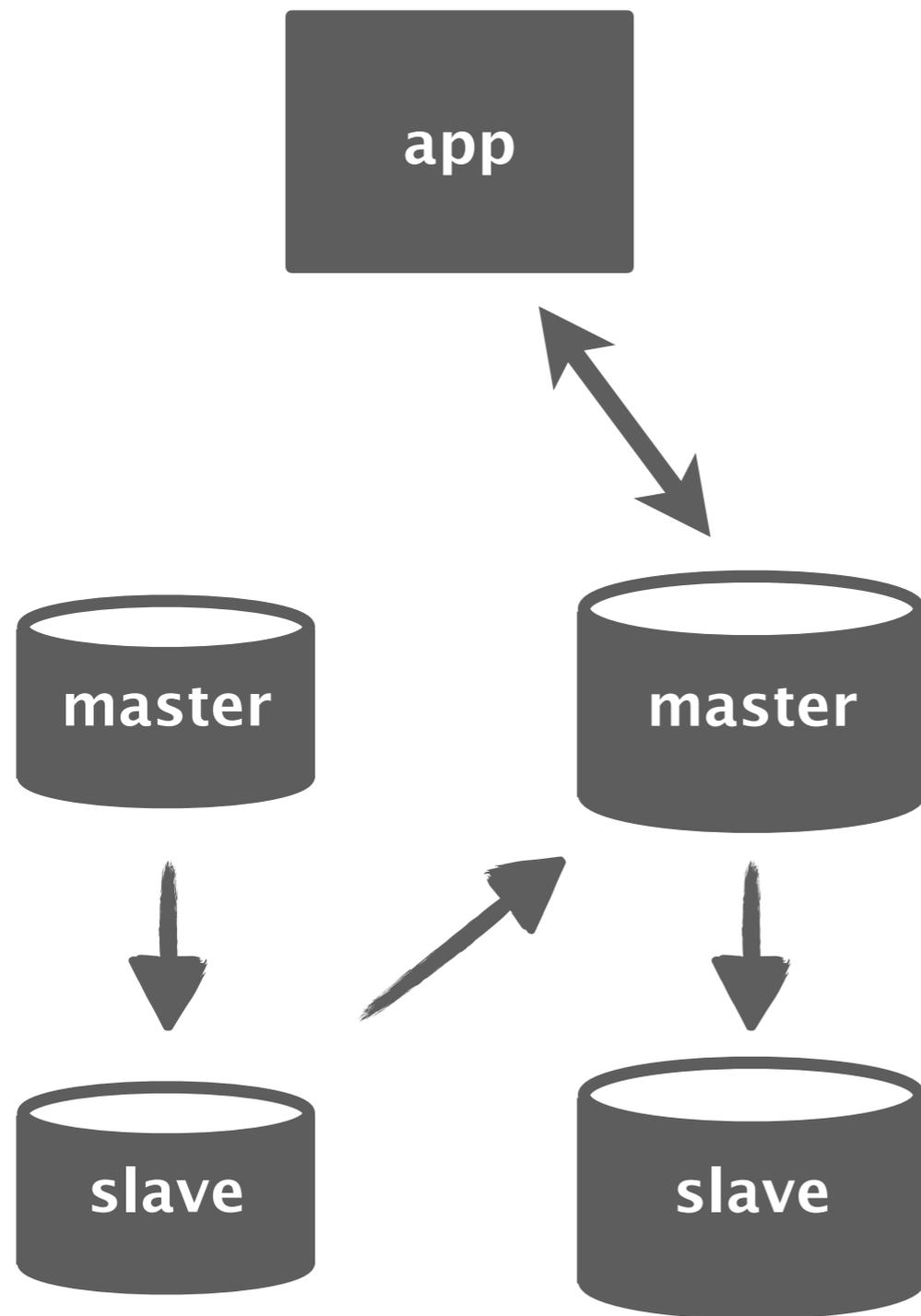
1. **create new DBs**
2. **setup replication**
3. **start using masters**
4. **remove old DBs**



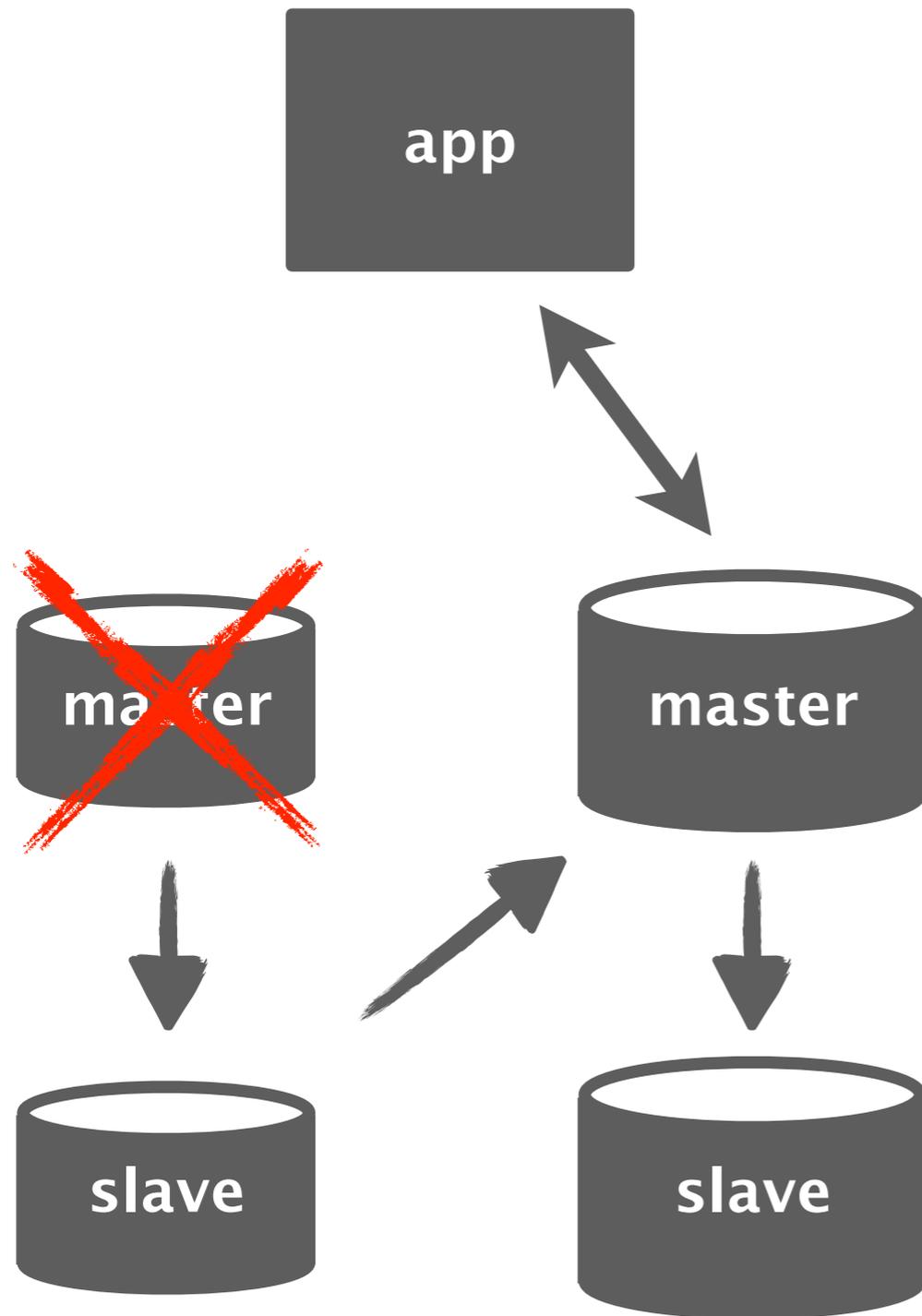
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. remove old DBs**



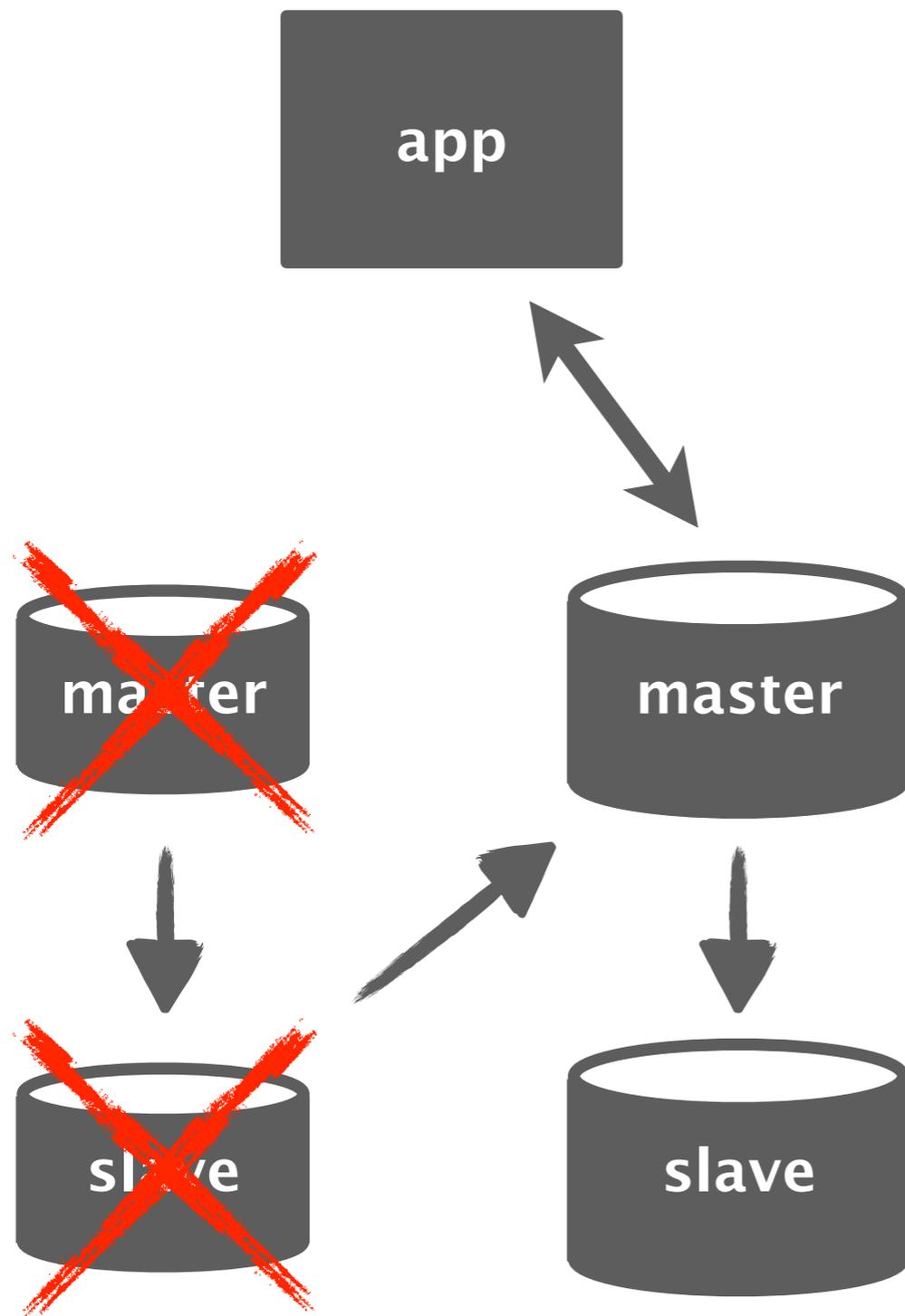
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**



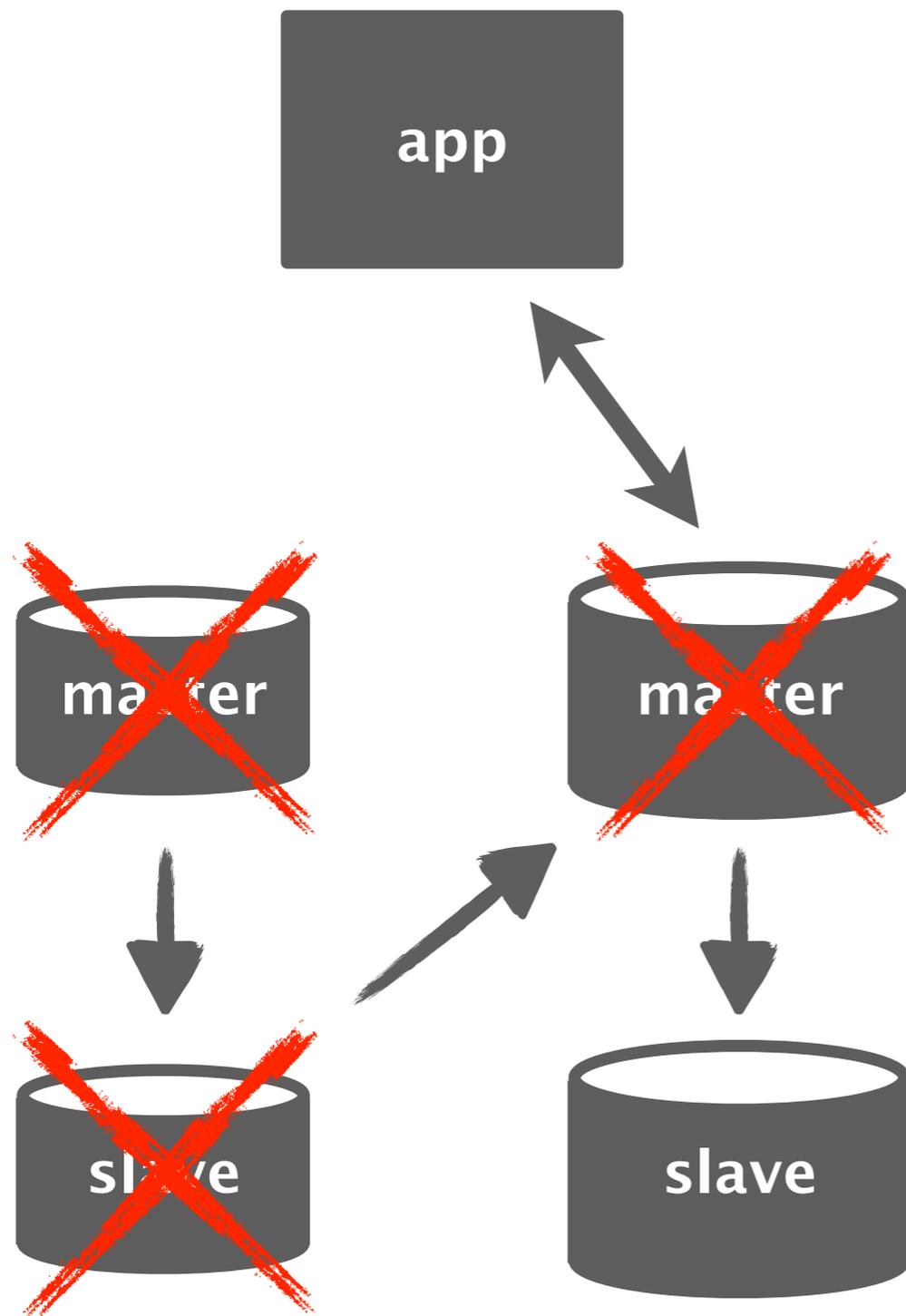
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**



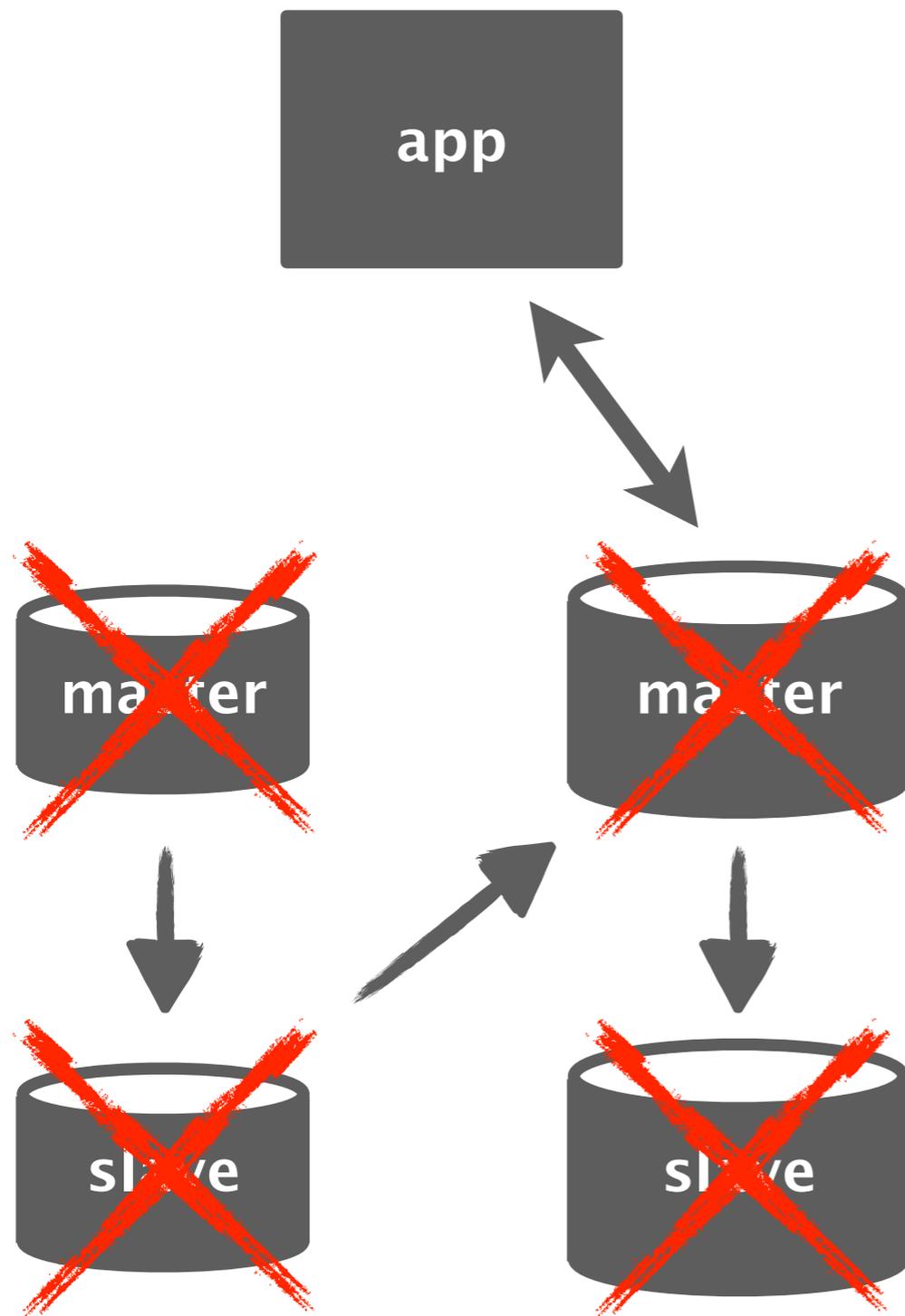
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**



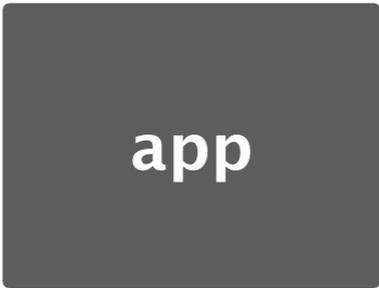
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**



- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**

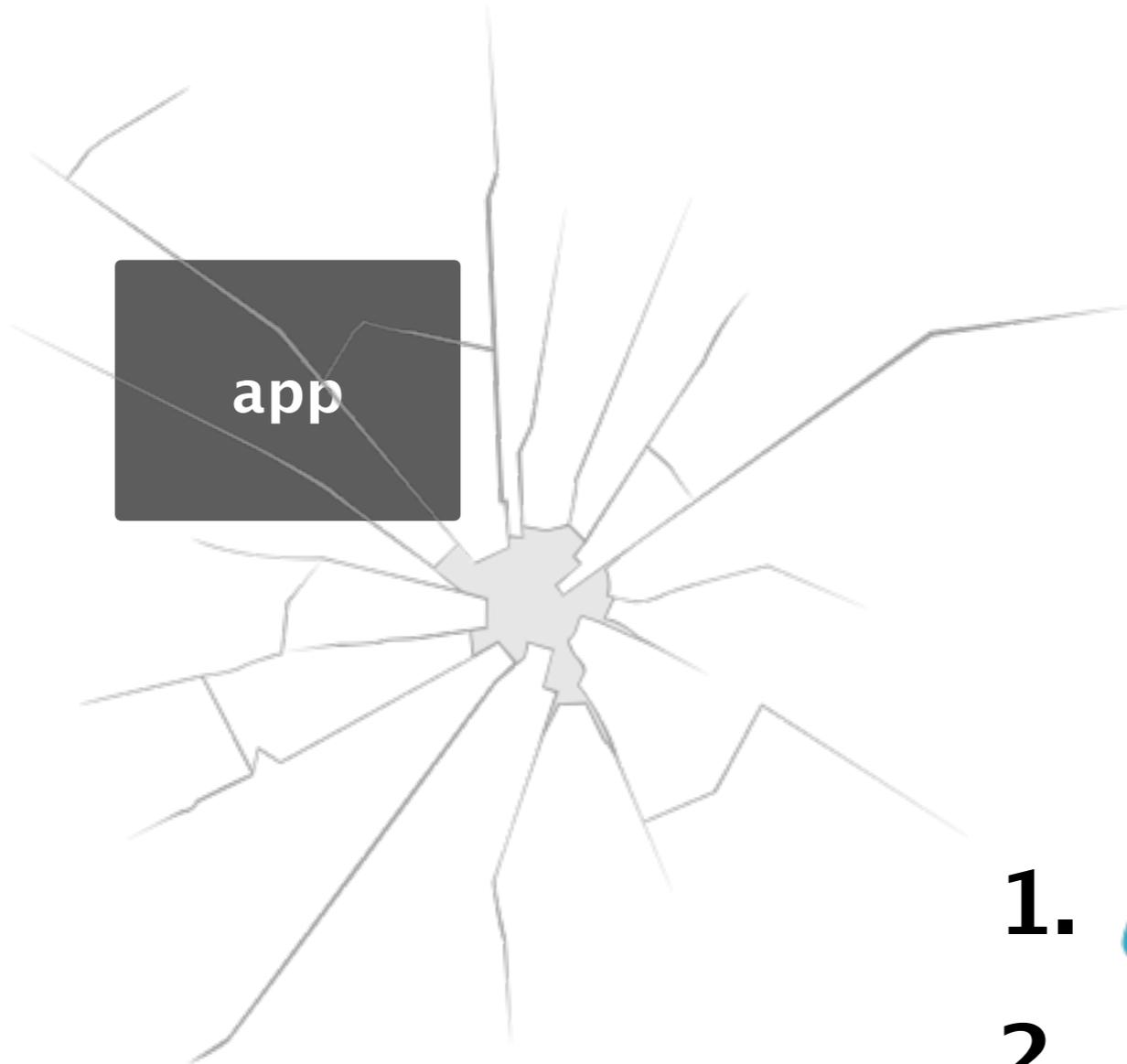


- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**



app

- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. drop database;**

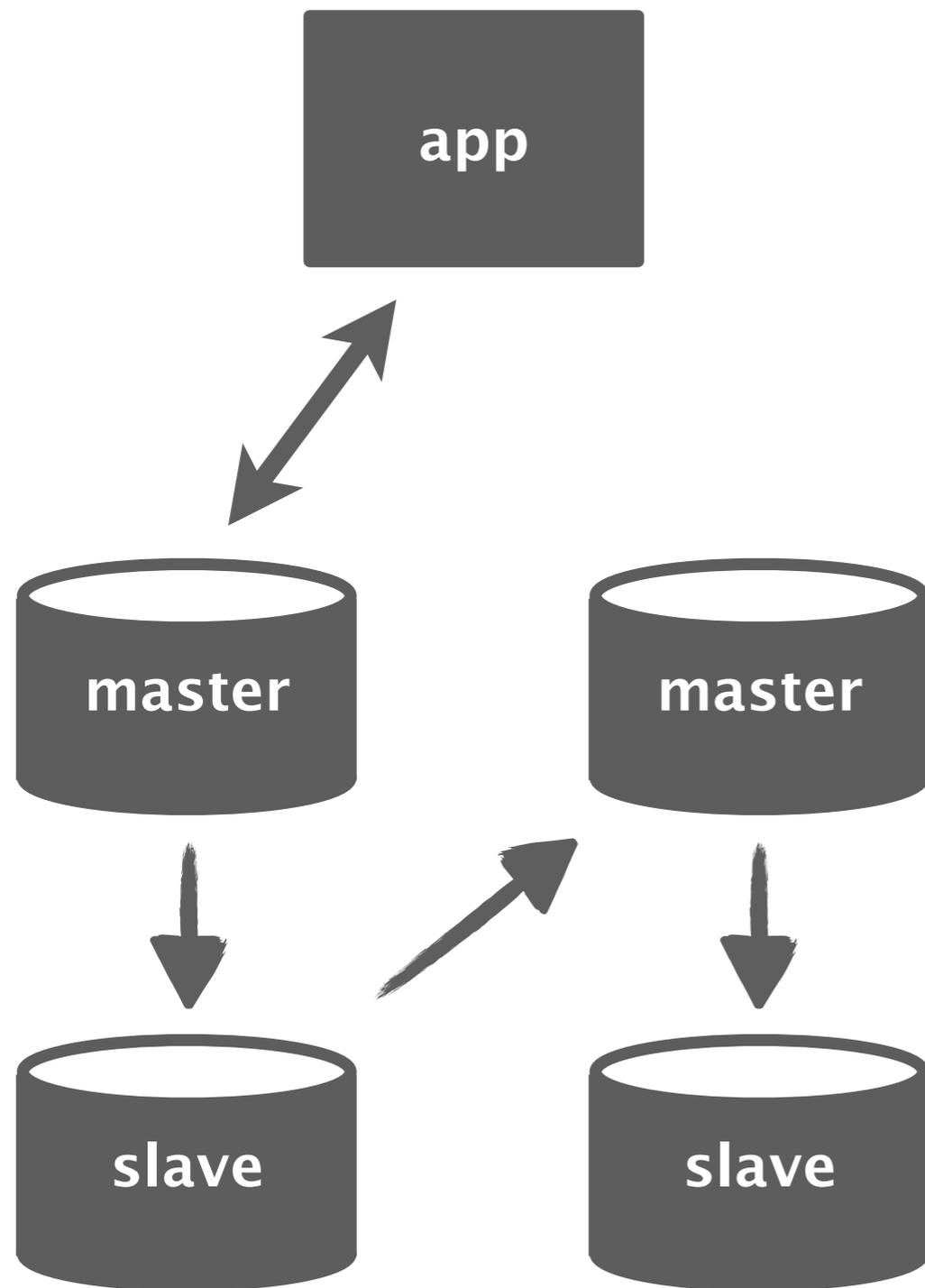


1. create `jobs`
2. setup relation
3. `sing`
4. `use;`

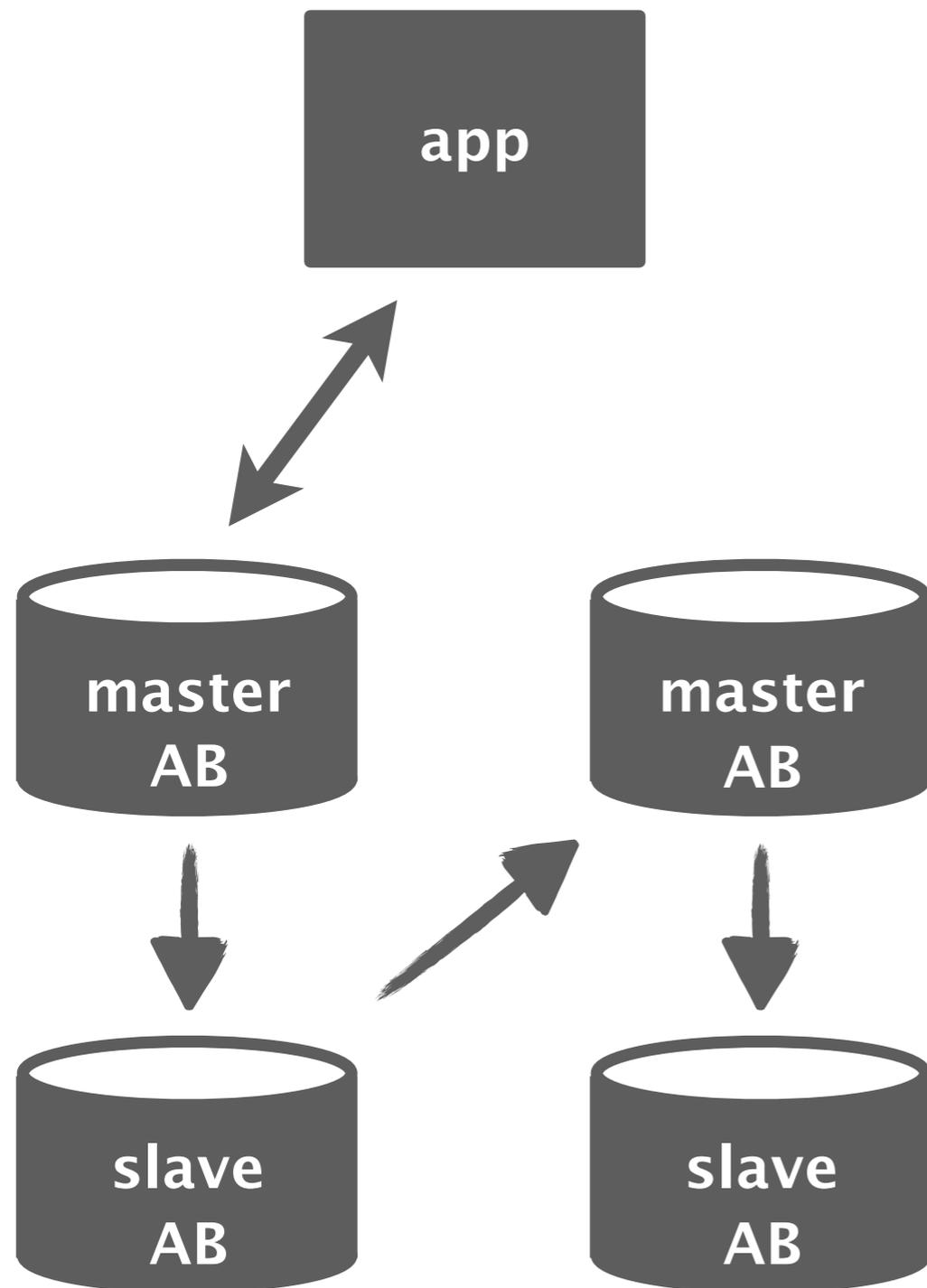
## Lesson 2:

**You will make  
mistakes!**

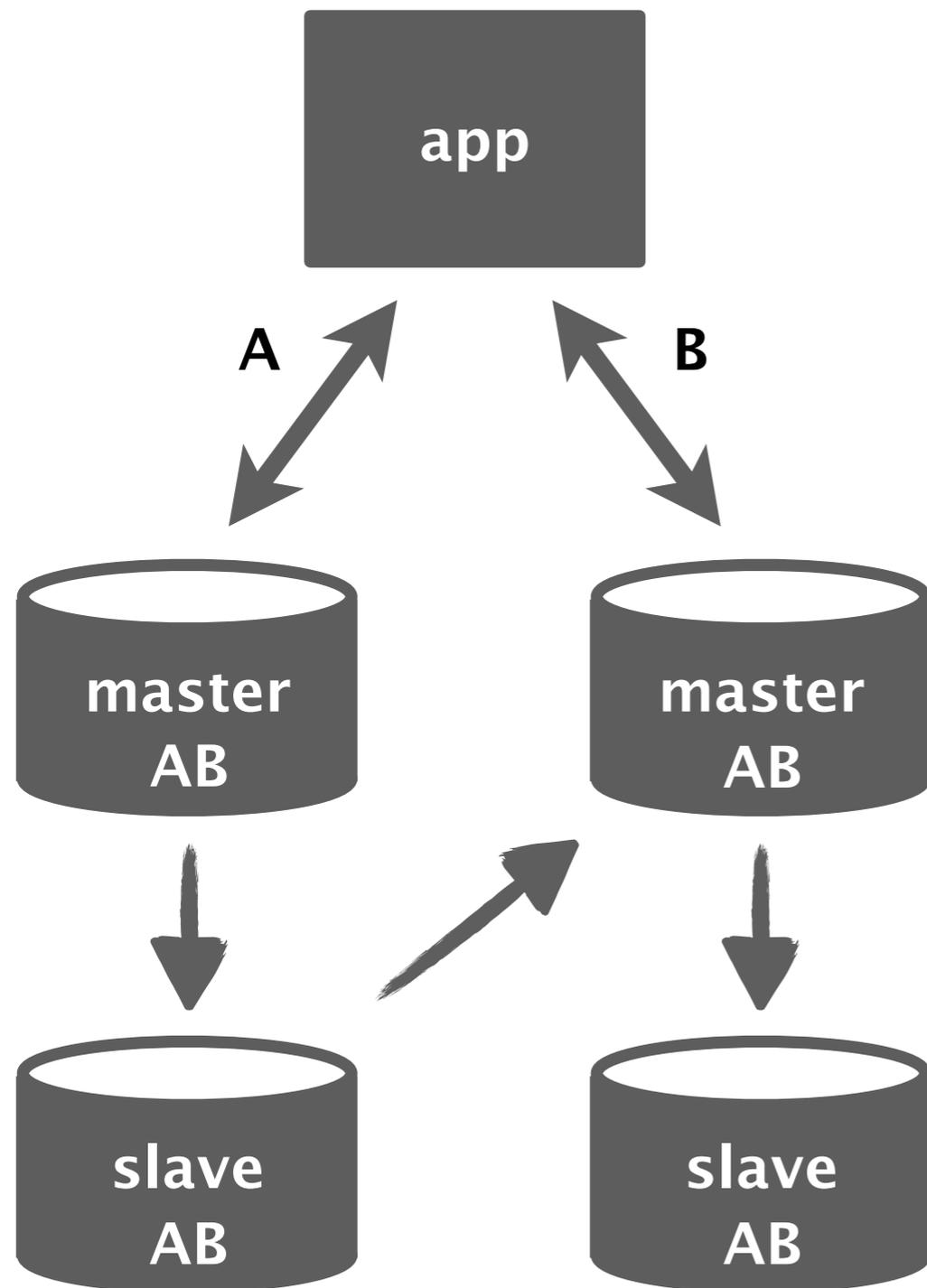
**More things...**



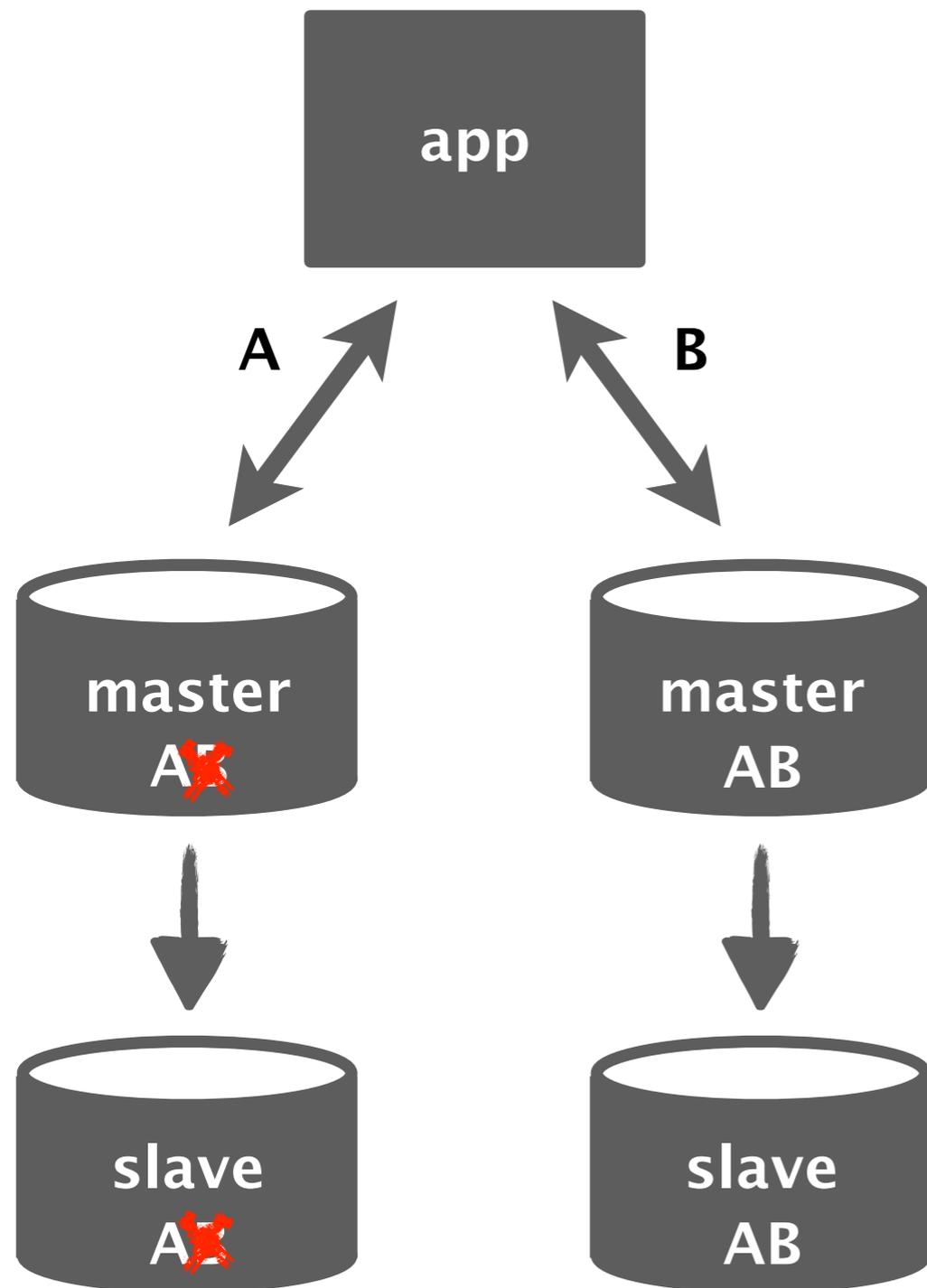
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. cut replication**



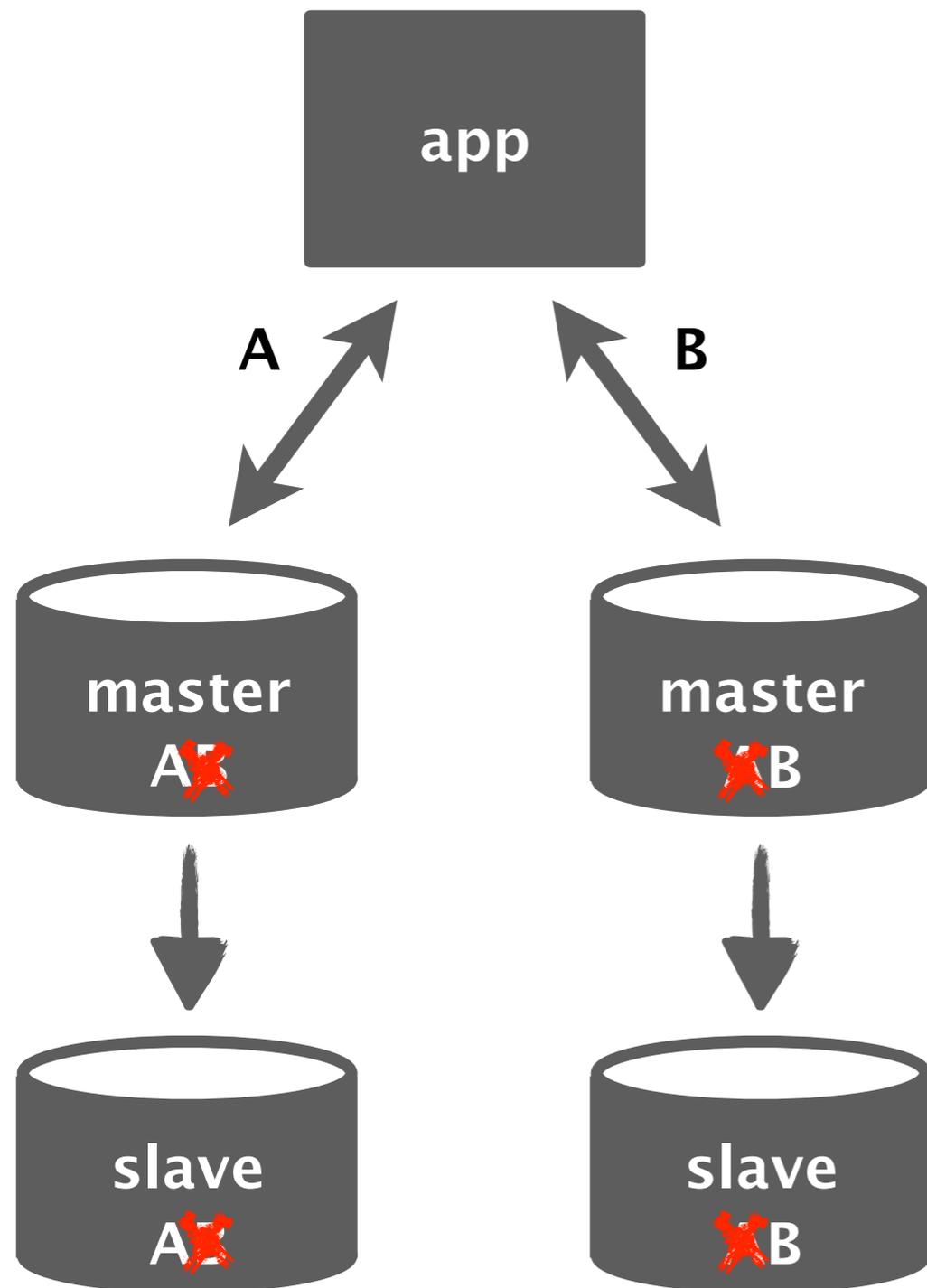
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**
- 4. cut replication**



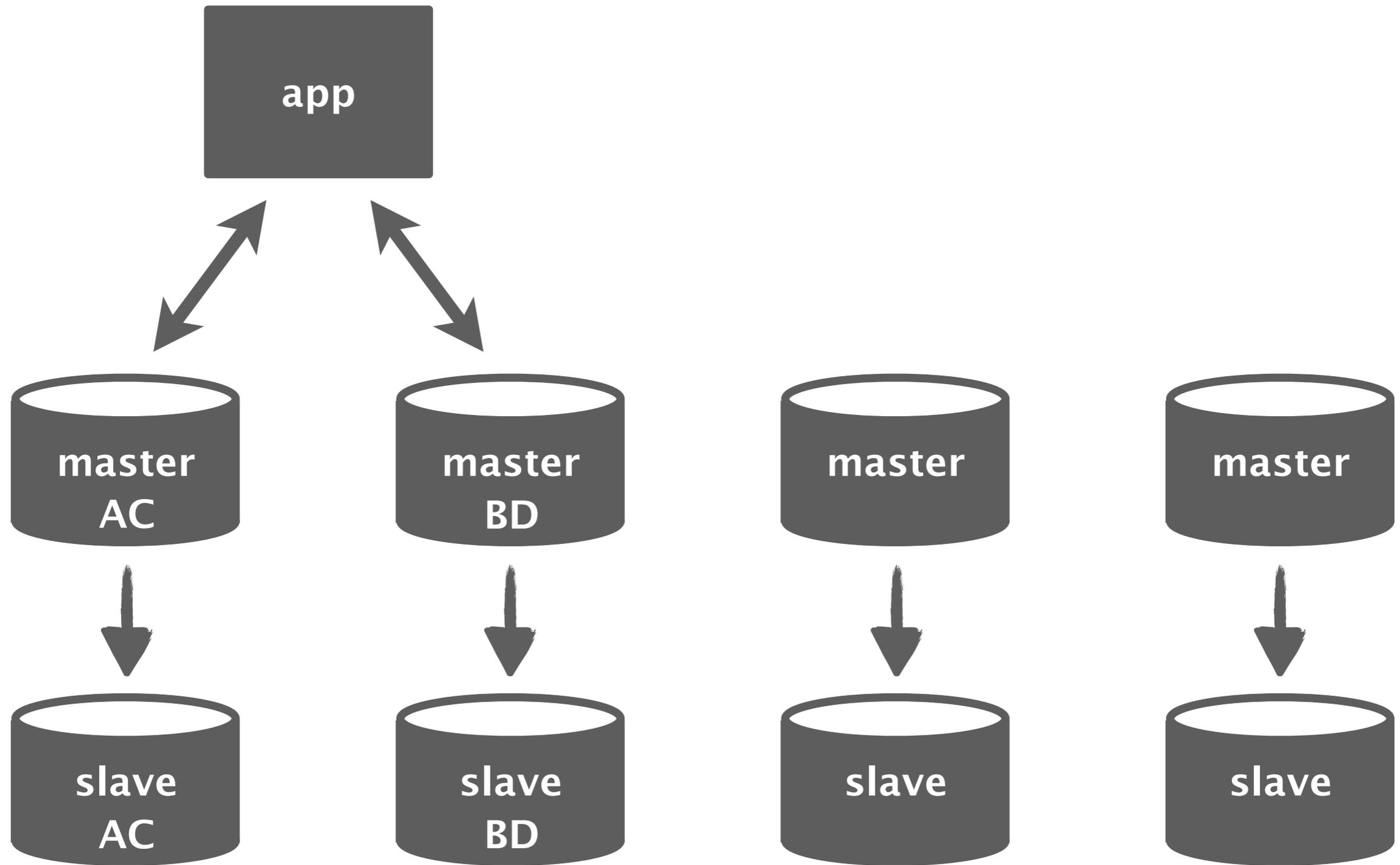
- 1. create new DBs**
- 2. setup replication**
- 3. start using masters**

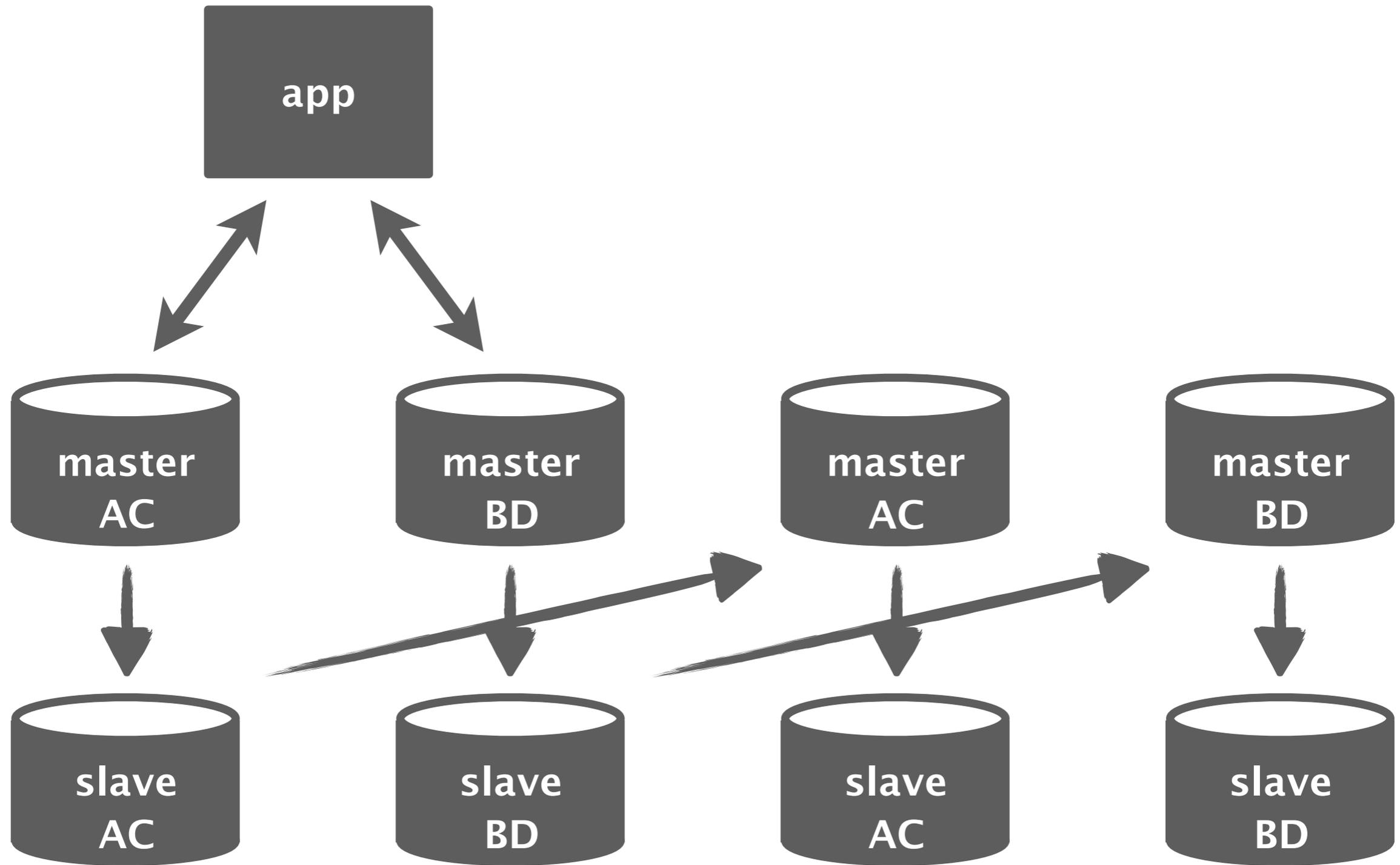


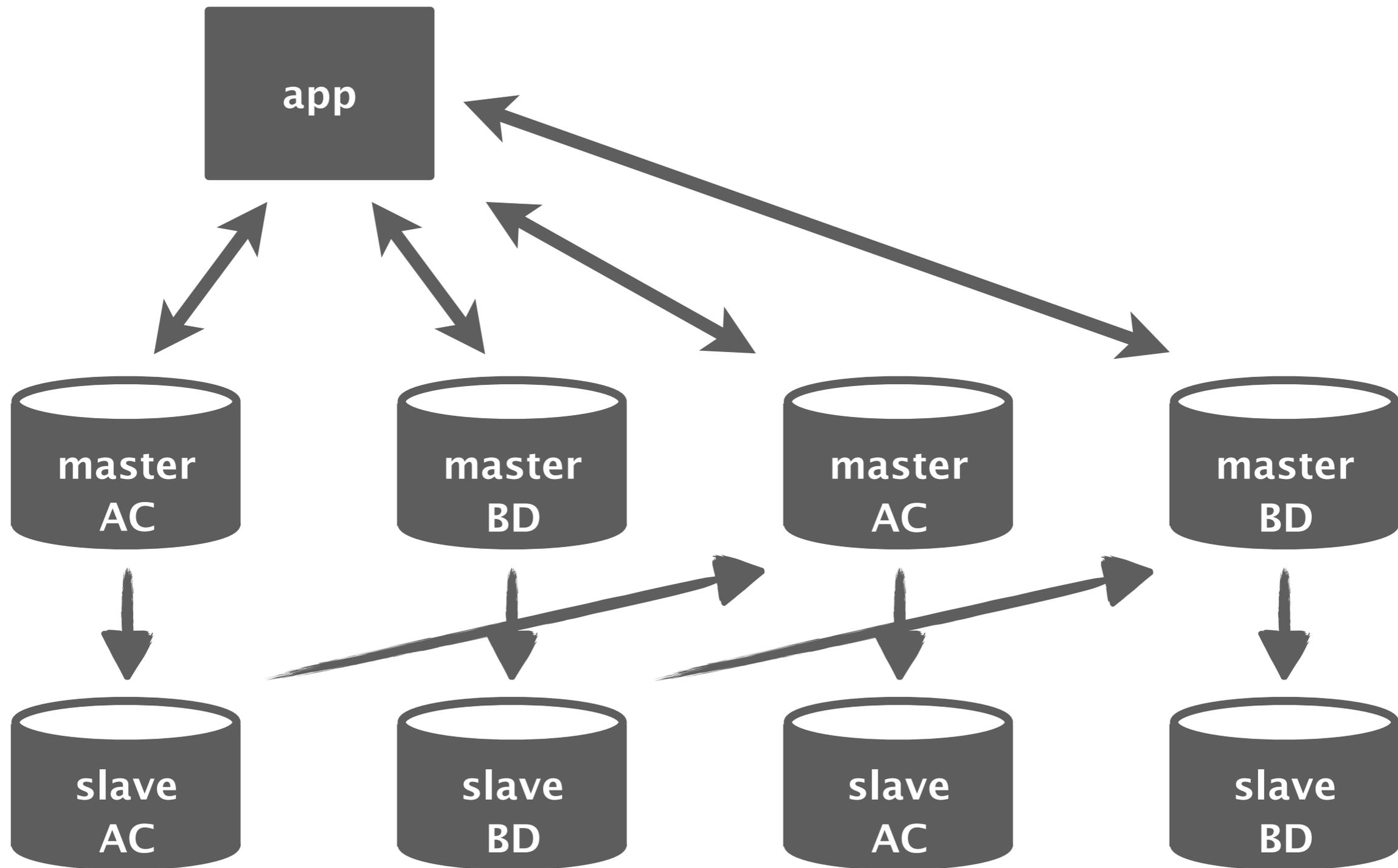
1. **create new DBs**
2. **setup replication**
3. **start using masters**
4. **cut replication**

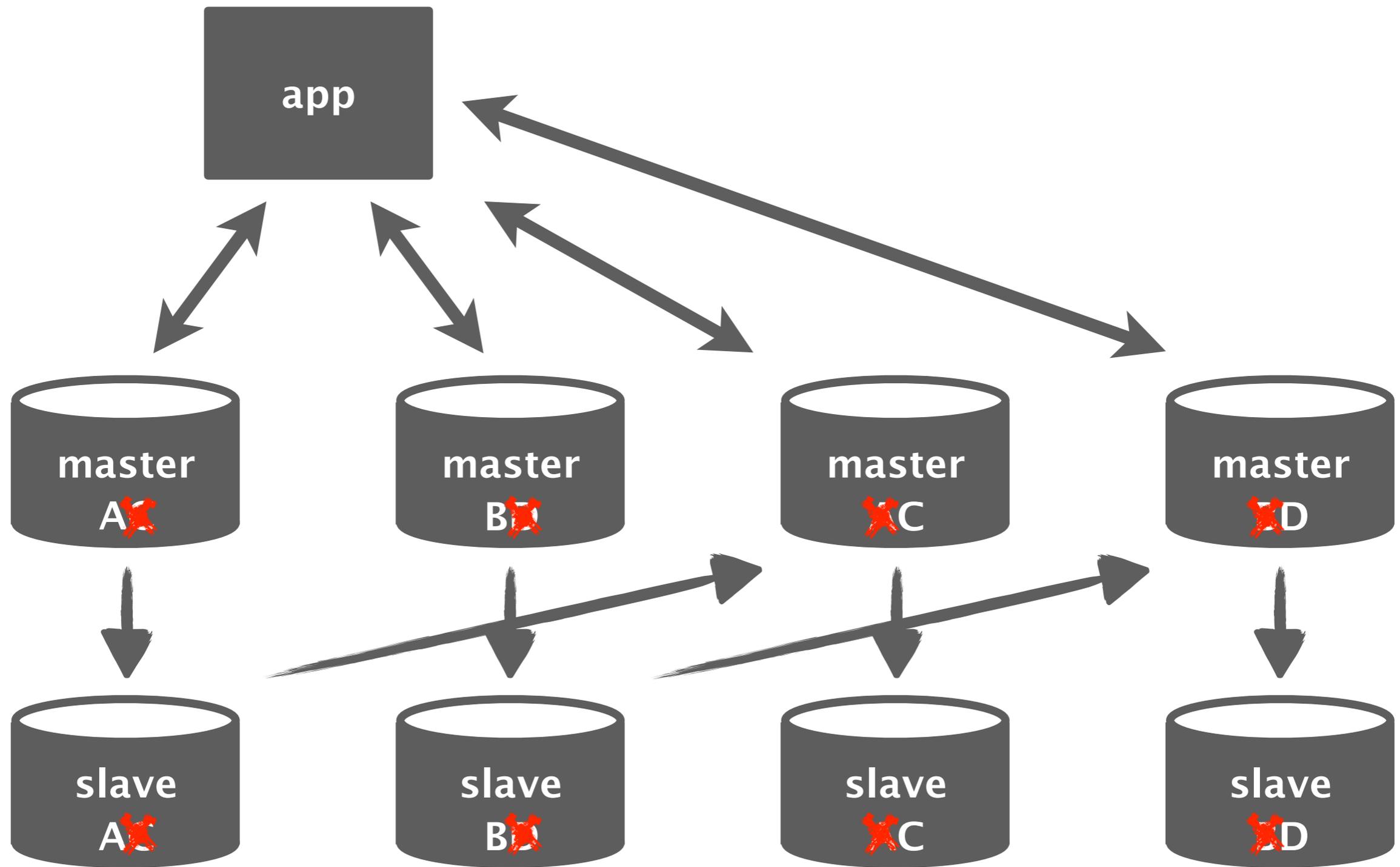


1. create new DBs
2. setup replication
3. start using masters
4. cut replication

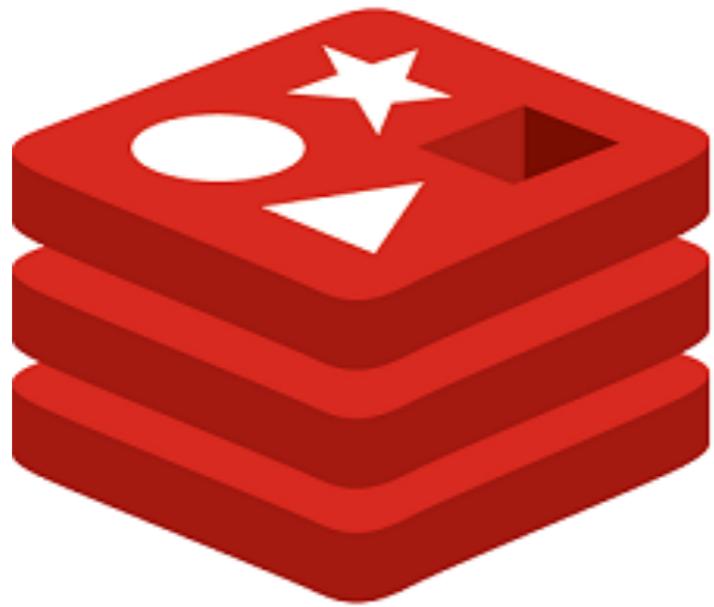








**The right thing...**



redis

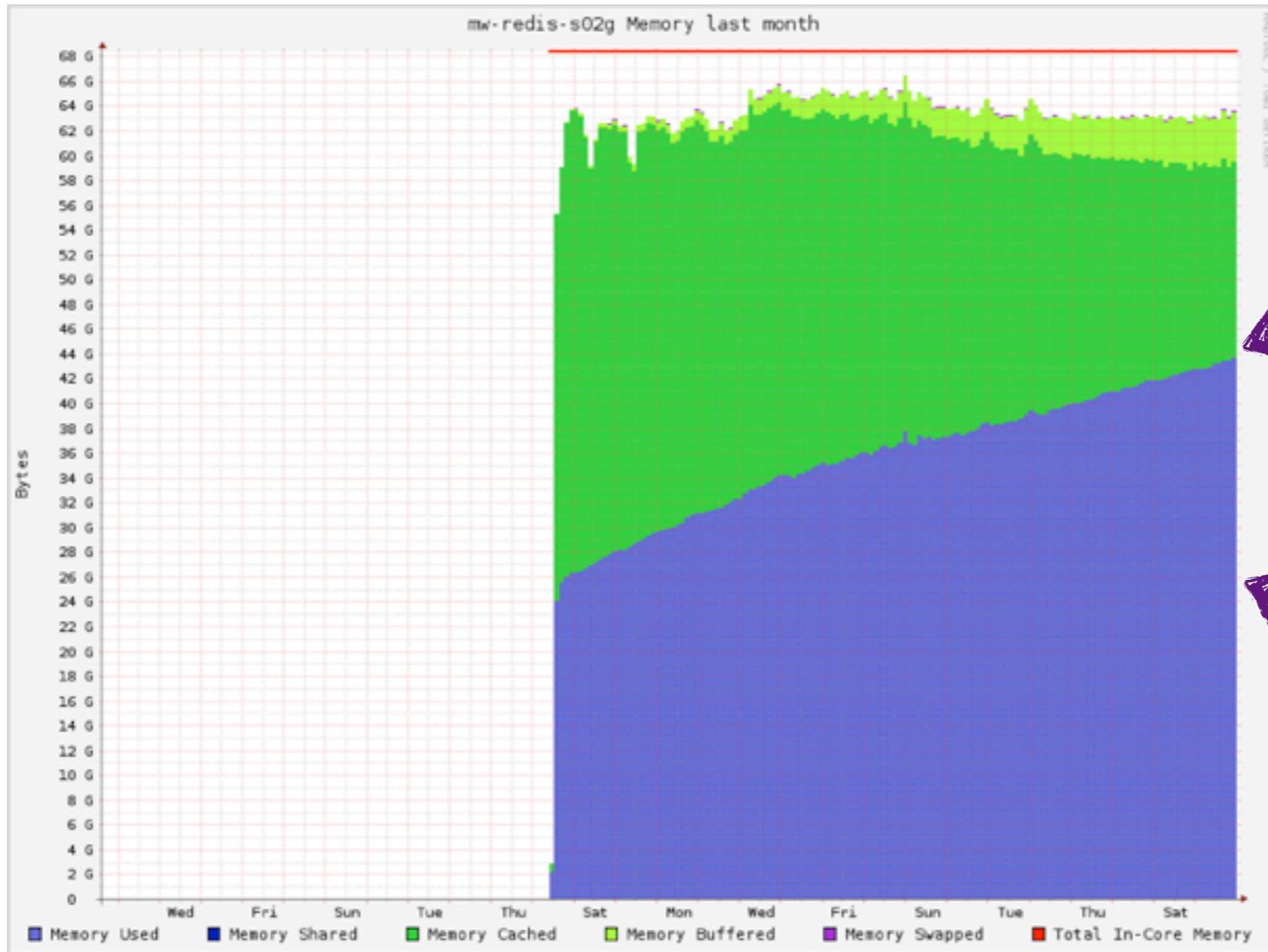
## calls\_per\_minute





## Lesson 3:

**Software is easy,  
data is hard!**



**44 GB**

**in 8 days**

**24 GB**

**Not enough memory**

**Not enough memory**

**=> no backups**

**Not enough memory**

**=> no backups**

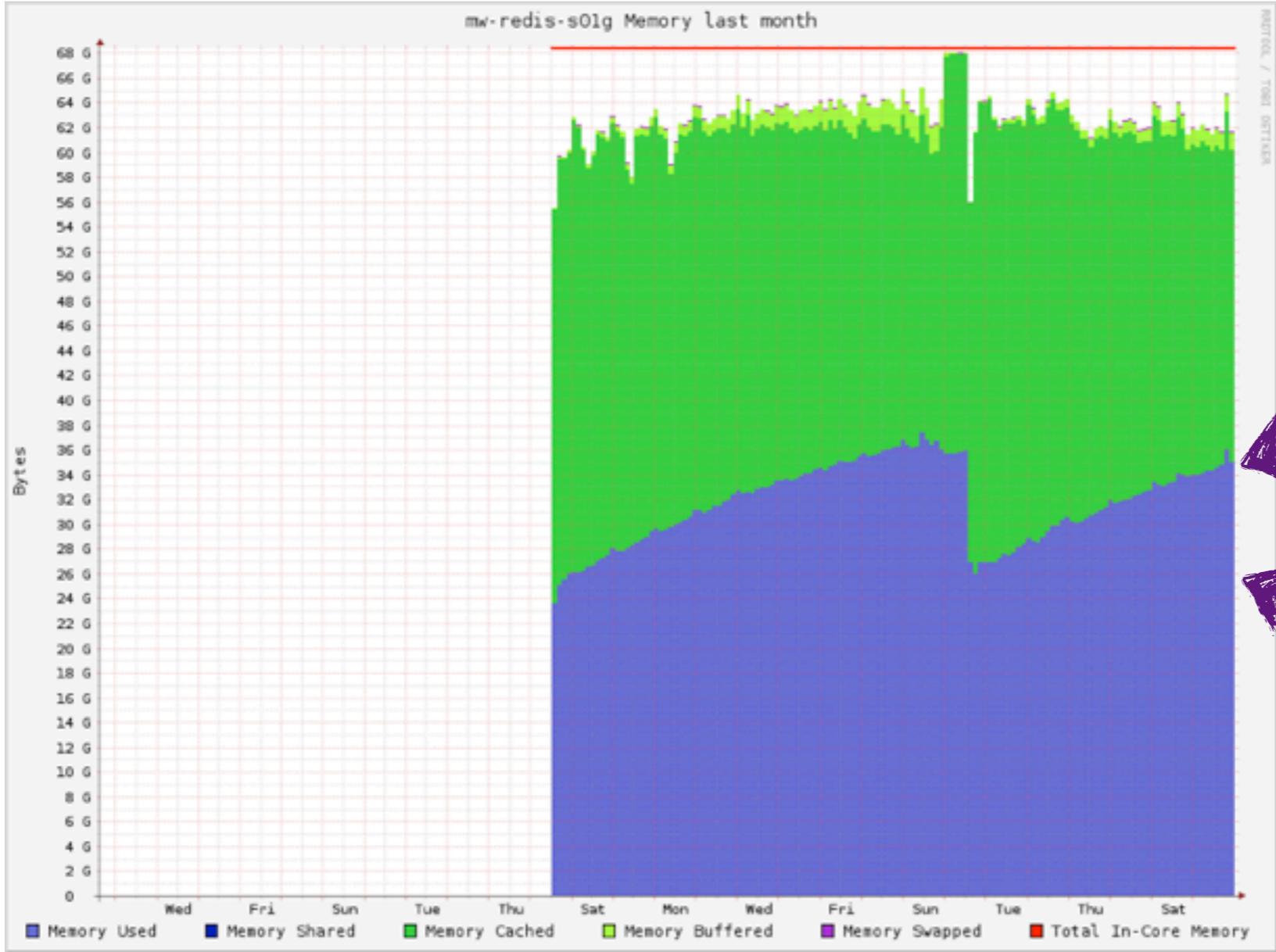
**=> no new slaves**

**Not enough memory**

**=> no backups**

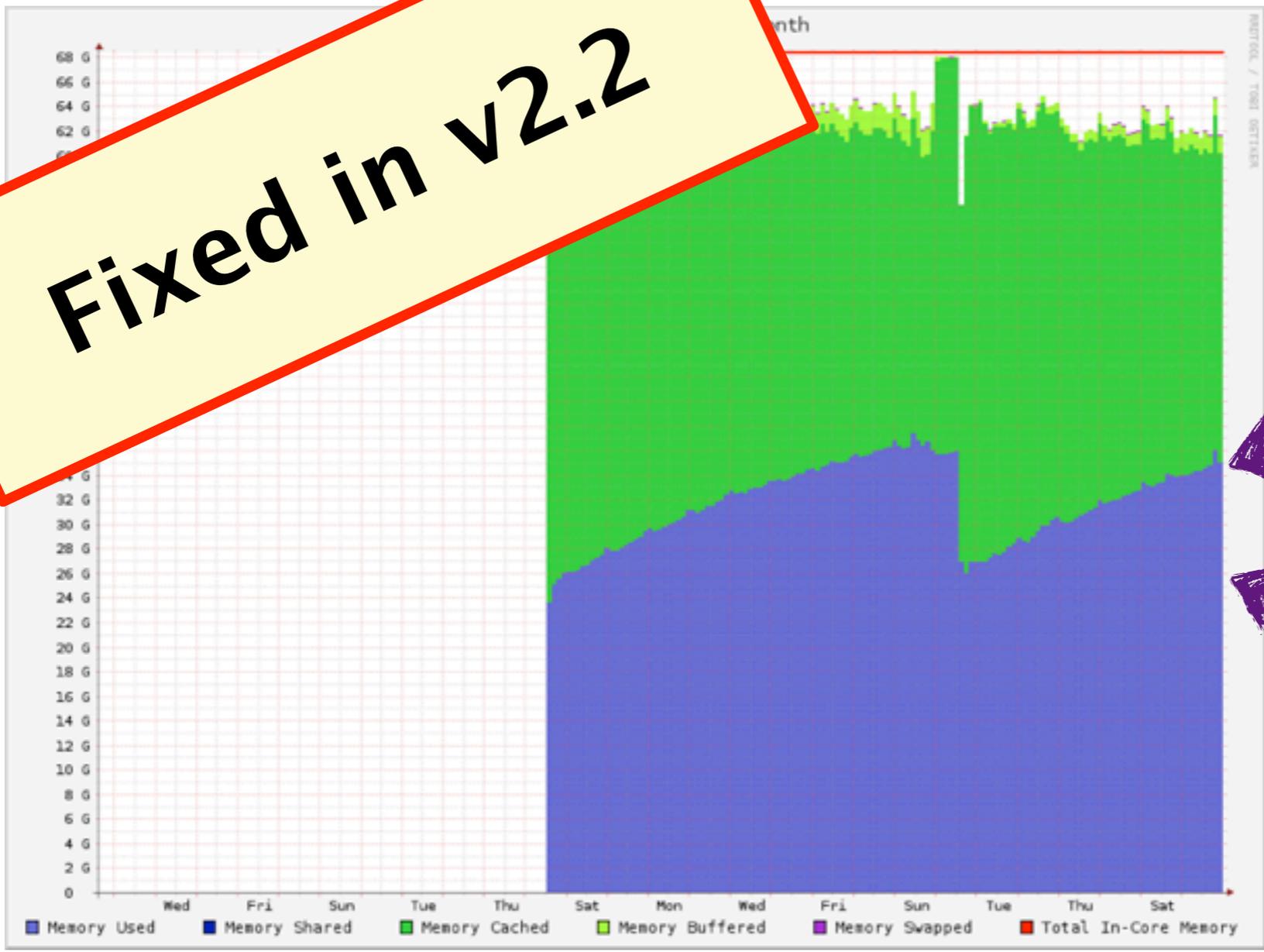
**=> no new slaves**

**=> big problem**



**38 GB**  
**in 3 days**  
**24 GB**

**Fixed in v2.2**



**38 GB**

**in 3 days**

**24 GB**

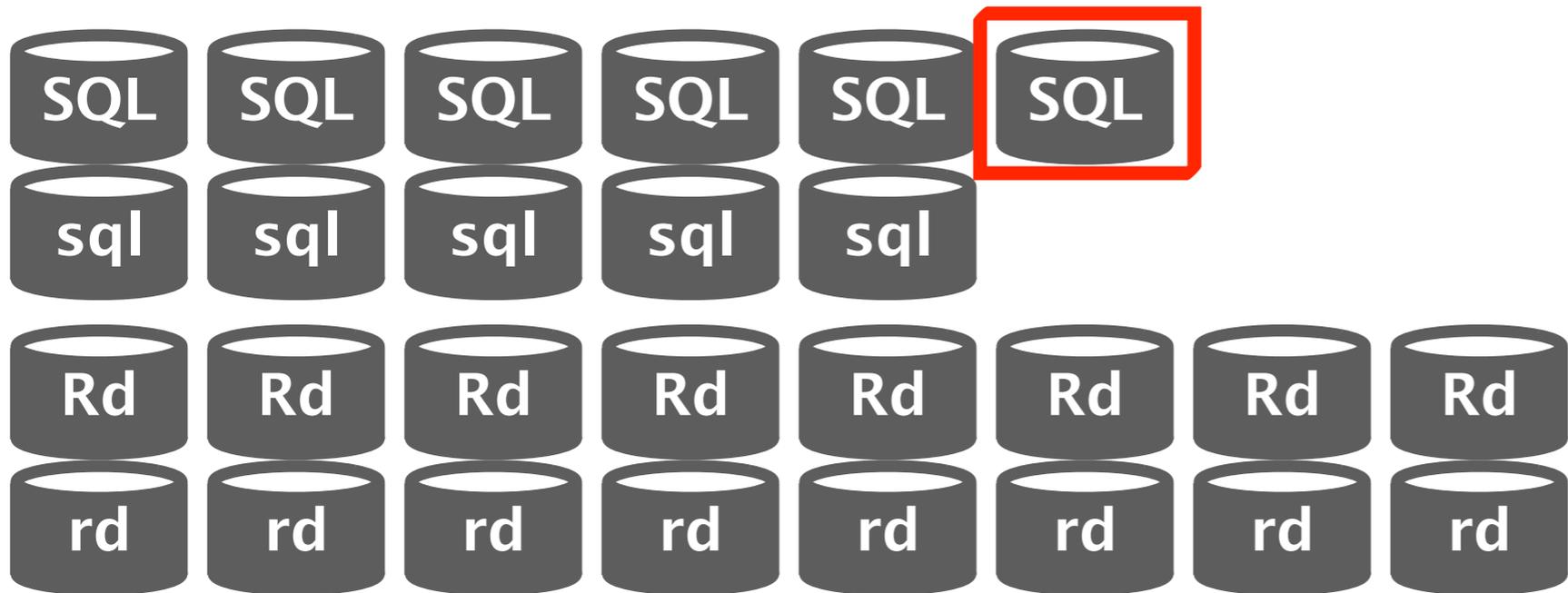
# 2011 Operation Hell

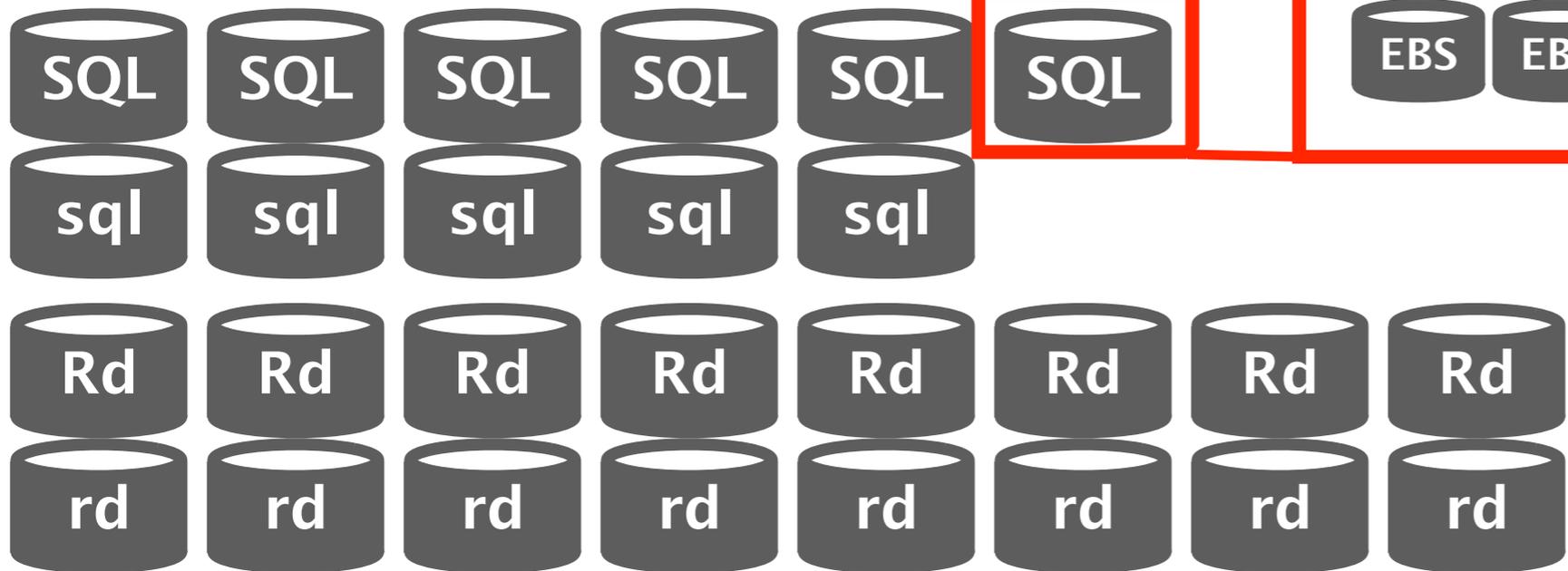
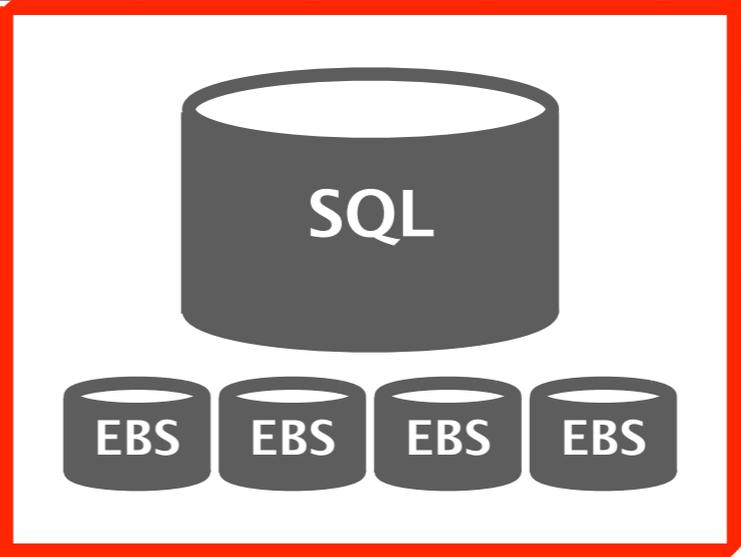
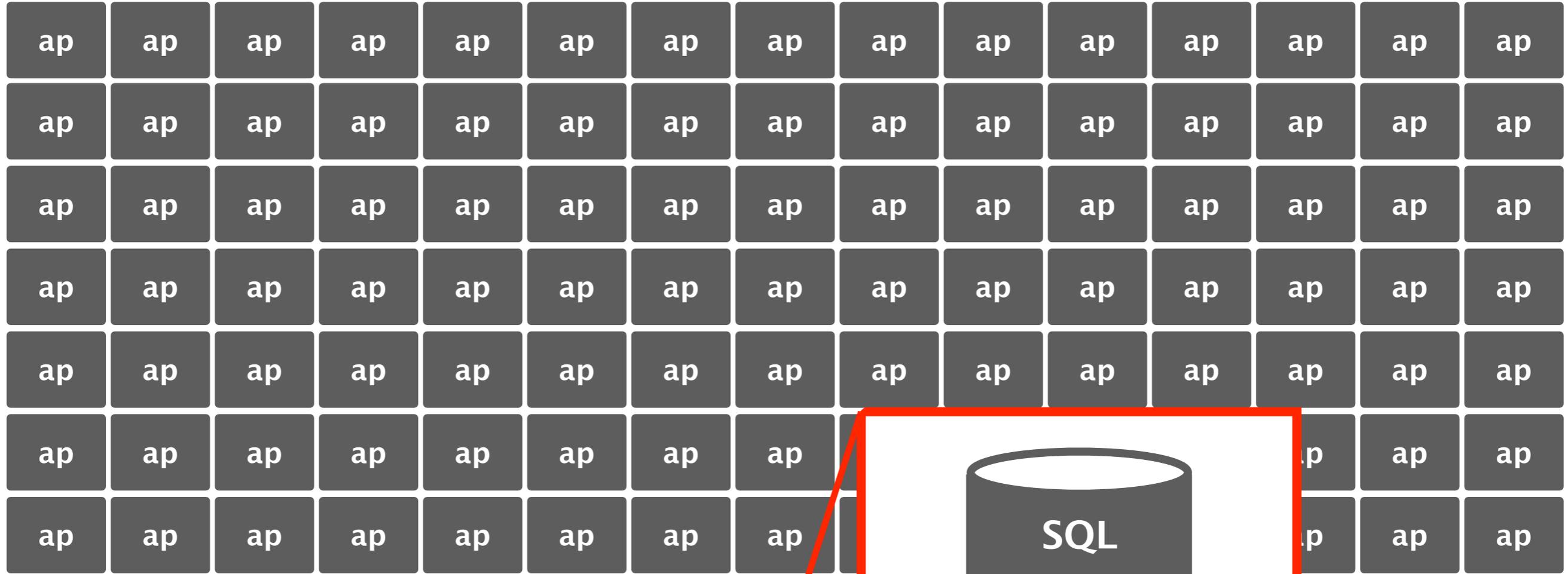
lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

SQL	SQL	SQL	SQL	SQL	SQL		
sql	sql	sql	sql	sql			
Rd	Rd	Rd	Rd	Rd	Rd	Rd	Rd
rd	rd	rd	rd	rd	rd	rd	rd

lb lb lb lb





Browser

lb  
lb  
lb  
lb

ap ap  
ap ap  
ap ap  
ap ap

SQL

EBS

Browser

lb  
lb  
lb  
lb

ap ap  
ap ap  
ap ap  
ap ap

SQL

EBS



Browser

lb  
lb  
lb  
lb

ap ap  
ap ap  
ap ap  
ap ap

SQL

EBS



Browser

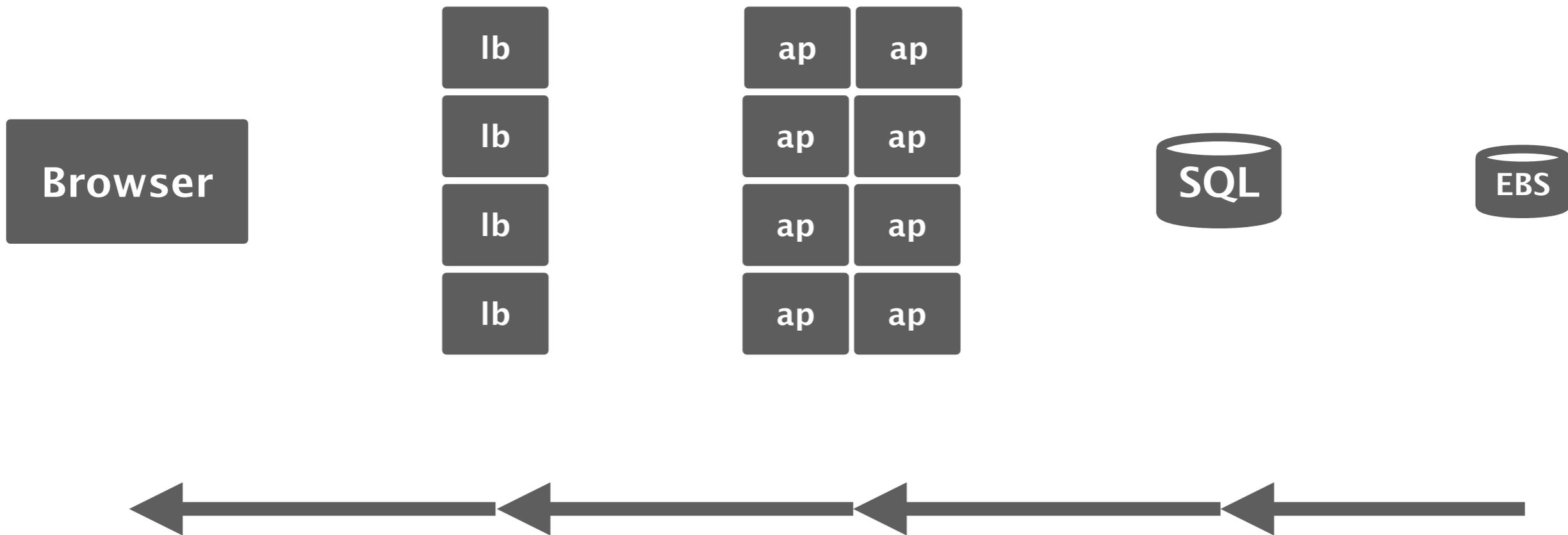
lb  
lb  
lb  
lb

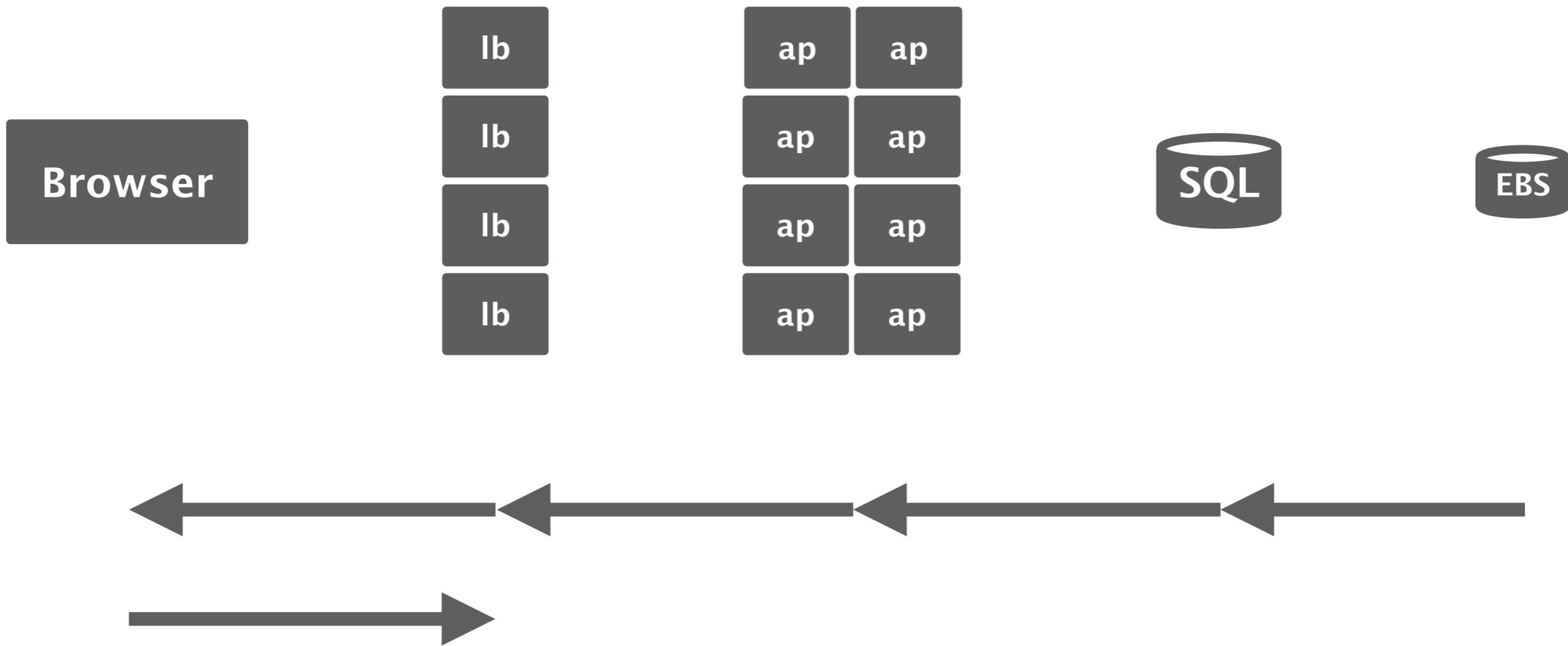
ap ap  
ap ap  
ap ap  
ap ap

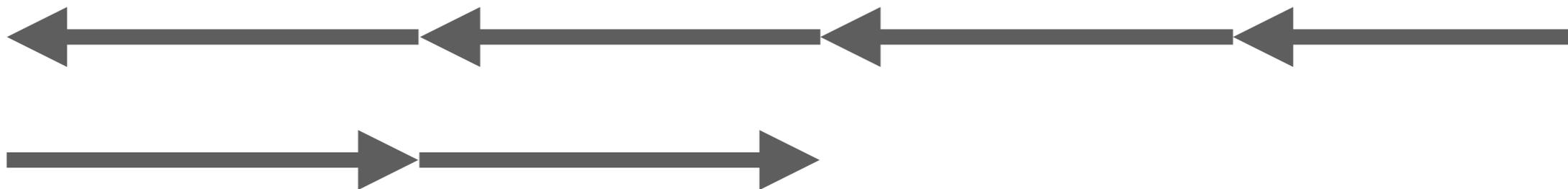
SQL

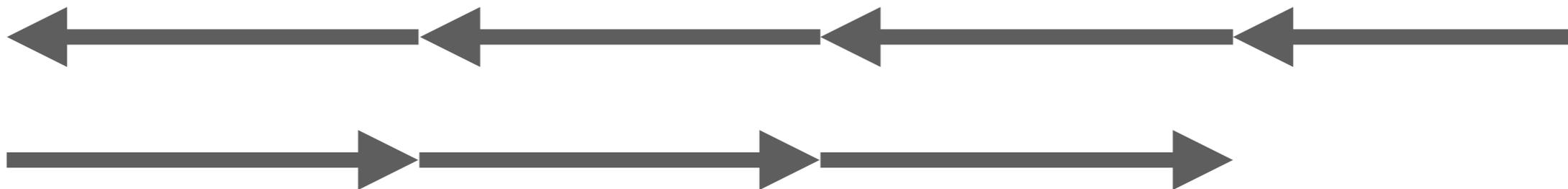
EBS

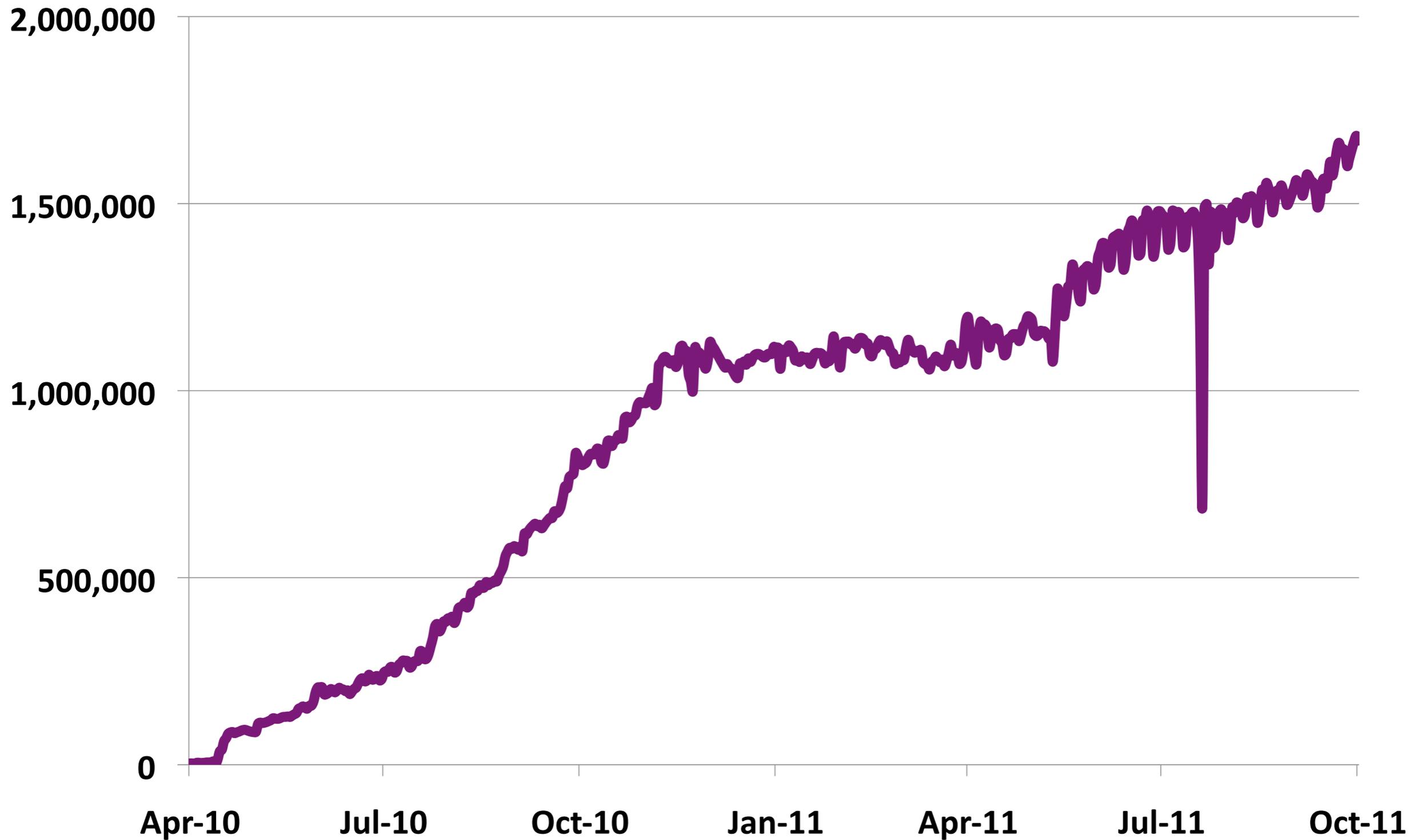


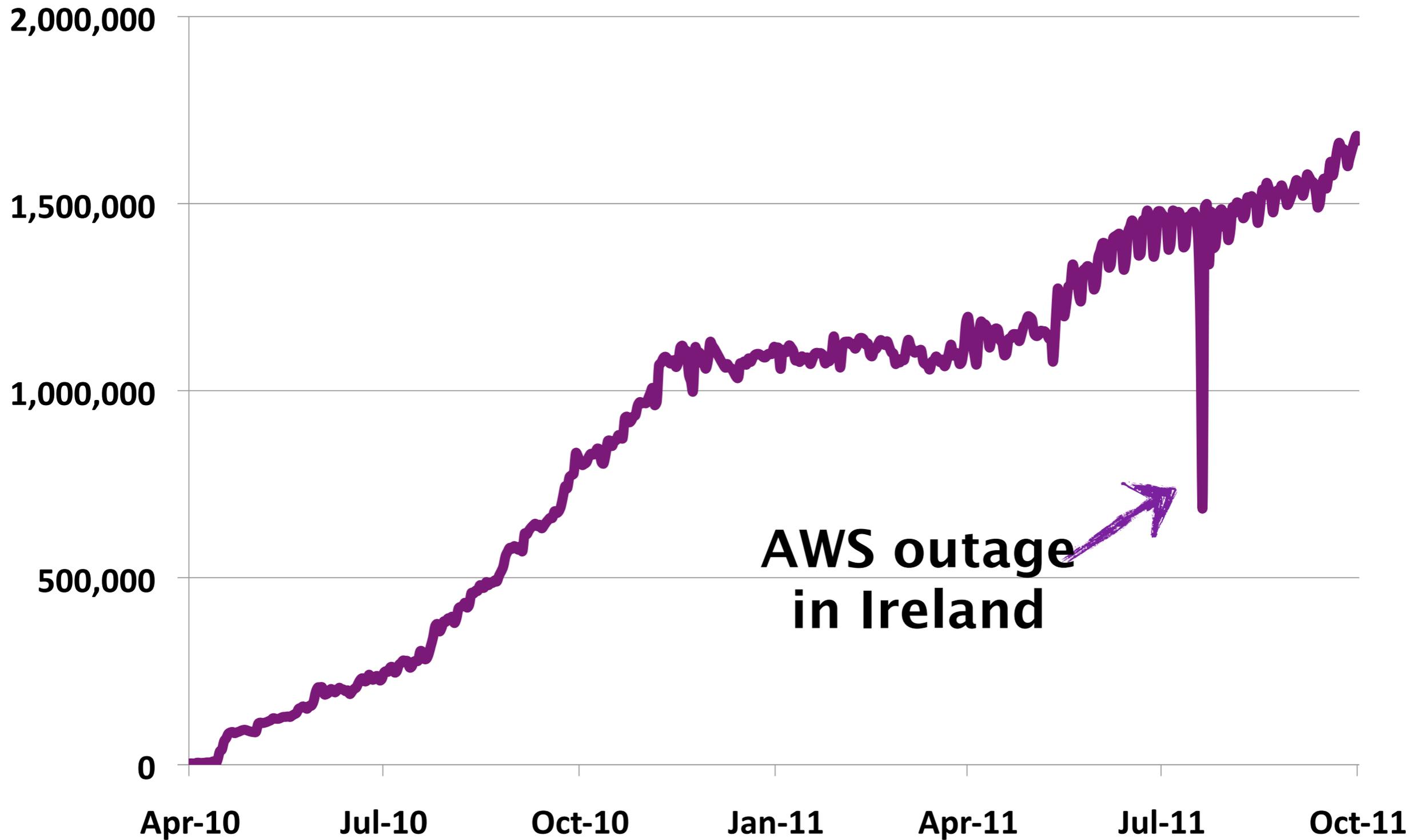












**AWS outage  
in Ireland**



[http://en.wikipedia.org/wiki/File:St%C3%B6wer\\_Titanic.jpg](http://en.wikipedia.org/wiki/File:St%C3%B6wer_Titanic.jpg)

lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

SQL	SQL	SQL	SQL	SQL	SQL		
sql	sql	sql	sql	sql			
Rd	Rd	Rd	Rd	Rd	Rd	Rd	Rd
rd	rd	rd	rd	rd	rd	rd	rd

lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

SQL	SQL	SQL	SQL	SQL	SQL			SQL	SQL	SQL	SQL	SQL
sql	sql	sql	sql	sql								
Rd	Rd	Rd	Rd	Rd	Rd	Rd	Rd					
rd	rd	rd	rd	rd	rd	rd	rd					

2.12.10

~~MOA~~<sub>a</sub>

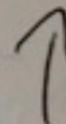
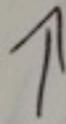
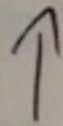
~~MOZ~~<sub>a</sub>

MO3<sub>a</sub>

SO1<sub>a</sub>

SO2<sub>a</sub>

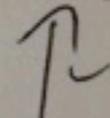
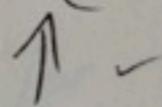
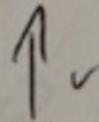
SO3<sub>a</sub>



SO1-vm  
(DUMP)

SO2-vm  
(DUMP)

SO3-vm  
(DUMP)



MO1b ✓

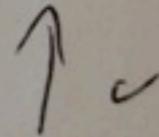
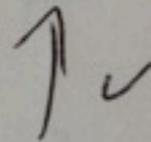
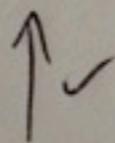
MO2b ✓

MO3b ✓

Dumper:

7win for  
stage of bei

ca. 1463  
human-read



SO1b ✓

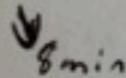
SO2b ✓

SO3b ✓

DUMP

DUMP?

DUMP



2.12.10

~~MOA<sub>a</sub>~~

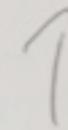
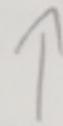
~~MOZ<sub>a</sub>~~

MO3<sub>a</sub>

SO1<sub>a</sub>

SO2<sub>a</sub>

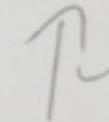
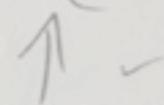
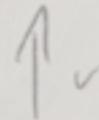
SO3<sub>a</sub>



SO1-vm  
(DUMP)

SO2-vm  
(DUMP)

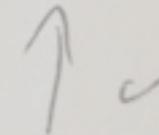
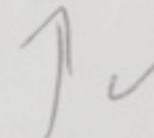
SO3-vm  
(DUMP)



MO1b ✓

MO2b ✓

MO3b ✓



Dumper:

3 min  
slave of  
ca. 1463  
human read

SO1b ✓

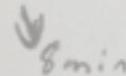
SO2b ✓

SO3b ✓

DUMP

DUMP?

DUMP



Installed in 3 years:

2.12.10

~~MOA<sub>a</sub>~~

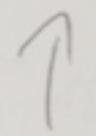
~~MOZ<sub>a</sub>~~

MO3<sub>a</sub>

SO1<sub>a</sub>

SO2<sub>a</sub>

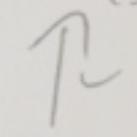
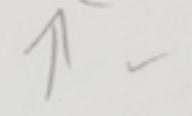
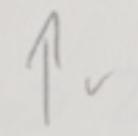
SO3<sub>a</sub>



SO1-vm  
(DUMP)

SO2-vm  
(DUMP)

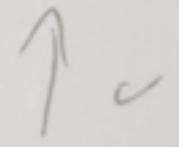
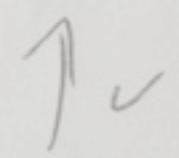
SO3-vm  
(DUMP)



MO1<sub>b</sub> ✓

MO2<sub>b</sub> ✓

MO3<sub>b</sub> ✓



Power:

Slave of  
ca. 14GB  
human-read

SO1<sub>b</sub> ✓  
DUMP

SO2<sub>b</sub> ✓  
DUMP?

SO3<sub>b</sub> ✓  
DUMP

**Installed in 3 years:  
98 MySQL machines**

2.12.10

~~MOA<sub>a</sub>~~

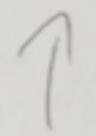
~~MOZ<sub>a</sub>~~

MO3<sub>a</sub>

SO1<sub>a</sub>

SO2<sub>a</sub>

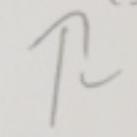
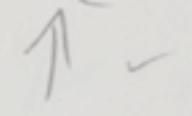
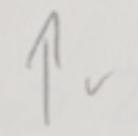
SO3<sub>a</sub>



SO1-vm  
(DUMP)

SO2-vm  
(DUMP)

SO3-vm  
(DUMP)



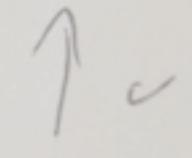
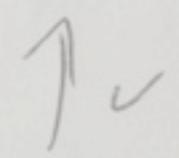
MO1<sub>b</sub> ✓

MO2<sub>b</sub> ✓

MO3<sub>b</sub> ✓

Power:

3 in 3  
slave of  
ca. 146B  
human-read



SO1<sub>b</sub> ✓  
DUMP

SO2<sub>b</sub> ✓  
DUMP?

SO3<sub>b</sub> ✓  
DUMP

**Installed in 3 years:  
98 MySQL machines  
195 Redis machines**

redis masters

+ Add Instance

▼ Actions

Instances (12)



Time Based Auto Scaling

Load Based Auto Scaling

Dependencies (1)

EBS Volumes (1)

Elastic IPs

Custom Recipes (2)

Role Settings

Hostname	Type	CPU	RAM	Load	External IP	Internal IP	Actions
24x7 Instances in datacenter eu-west-1a							
mw-redis-m01v	HighMEM 4XL	4%	87%	0.0			
mw-redis-m02y	HighMEM 4XL	7%	86%	0.0			
mw-redis-m04s	HighMEM 4XL	3%	72%	0.0			
mw-redis-md01b	HighMEM 2XL	0%	38%	0.0			
mw-redis-md02b	HighMEM 2XL	1%	41%	0.0			
mw-redis-mm01a	HighMEM XL	0%	19%	0.0			
mw-redis-mr01e	HighMEM 4XL	0%	36%	0.0			
mw-redis-mrr01a	HighMEM 4XL	1%	56%	0.0			
mw-redis-mu1i	HighMEM 2XL	3%	93%	0.0			
mw-redis-mu2g	HighMEM 4XL	3%	48%	0.0			
mw-redis-mui1c	HighMEM 4XL	1%	51%	0.0			
mw-redis-mur1	HighMEM XL	0%	12%	0.0			



**OpsWorks**



**amazon**  
web services™

# MySQL Master

[+ Add Instance](#)

[▼ Actions](#)

Instances (13)



Time Based Auto Scaling

Load Based Auto Scaling

Dependencies (1)

EBS Volumes

Elastic IPs

MySQL Settings

Custom Recipes (7)

Role Settings

Hostname	Type	CPU	RAM	Load	External IP	Internal IP	Actions
<b>24x7 Instances in datacenter eu-west-1a</b>							
mw-xdb-m01l	HighMEM 4XL	4%	100%	0.2			
mw-xdb-m02h	HighMEM 4XL	5%	100%	0.4			
mw-xdb-m03g	HighMEM 4XL	5%	100%	0.2			
mw-xdb-m04i	HighMEM 4XL	0%	99%	0.0			
mw-xdb-m04j	HighMEM 4XL	10%	100%	0.2			
mw-xdb-mf1g	HighMEM 2XL	12%	94%	0.2			
mw-xdb-ms1	Standard L	0%	94%	0.0			
mw-xdb-mui1c	HighMEM 4XL	4%	100%	0.2			
<b>24x7 Instances in datacenter eu-west-1c</b>							
mw-xdb-bm01l	HighMEM 4XL	20%	100%	2.5			
mw-xdb-bm02h	HighMEM 4XL	2%	100%	0.2			
mw-xdb-bm03g	HighMEM 4XL	2%	100%	0.4			
mw-xdb-bm04i	HighMEM 4XL	1%	100%	0.2			
mw-xdb-bm04j	HighMEM 4XL	1%	100%	0.2			

# MySQL Master

[+ Add Instance](#)

[▼ Actions](#)

Instances (13)



Time Based Auto Scaling

Load Based Auto Scaling

Dependencies (1)

EBS Volumes

Elastic IPs

MySQL Settings

Custom Recipes (7)

Role Settings

Hostname	Type	CPU	RAM	Load	Ext	Internal IP	Actions
<b>24x7 Instances in datacenter eu-west-1a</b>							
mw-xdb-m01	HighMEM 4XL	4%	100%	0.1			
mw-xdb-m02	HighMEM 4XL	5%	100%	0.1			
mw-xdb-m03g	HighMEM 4XL	5%	100%	0.2			
mw-xdb-m04i	HighMEM 4XL	0%	99%	0.0			
mw-xdb-m04j	HighMEM 4XL	10%	100%	0.1			
mw-xdb-mf1g	HighMEM 2XL	12%	94%	0.1			
mw-xdb-ms1	Standard L	0%	94%	0.0			
mw-xdb-mui1c	HighMEM 4XL	4%	100%	0.2			
<b>24x7 Instances in datacenter eu-west-1c</b>							
mw-xdb-bm01l	HighMEM 4XL	20%	100%	0.1			
mw-xdb-bm02h	HighMEM 4XL	2%	100%	0.1			
mw-xdb-bm03g	HighMEM 4XL	2%	100%	0.1			
mw-xdb-bm04i	HighMEM 4XL	1%	100%	0.1			
mw-xdb-bm04j	HighMEM 4XL	1%	100%	0.1			



# 2012/2013 Refactoring

# Lessons learned

**Server**

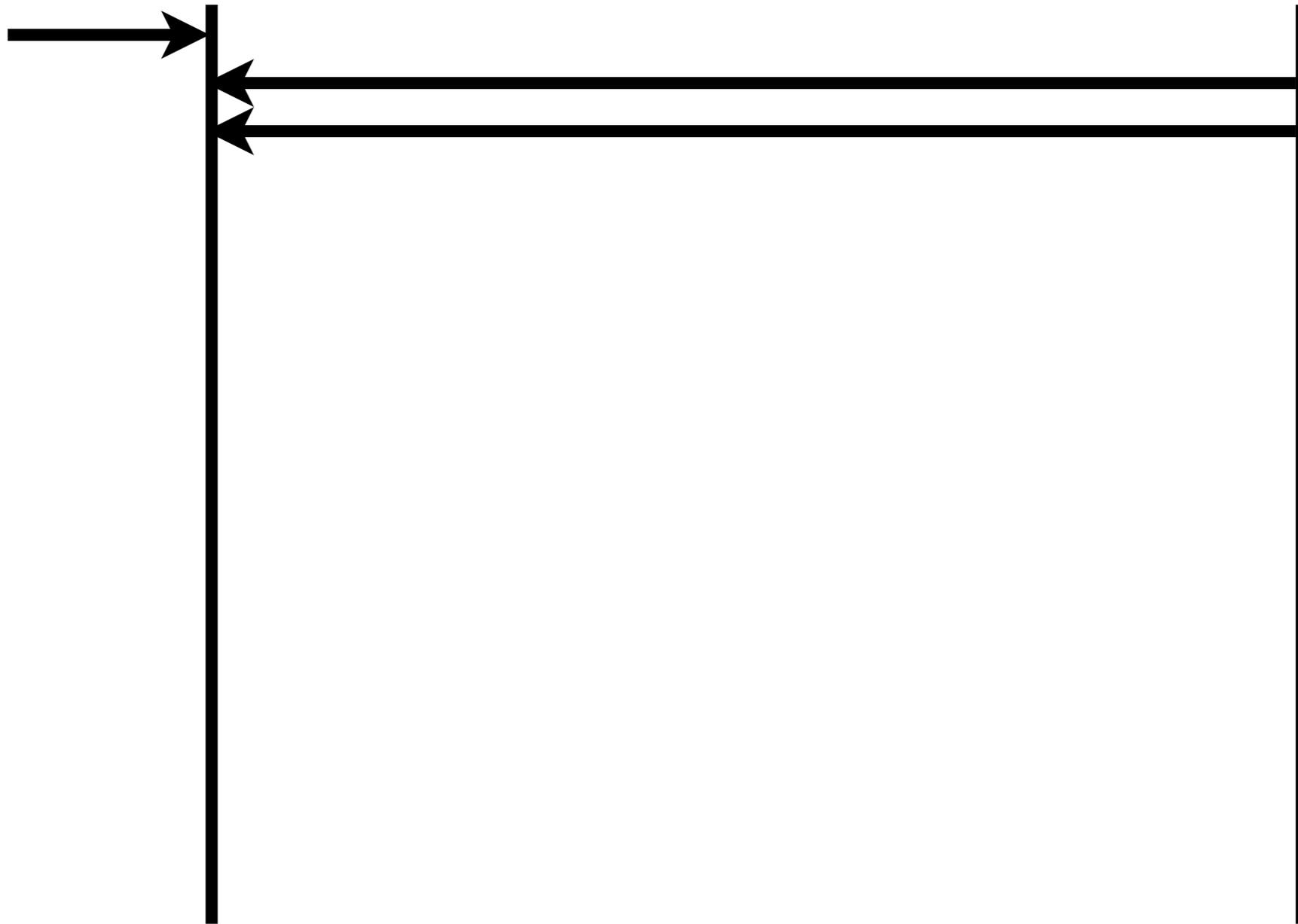


**Database**



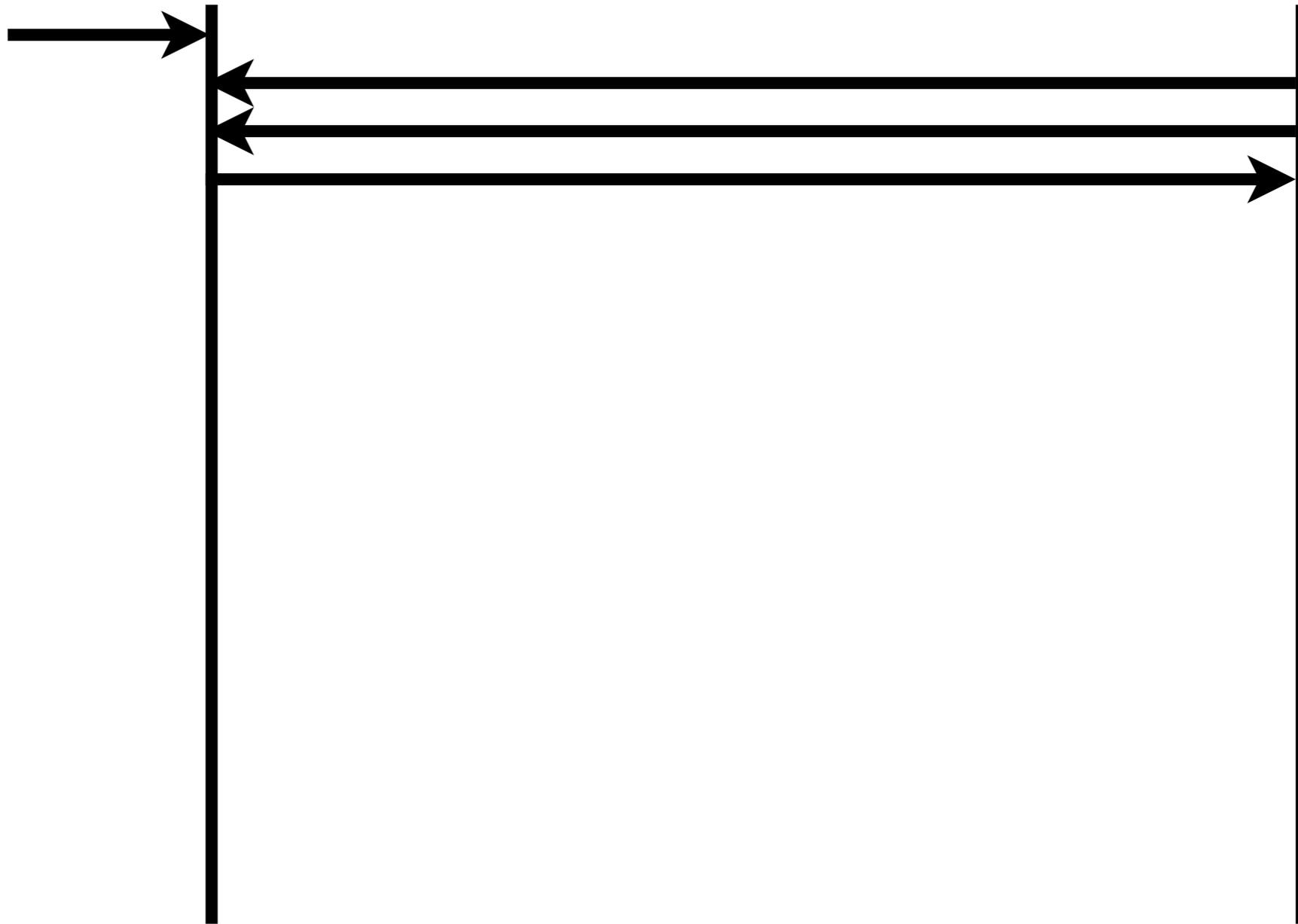
**Server**

**Database**



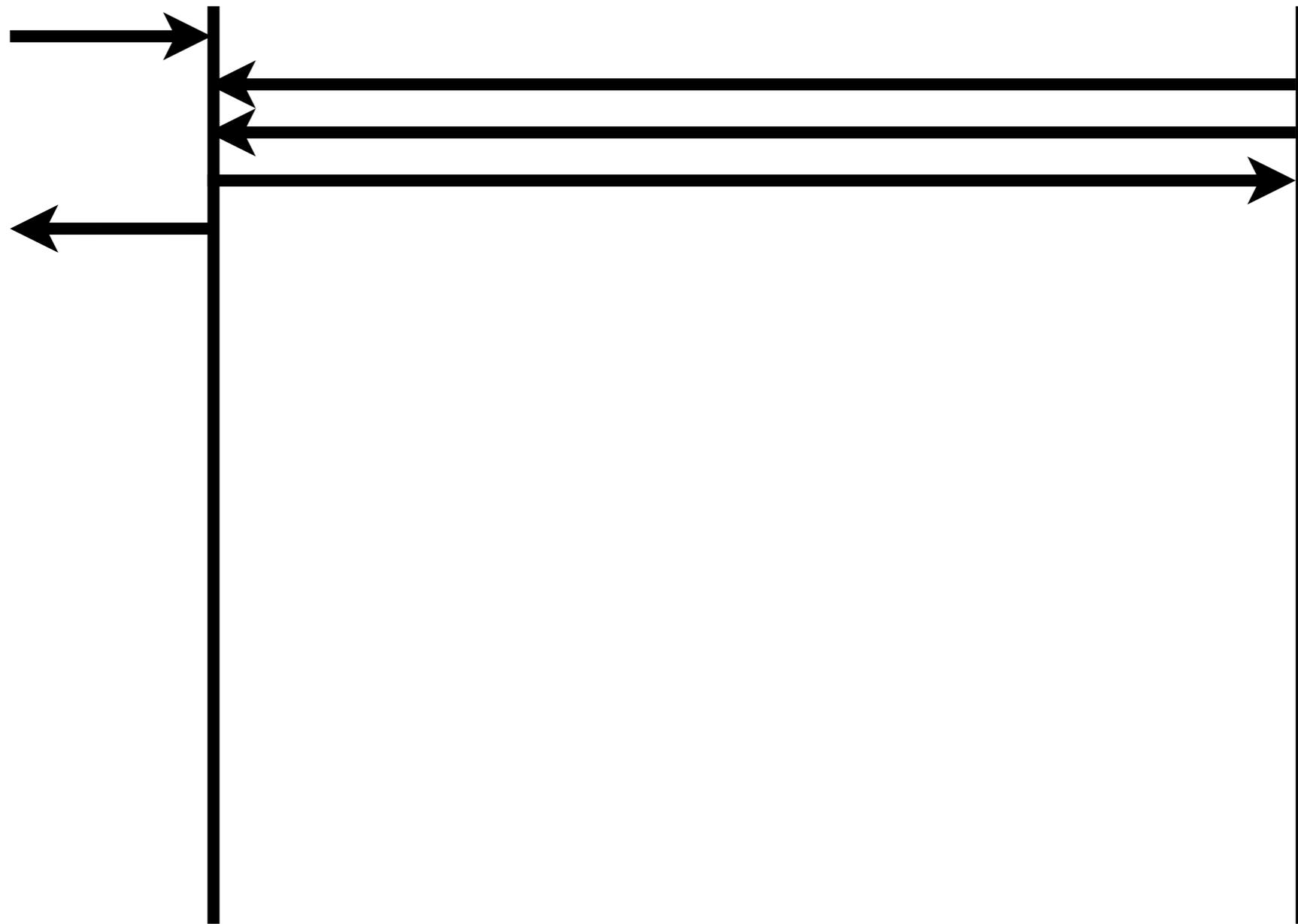
**Server**

**Database**



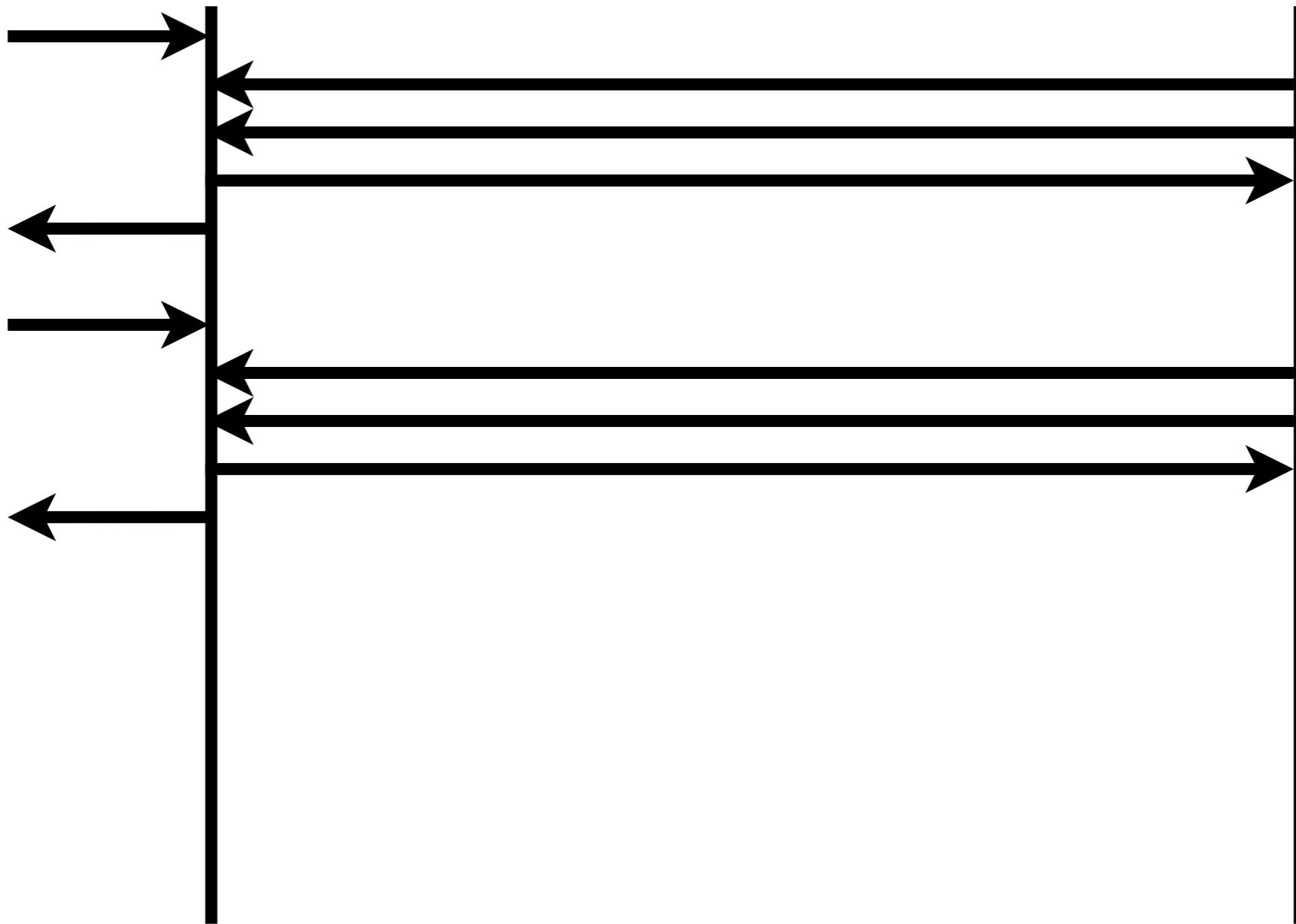
**Server**

**Database**



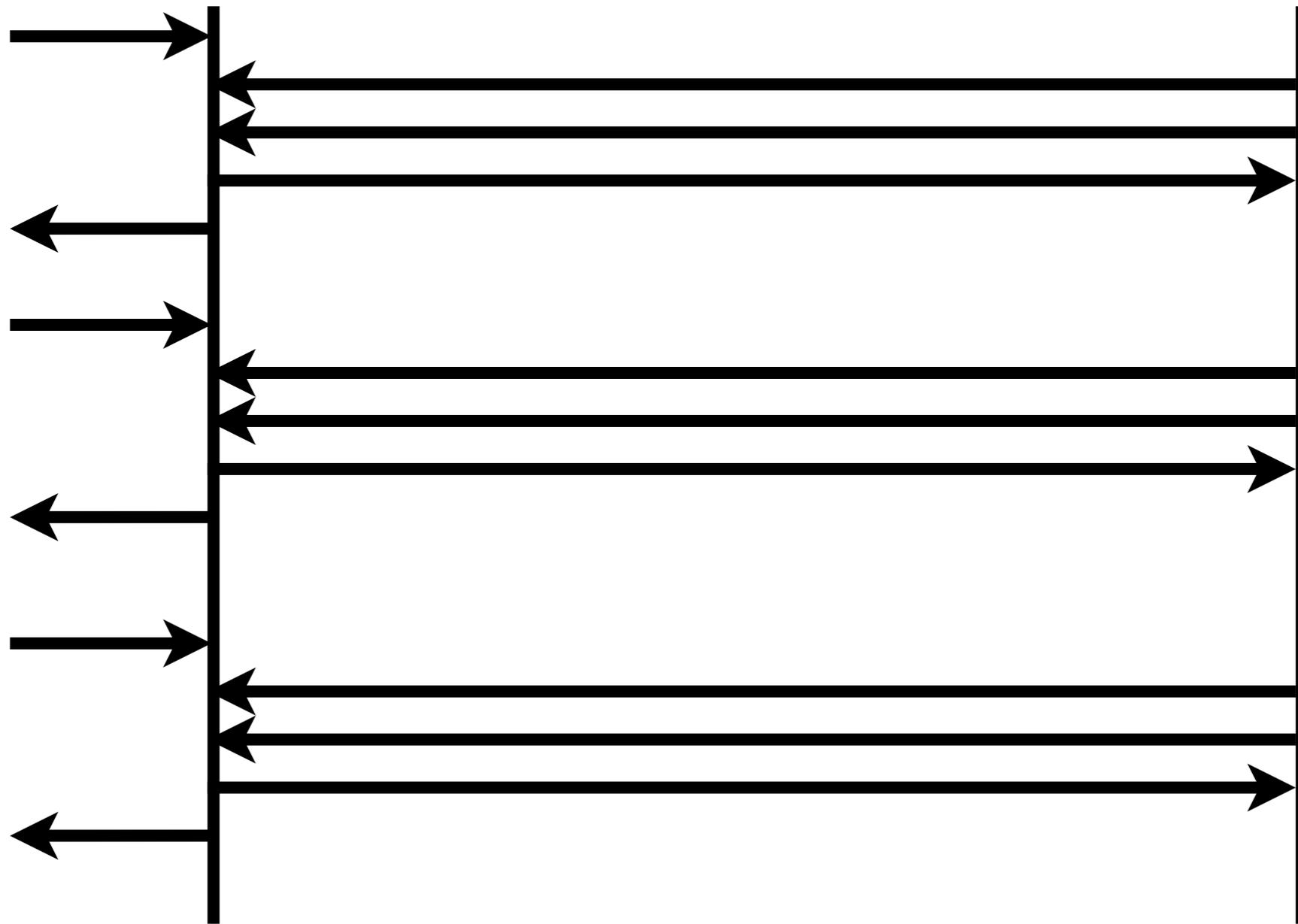
**Server**

**Database**



**Server**

**Database**



**Server**

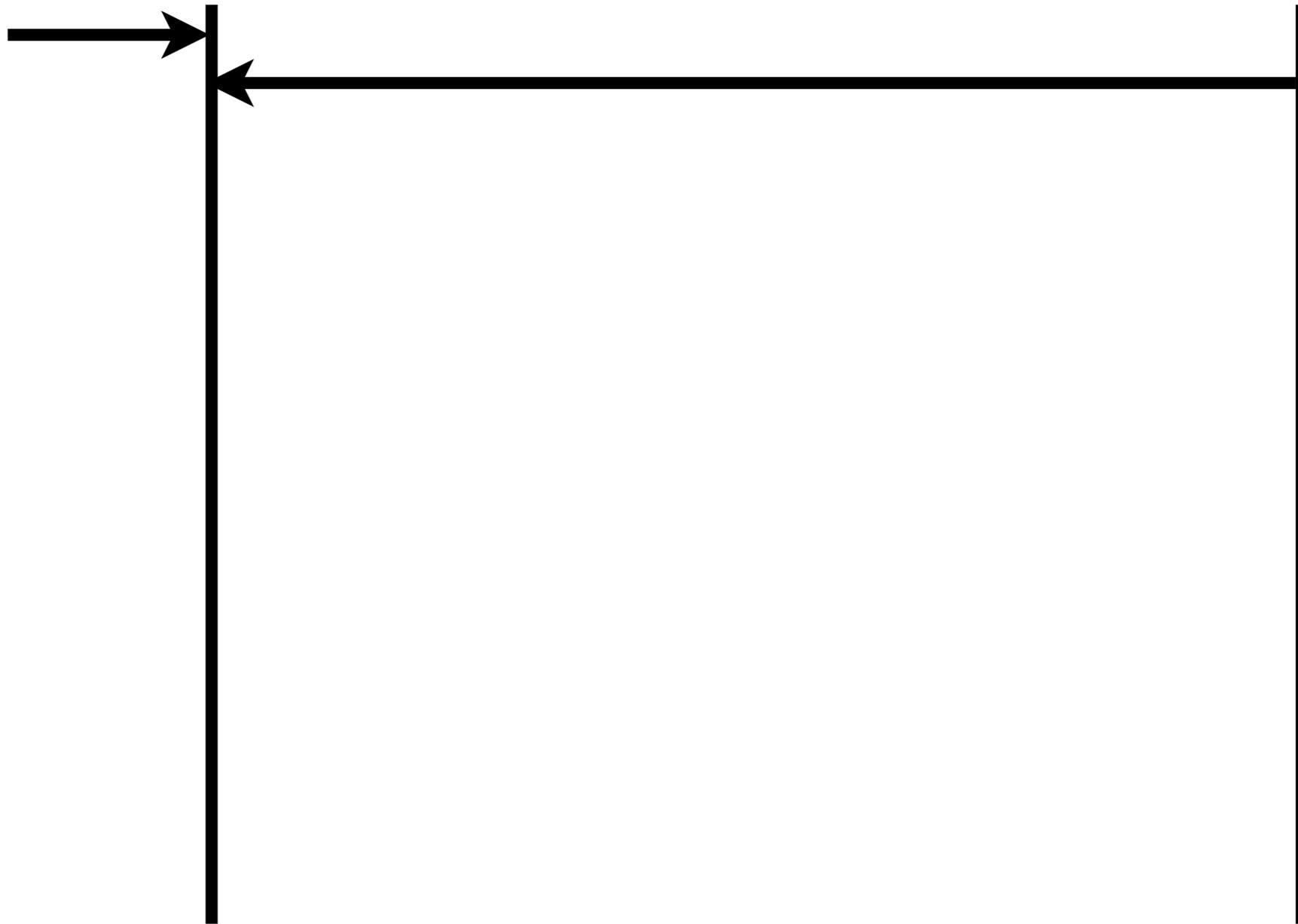


**Database**



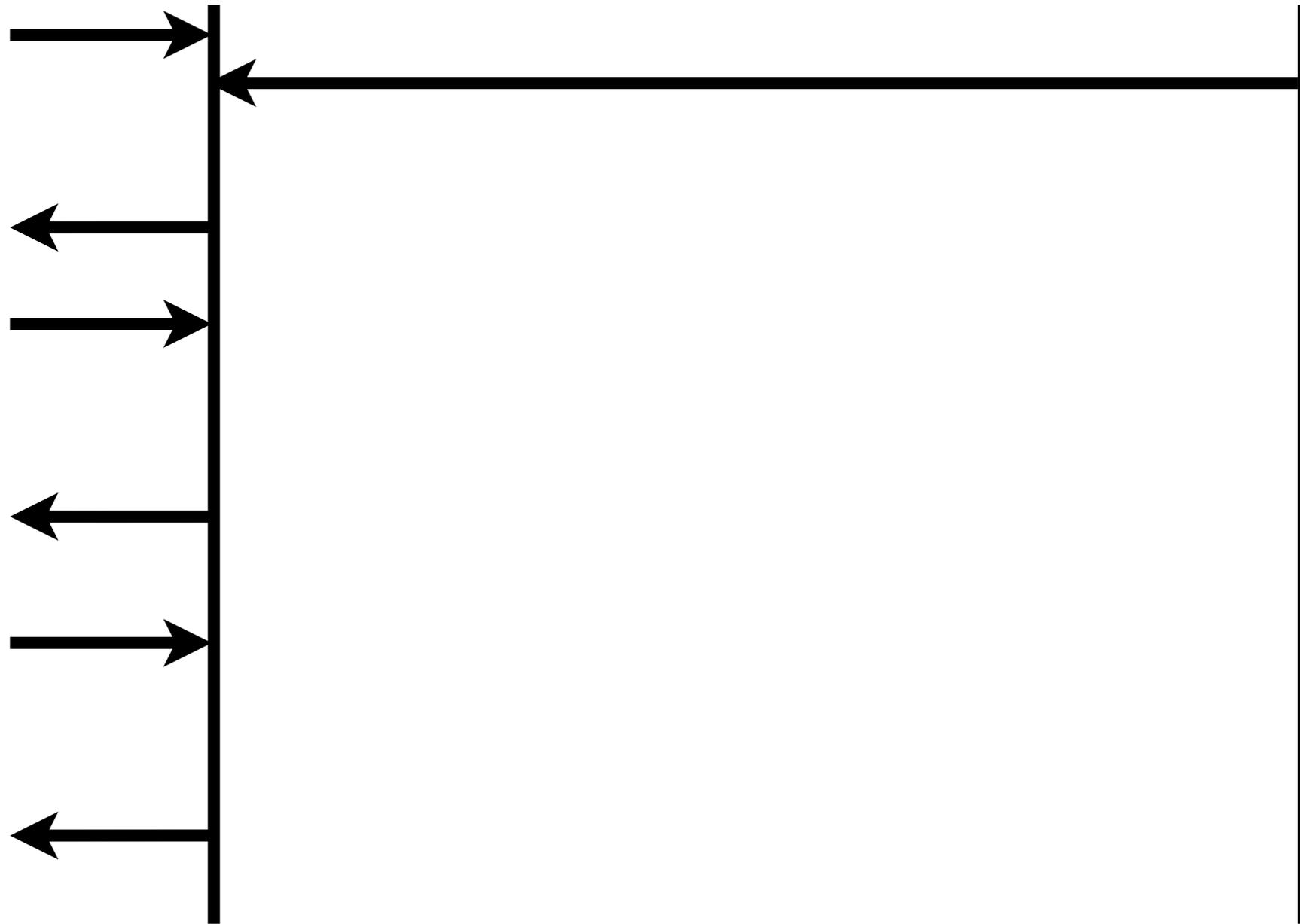
**Server**

**Database**



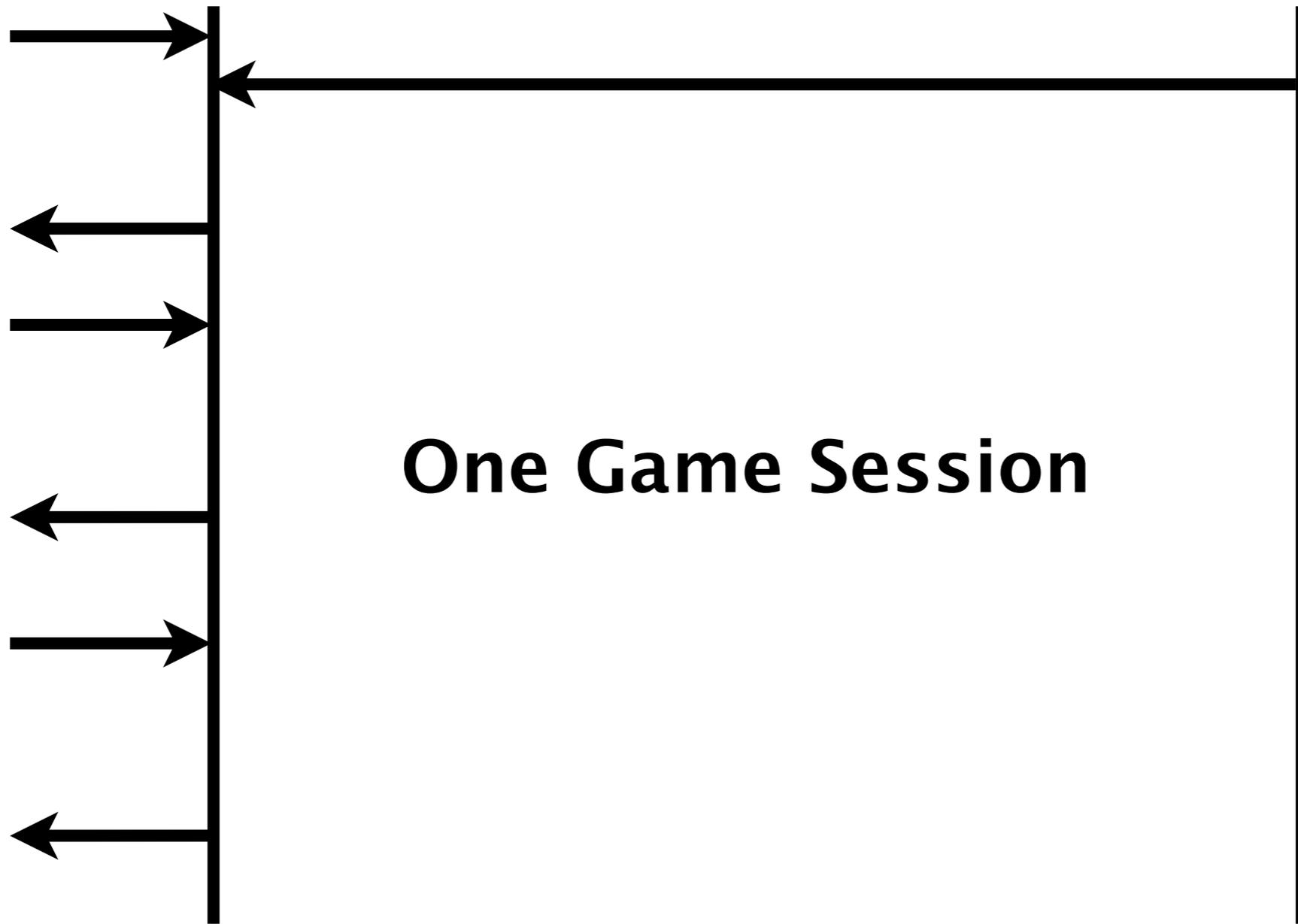
**Server**

**Database**



**Server**

**Database**



**One Game Session**

**Server**

**Database**



**One Game Session**

lb lb lb lb

ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap

SQL  
sql sql sql sql sql  
Rd Rd Rd Rd Rd Rd Rd Rd  
rd rd rd rd rd rd rd rd

lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

Rd  
rd

lb lb lb lb

ap ap ap

Rd  
rd



# 1. Separate user and world DBs

- 1. Separate user and world DBs**
- 2. Migrate to JRuby**

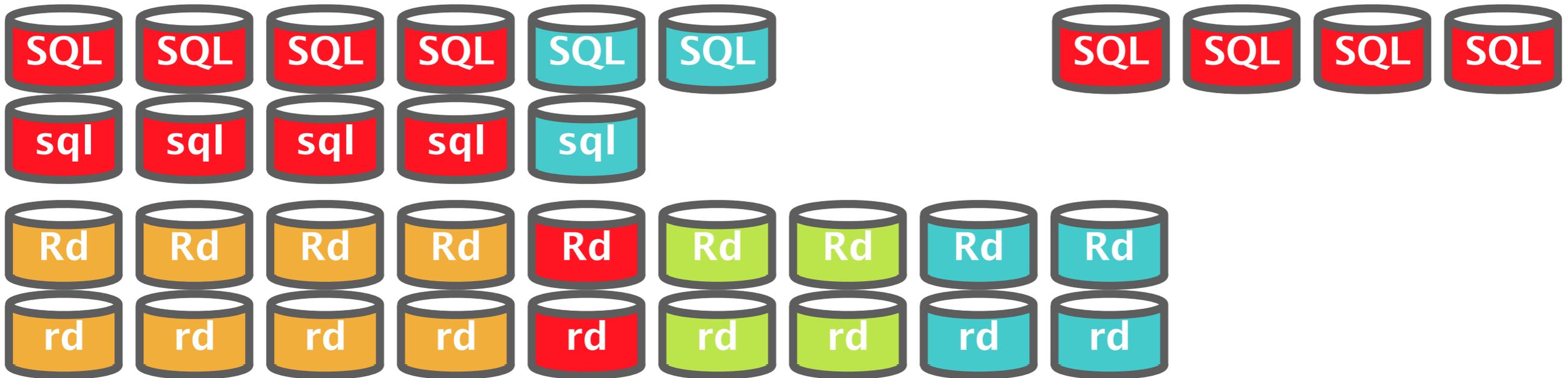
- 1. Separate user and world DBs**
- 2. Migrate to JRuby**
- 3. Introduce life cycle**

- 1. Separate user and world DBs**
- 2. Migrate to JRuby**
- 3. Introduce life cycle**
- 4. Remove (user) DBs**

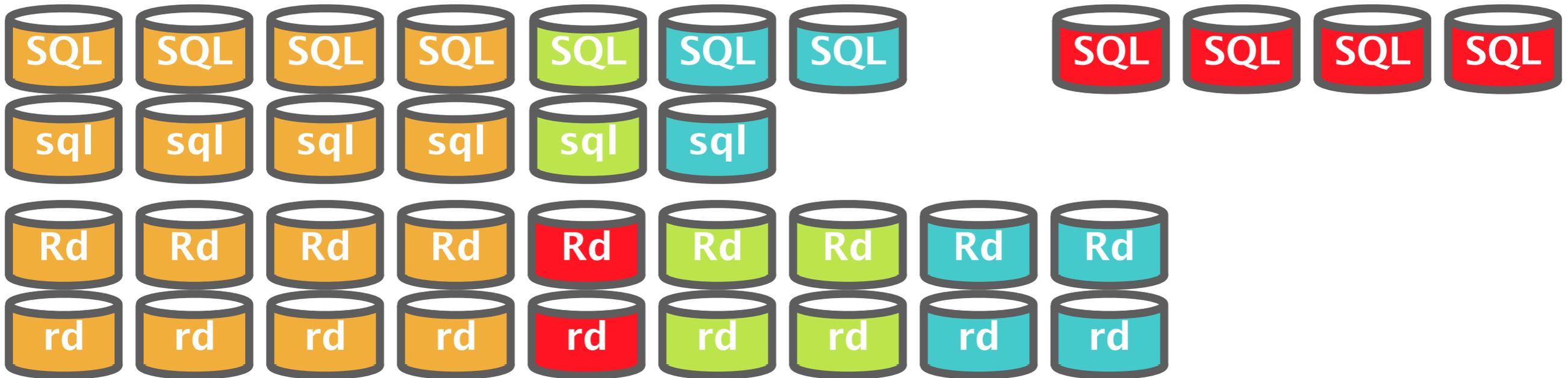
- 1. Separate user and world DBs**
- 2. Migrate to JRuby**
- 3. Introduce life cycle**
- 4. Remove (user) DBs**
- 5. Enjoy!**

# Separate user DBs

lb lb lb lb



lb lb lb lb

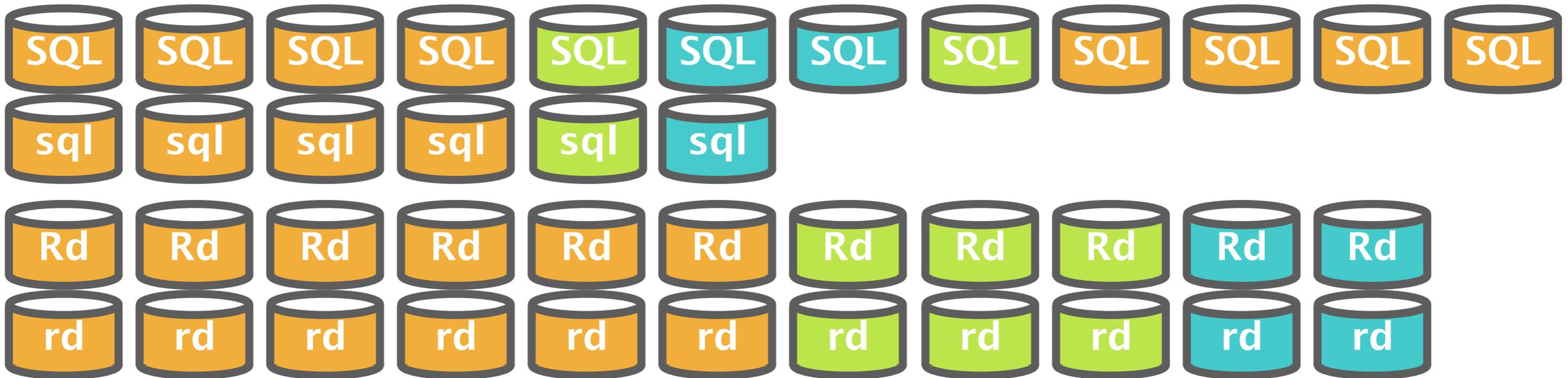


lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

SQL												
sql												
Rd												
rd												

lb lb lb lb



# JRuby

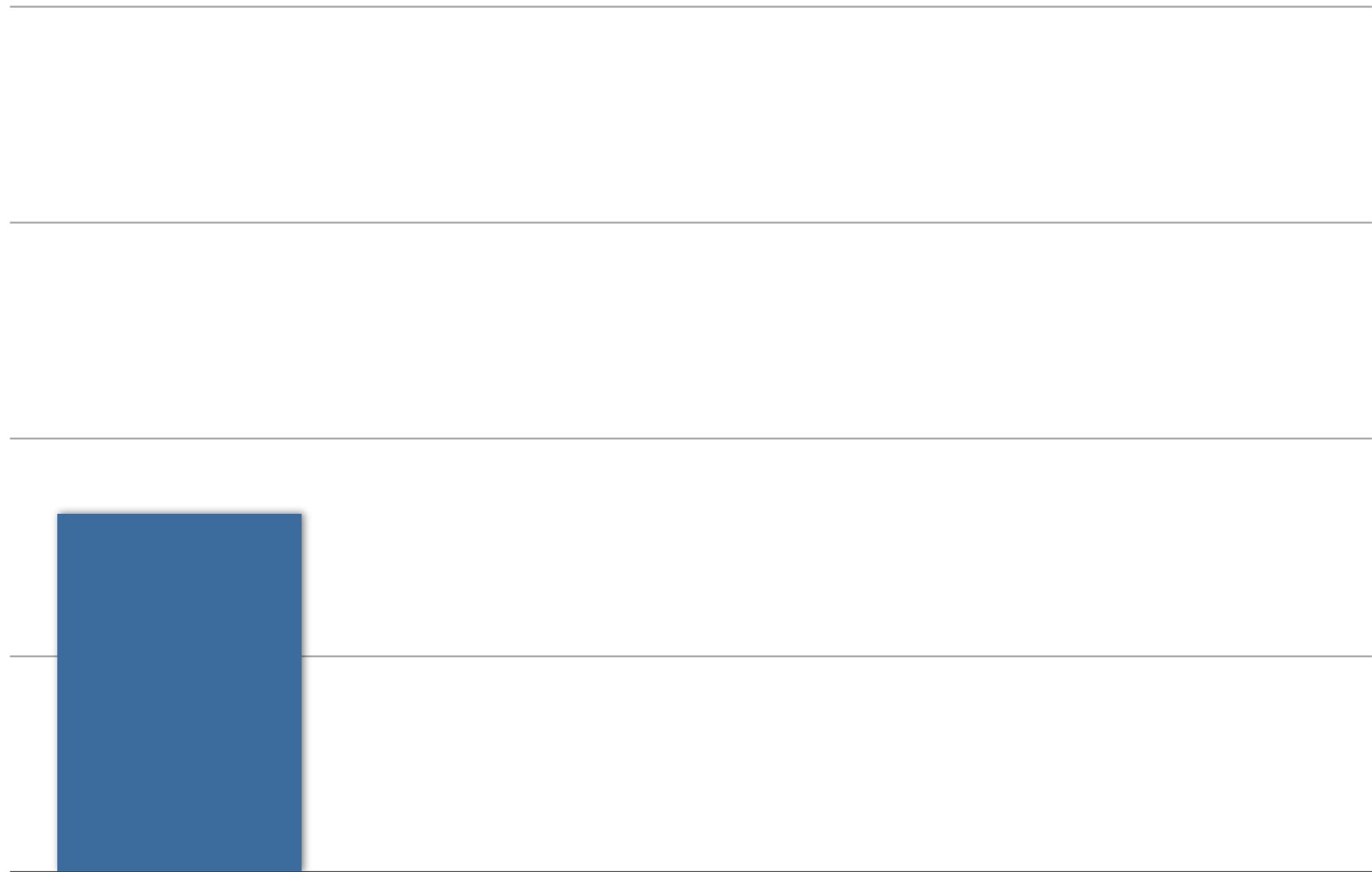


<http://www.flickr.com/photos/biblicone/3425903181/sizes/l/in/photostream/>

Monday, 18 March 13

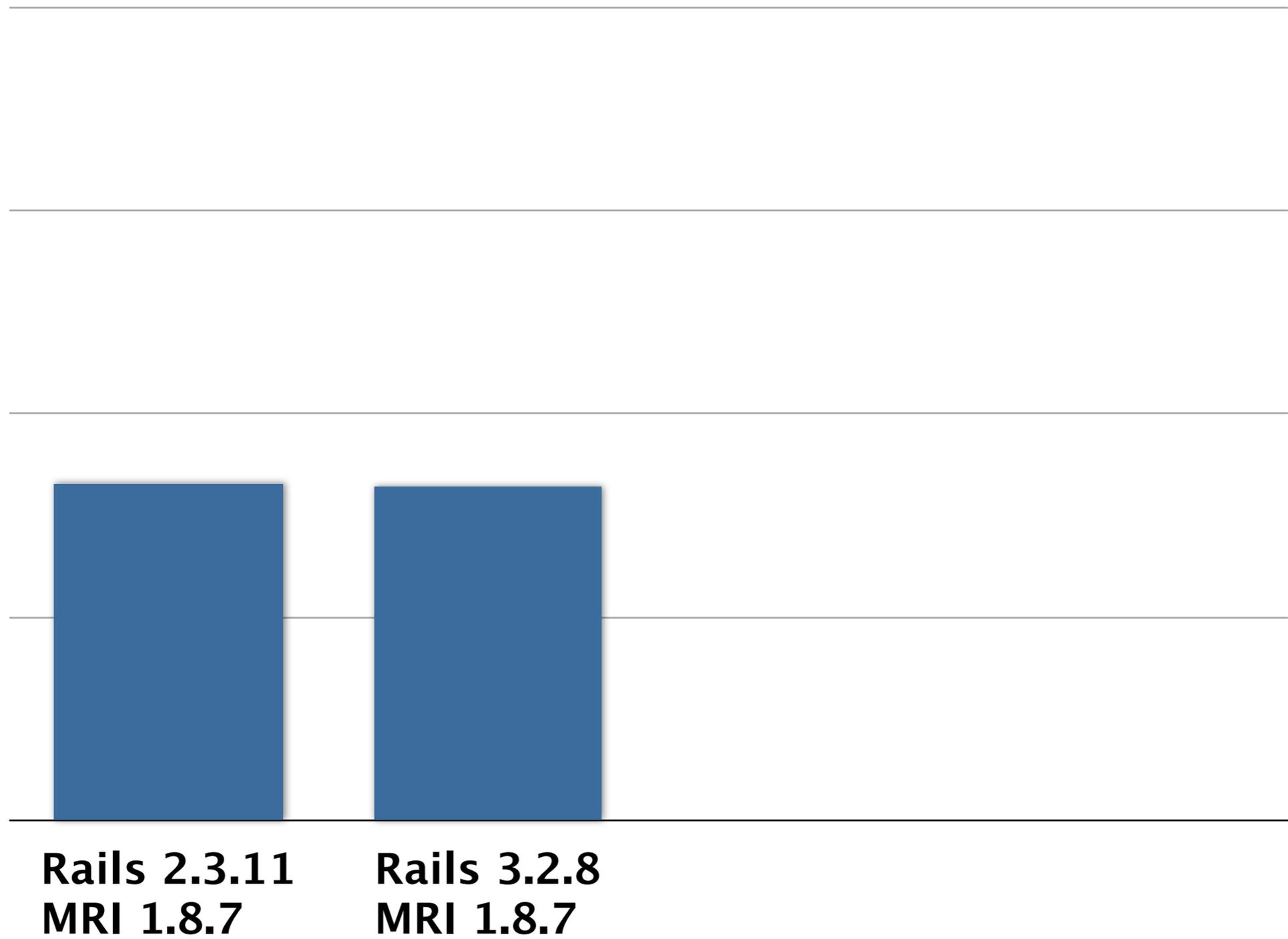
# JRuby v2

# Throughput

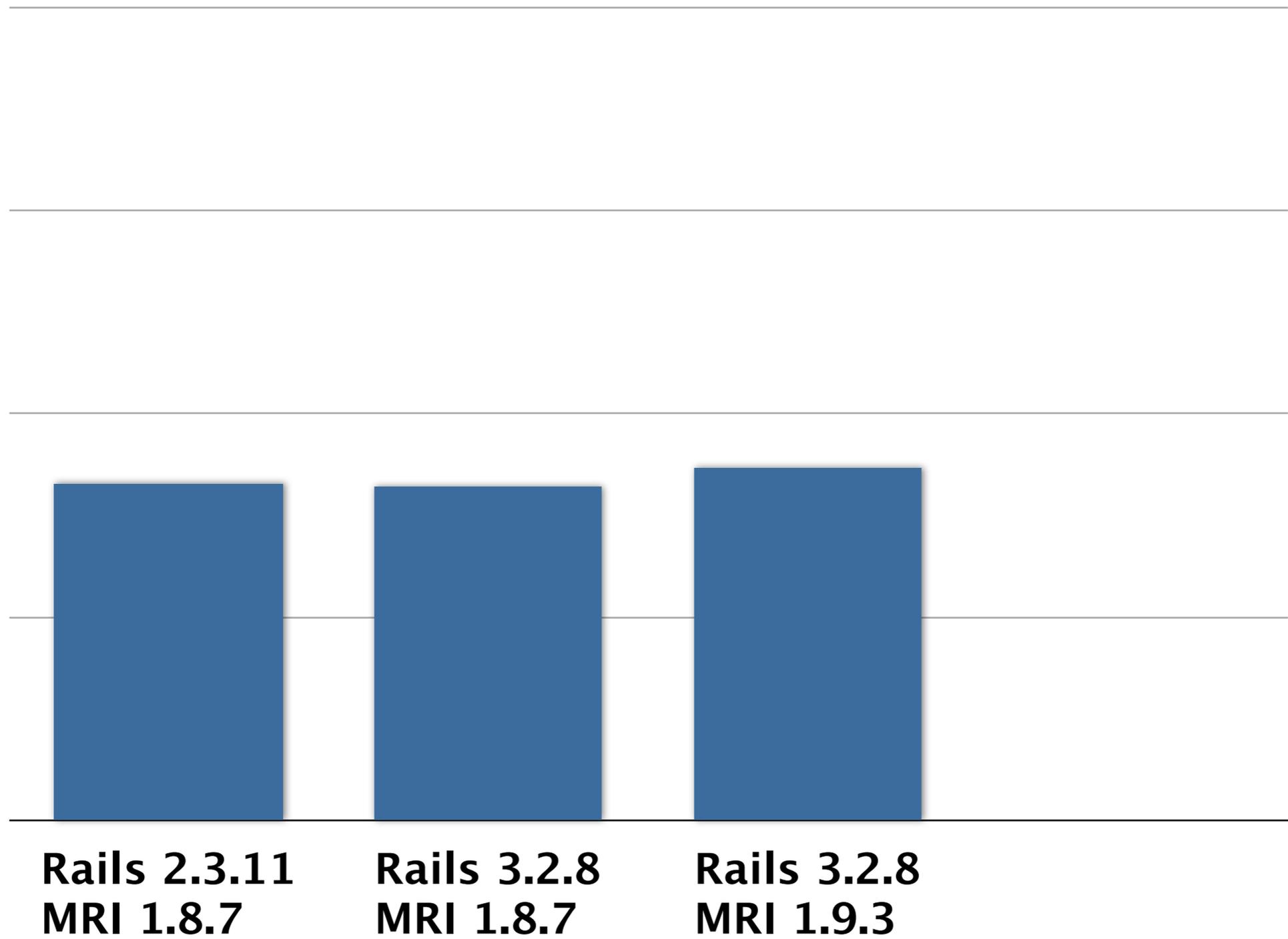


**Rails 2.3.11**  
**MRI 1.8.7**

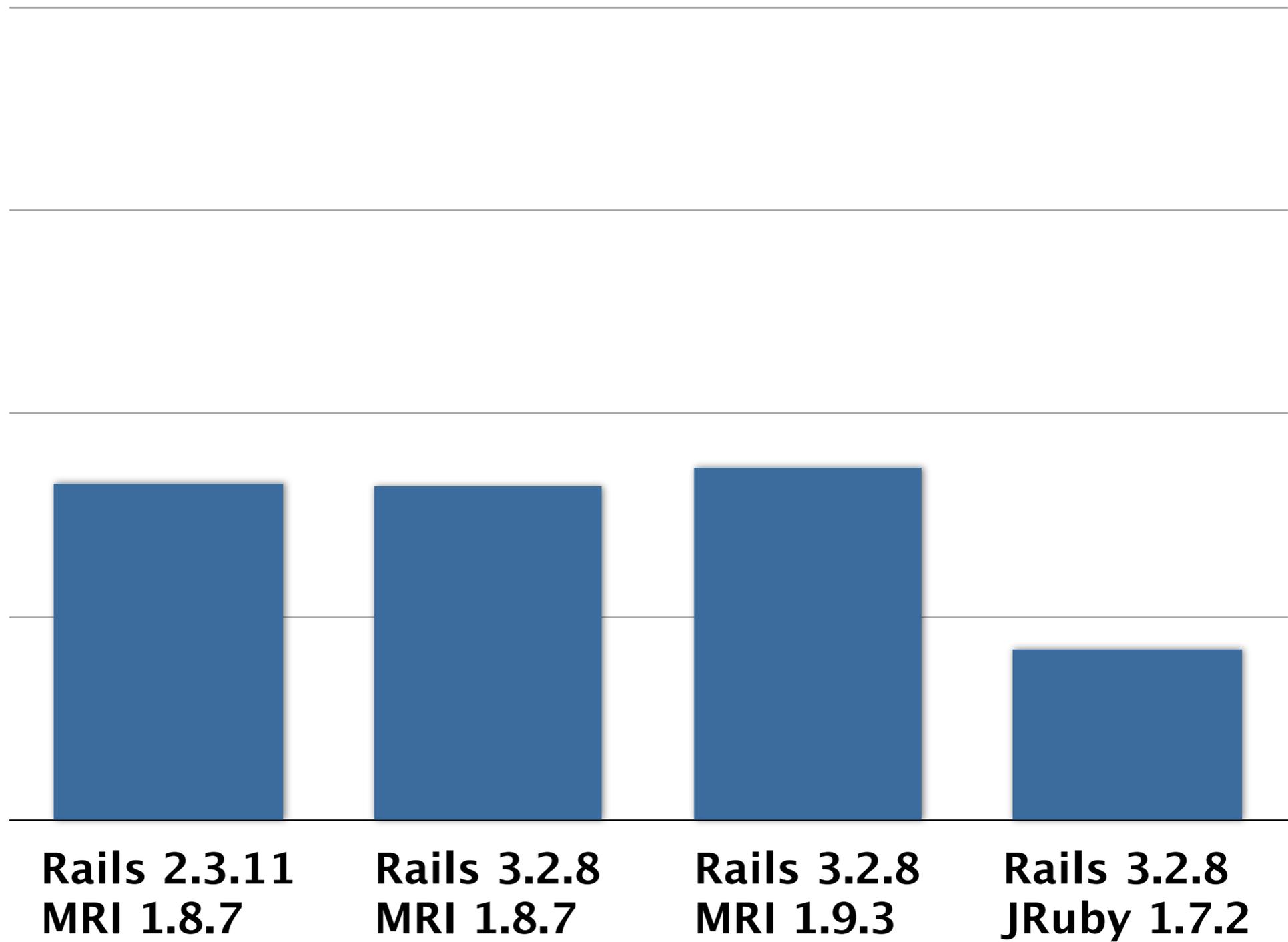
# Throughput



# Throughput

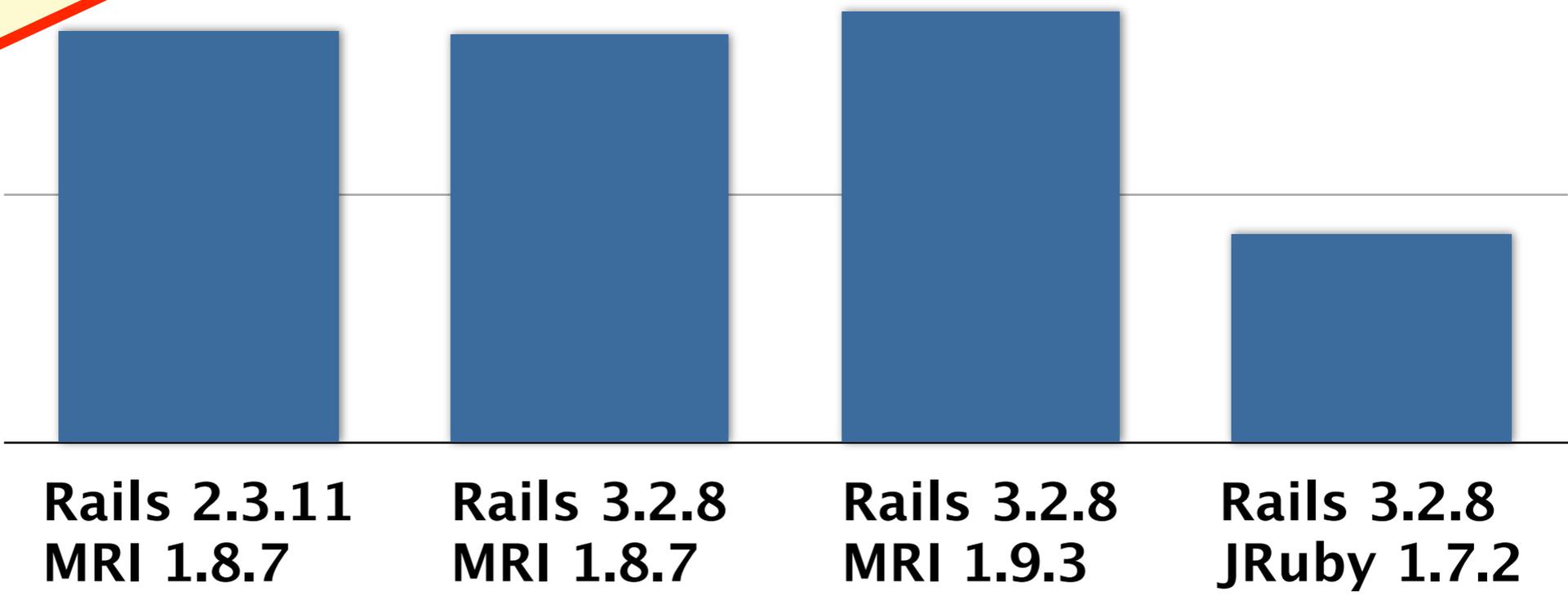


# Throughput



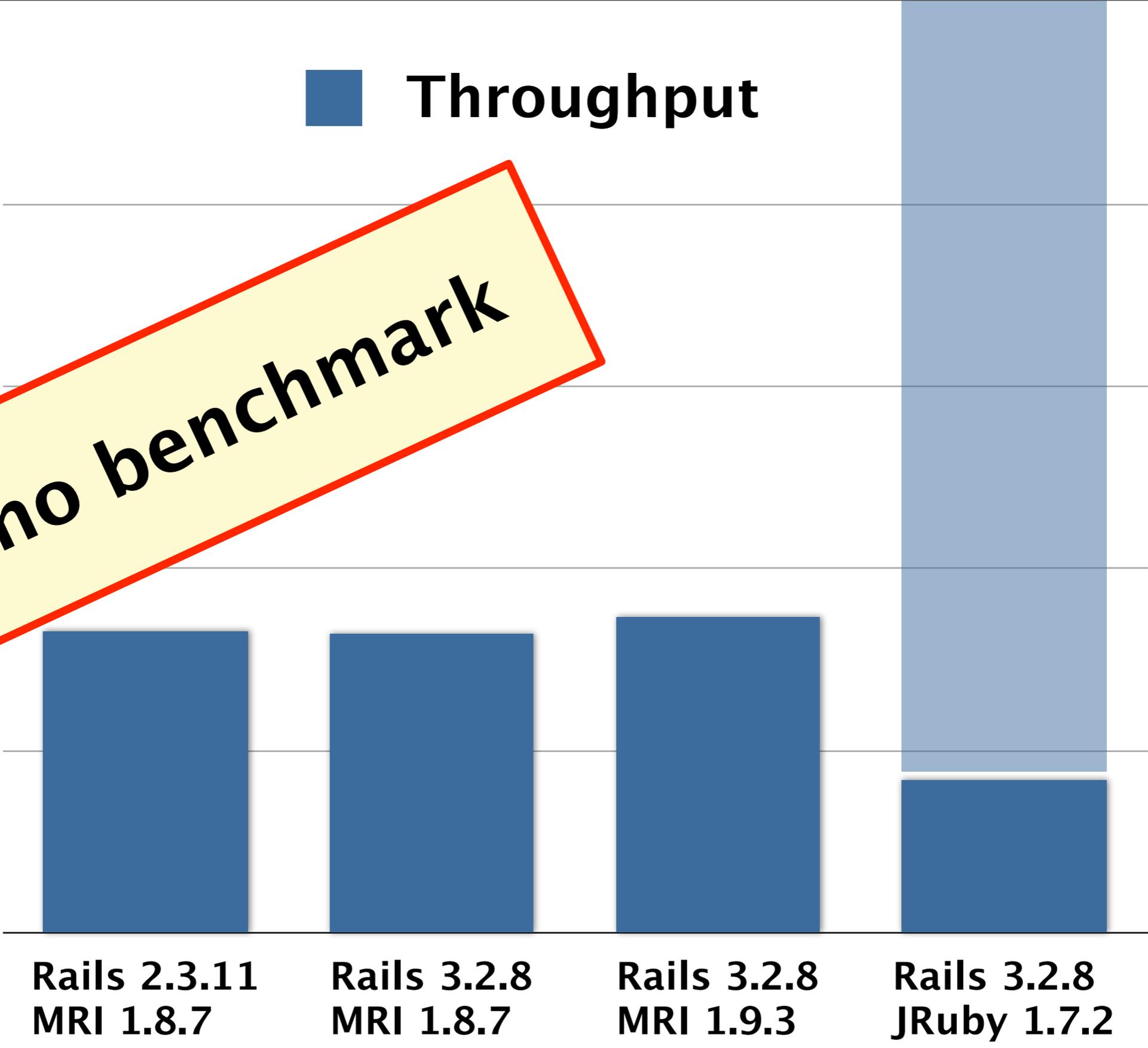
**Throughput**

**no benchmark**



■ **Throughput**

**no benchmark**



**Rails 2.3.11  
MRI 1.8.7**

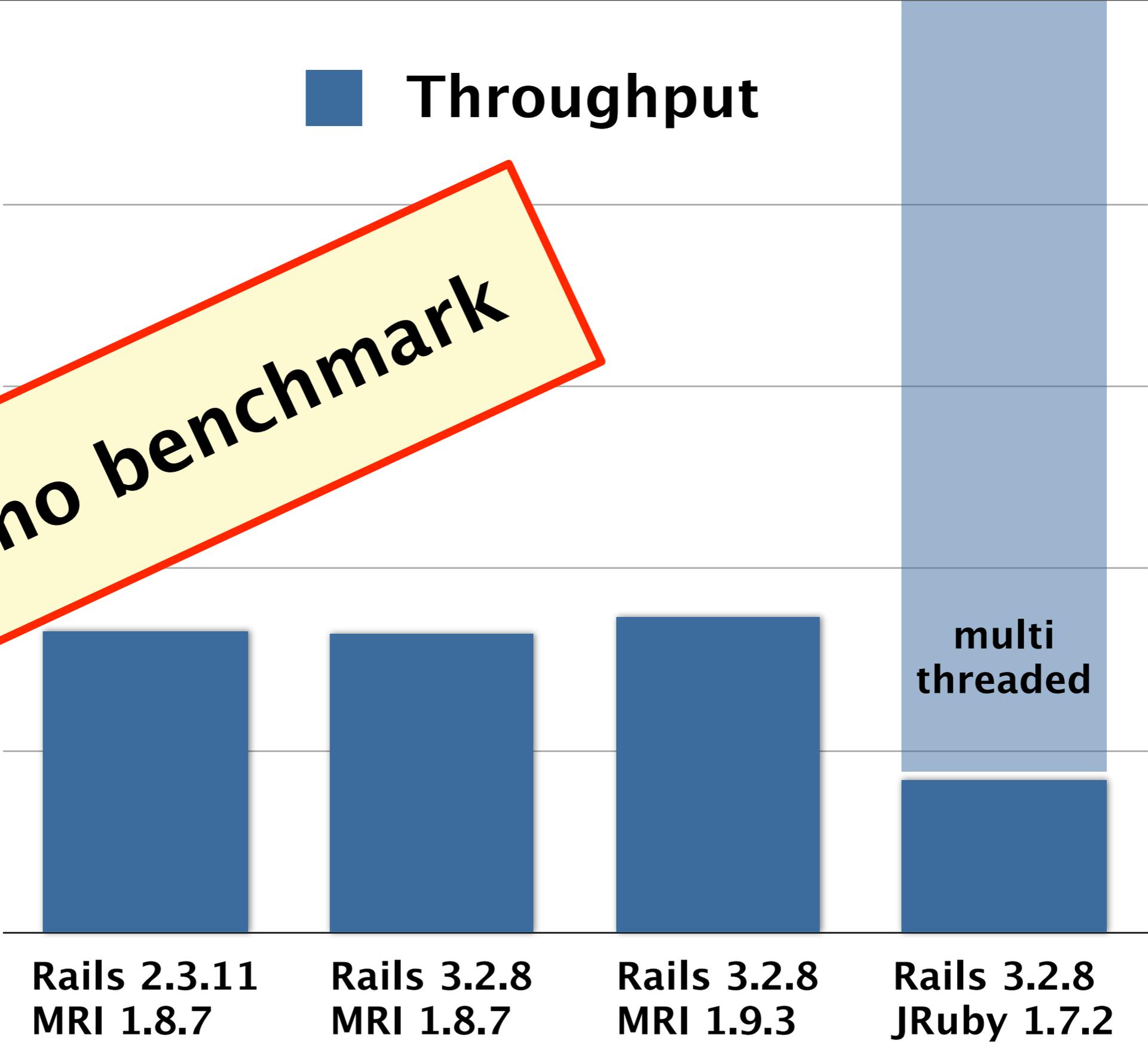
**Rails 3.2.8  
MRI 1.8.7**

**Rails 3.2.8  
MRI 1.9.3**

**Rails 3.2.8  
JRuby 1.7.2**

**Throughput**

**no benchmark**



**Rails 2.3.11  
MRI 1.8.7**

**Rails 3.2.8  
MRI 1.8.7**

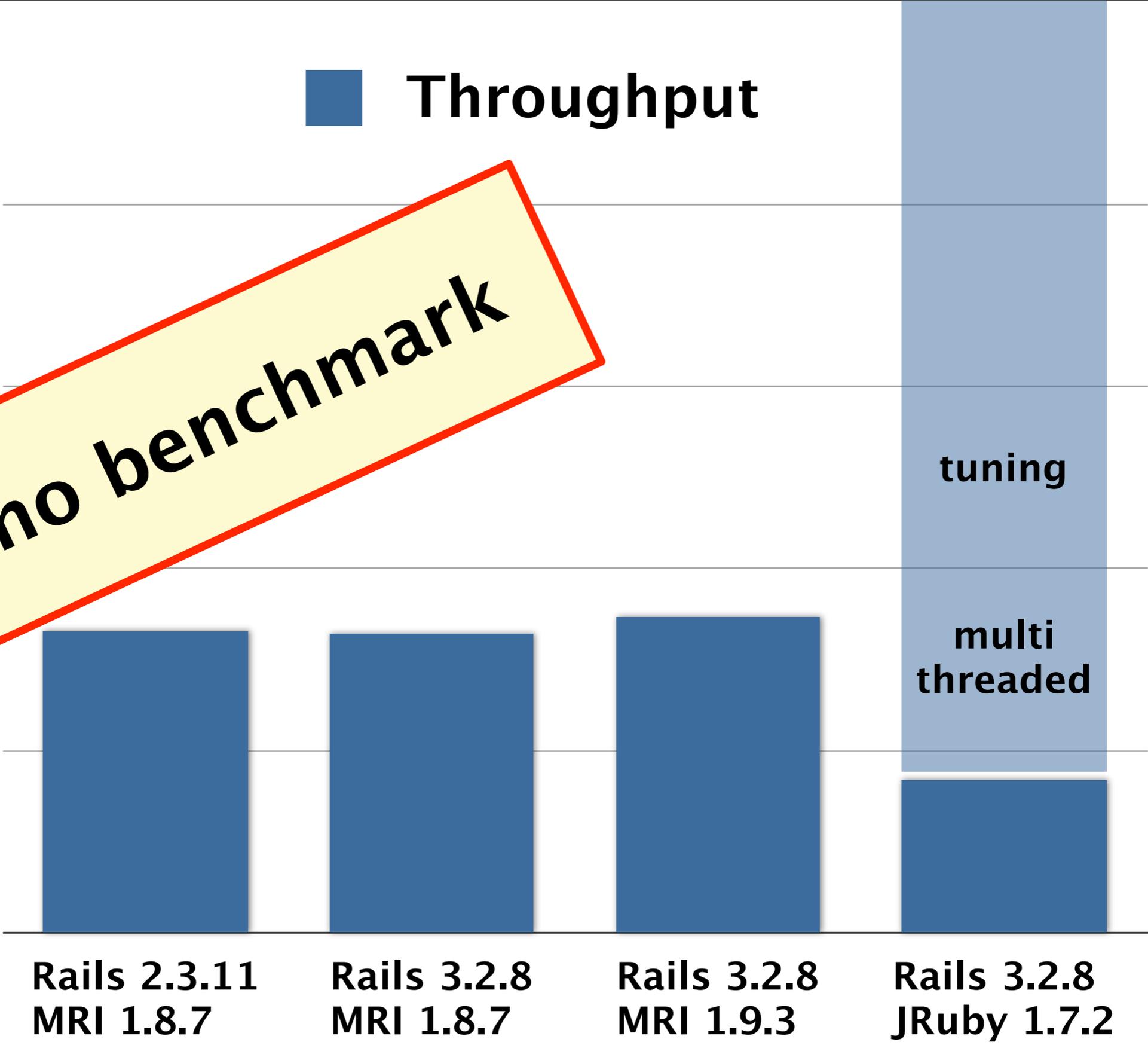
**Rails 3.2.8  
MRI 1.9.3**

**Rails 3.2.8  
JRuby 1.7.2**

**multi threaded**

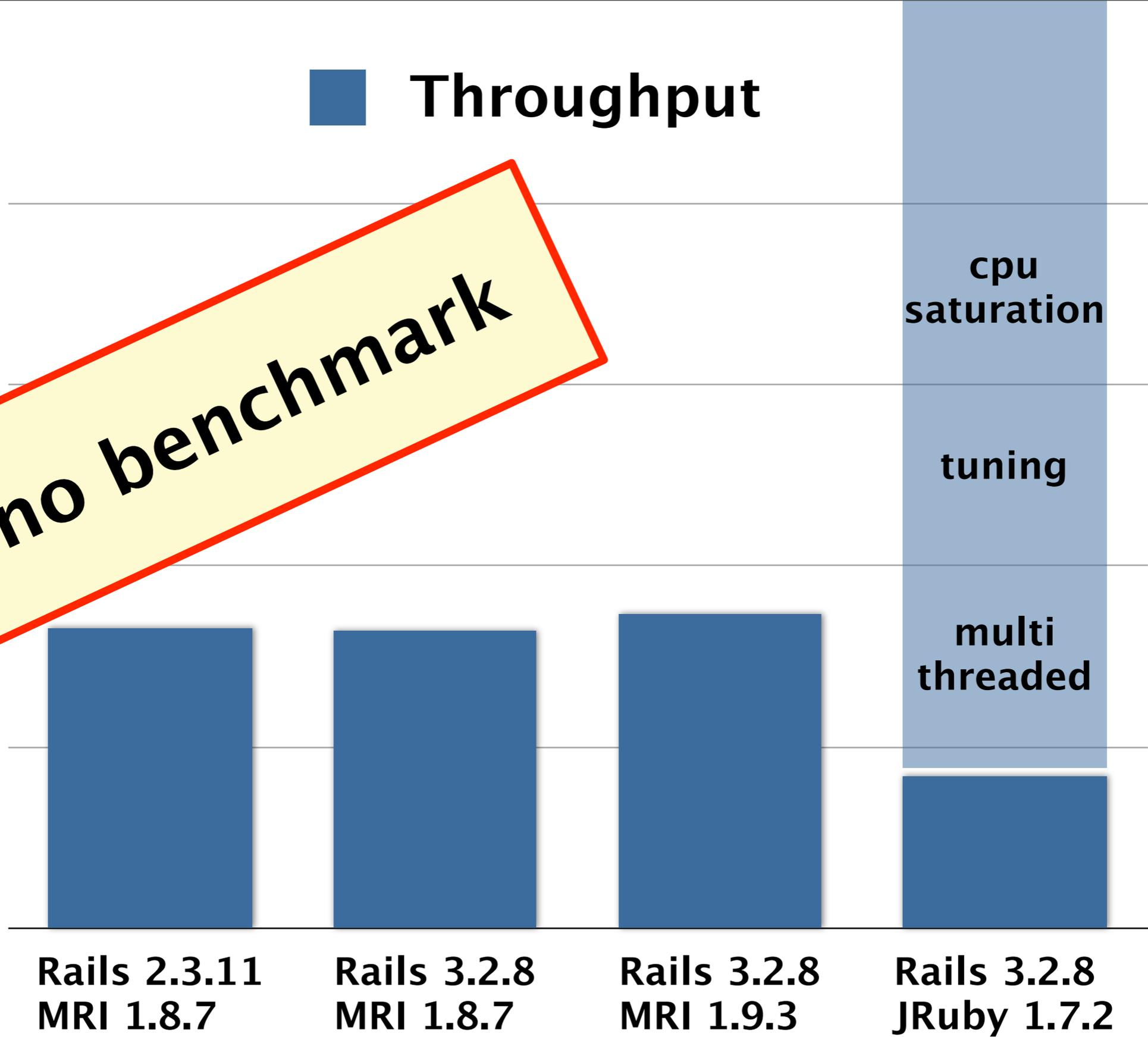
**Throughput**

**no benchmark**



**Throughput**

**no benchmark**

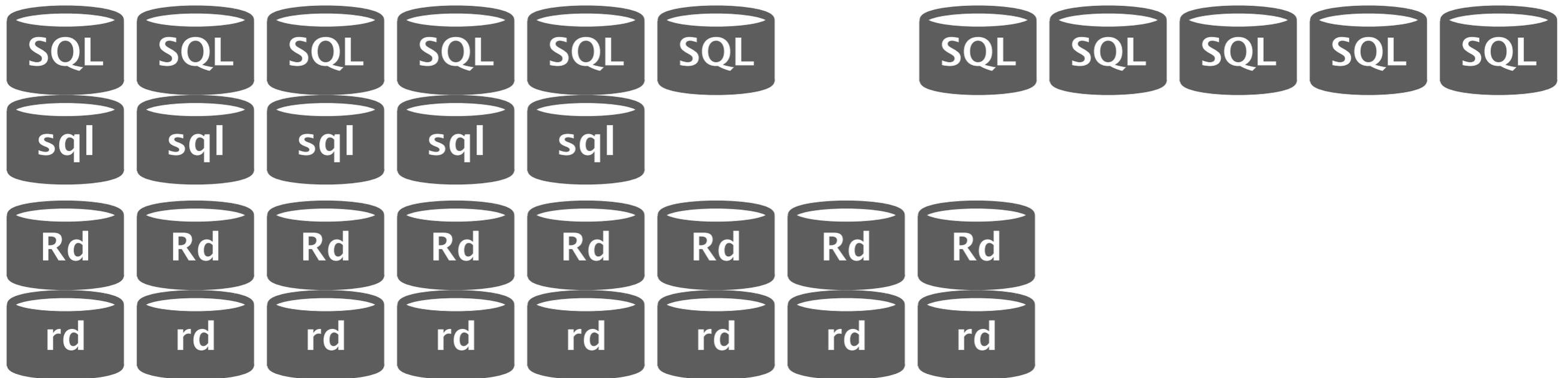


lb lb lb lb

ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap  
ap ap ap ap ap ap ap ap ap ap ap ap ap ap ap

SQL  
sql sql sql sql sql  
Rd Rd Rd Rd Rd Rd Rd Rd  
rd rd rd rd rd rd rd rd

lb lb lb lb



# Faults Reloaded

client\_swf

v1:MonsterBootstrap.swf v2:Bootstrap.swf

action/user	10 Minutes		
v1:MonsterBootstrap.swf v2:Bootstrap.swf	v1	v2	total
<b>user distribution:</b>	<b>9.69% (7265)</b>	<b>90.23% (67619)</b>	<b>100.00% (74939)</b>
<a href="#">client.connection v1 v2</a>	0.87% (63)	0.99% (667)	0.97% (730)
<a href="#">client.timeout v1 v2</a>	0.43% (31)	0.50% (336)	0.49% (367)
<a href="#">plant v1 v2</a>	0.19% (14)	0.22% (148)	0.22% (162)
<a href="#">gift_at_friend v1 v2</a>	0.03% (2)	0.22% (150)	0.20% (152)
<a href="#">feed_at_friend v1 v2</a>	0.03% (2)	0.10% (69)	0.09% (71)
<a href="#">harvest v1 v2</a>	0.10% (7)	0.11% (71)	0.10% (78)
<a href="#">client.LoadSingleConfigurationCommand v1 v2</a>		0.10% (69)	0.09% (69)
<a href="#">mission_accomplished v1 v2</a>	0.26% (19)	0.11% (73)	0.12% (92)
<a href="#">add v1 v2</a>	0.39% (28)	0.03% (18)	0.06% (46)
<a href="#">accepted v1 v2</a>	0.06% (4)	0.05% (36)	0.05% (40)
<a href="#">ready v1 v2</a>	0.08% (6)	0.07% (48)	0.07% (54)
<a href="#">update v1 v2</a>	0.03% (2)	0.05% (36)	0.05% (38)
<a href="#">client.SetupRequestCommand v1 v2</a>		0.10% (66)	0.09% (66)
<a href="#">move v1 v2</a>	0.15% (11)	0.05% (31)	0.06% (42)
<a href="#">trade v1 v2</a>		0.01% (10)	0.01% (10)
<a href="#">visit v1 v2</a>	0.03% (2)	0.07% (44)	0.06% (46)
<a href="#">buy v1 v2</a>	0.08% (6)	0.01% (10)	0.02% (16)
<a href="#">client.Bootstrap v1 v2</a>		0.02% (13)	0.02% (13)
<a href="#">craft v1 v2</a>	0.03% (2)	0.04% (24)	0.03% (26)
<a href="#">place v1 v2</a>	0.01% (1)	0.01% (9)	0.01% (10)
<a href="#">buy_to_garden v1 v2</a>	0.06% (4)	0.01% (6)	0.01% (10)
<a href="#">feed v1 v2</a>	0.01% (1)	0.02% (12)	0.02% (13)
<a href="#">get_dry v1 v2</a>	0.03% (2)	0.03% (20)	0.03% (22)
<a href="#">sell v1 v2</a>	0.03% (2)	0.01% (9)	0.01% (11)
<a href="#">set_level v1 v2</a>	0.04% (3)	0.02% (13)	0.02% (16)
<a href="#">unlock_product v1 v2</a>	0.26% (19)		0.03% (19)
<a href="#">client.LoadFeatureDependentModuleCommand v1 v2</a>	0.01% (1)		0.00% (1)
<a href="#">eat v1 v2</a>	0.01% (1)	0.02% (12)	0.02% (13)
<a href="#">fertilize_at_friend v1 v2</a>		0.03% (20)	0.03% (20)
<a href="#">finish_factory v1 v2</a>	0.03% (2)		0.00% (2)
<a href="#">water v1 v2</a>	0.03% (2)	0.02% (12)	0.02% (14)
<a href="#">accept v1 v2</a>	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

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<a href="#">client.connection v1 v2</a>	0.87% (63)	0.99% (667)	0.97% (730)
<a href="#">client.timeout v1 v2</a>	0.43% (31)	0.50% (336)	0.49% (367)
<a href="#">plant v1 v2</a>	0.19% (14)	0.22% (148)	0.22% (162)
<a href="#">gift_at_friend v1 v2</a>	0.03% (2)	0.22% (150)	0.20% (152)
<a href="#">feed_at_friend v1 v2</a>	0.03% (2)	0.10% (69)	0.09% (71)
<a href="#">harvest v1 v2</a>	0.10% (7)	0.11% (71)	0.10% (78)
<a href="#">client.LoadSingleConfigurationCommand v1 v2</a>		0.10% (69)	0.09% (69)
<a href="#">mission_accomplished v1 v2</a>	0.26% (19)	0.11% (73)	0.12% (92)
<a href="#">add v1 v2</a>	0.39% (28)	0.03% (18)	0.06% (46)
<a href="#">accepted v1 v2</a>	0.06% (4)	0.05% (36)	0.05% (40)
<a href="#">ready v1 v2</a>	0.08% (6)	0.07% (48)	0.07% (54)
<a href="#">update v1 v2</a>	0.03% (2)	0.05% (36)	0.05% (38)
<a href="#">client.SetupRequestCommand v1 v2</a>		0.10% (66)	0.09% (66)
<a href="#">move v1 v2</a>	0.15% (11)	0.05% (31)	0.06% (42)
<a href="#">trade v1 v2</a>		0.01% (10)	0.01% (10)
<a href="#">visit v1 v2</a>	0.03% (2)	0.07% (44)	0.06% (46)
<a href="#">buy v1 v2</a>	0.08% (6)	0.01% (10)	0.02% (16)
<a href="#">client.Bootstrap v1 v2</a>		0.02% (13)	0.02% (13)
<a href="#">craft v1 v2</a>	0.03% (2)	0.04% (24)	0.03% (26)
<a href="#">place v1 v2</a>	0.01% (1)	0.01% (9)	0.01% (10)
<a href="#">buy_to_garden v1 v2</a>	0.06% (4)	0.01% (6)	0.01% (10)
<a href="#">feed v1 v2</a>	0.01% (1)	0.02% (12)	0.02% (13)
<a href="#">get_dry v1 v2</a>	0.03% (2)	0.03% (20)	0.03% (22)
<a href="#">sell v1 v2</a>	0.03% (2)	0.01% (9)	0.01% (11)
<a href="#">set_level v1 v2</a>	0.04% (3)	0.02% (13)	0.02% (16)
<a href="#">unlock_product v1 v2</a>	0.26% (19)		0.03% (19)
<a href="#">client.LoadFeatureDependentModuleCommand v1 v2</a>	0.01% (1)		0.00% (1)
<a href="#">eat v1 v2</a>	0.01% (1)	0.02% (12)	0.02% (13)
<a href="#">fertilize_at_friend v1 v2</a>		0.03% (20)	0.03% (20)
<a href="#">finish_factory v1 v2</a>	0.03% (2)		0.00% (2)
<a href="#">water v1 v2</a>	0.03% (2)	0.02% (12)	0.02% (14)
<a href="#">accept v1 v2</a>	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

client\_swf

v1:MonsterBootstrap.swf v2:Bootstrap.swf

10 Minutes ↻			
action/user	v1	v2	total
v1:MonsterBootstrap.swf v2:Bootstrap			
user distribution:	<b>9.69%</b>	<b>90.23%</b>	<b>100.00%</b>
	<b>(7265)</b>	<b>(67619)</b>	<b>(74939)</b>
client.connection v1 v2			
client.timeout v1 v2	0.43% (31)	0.50% (336)	0.49% (367)
plant v1 v2	0.19% (14)	0.22% (148)	0.22% (162)
gift_at_friend v1 v2	0.03% (2)	0.22% (150)	0.20% (152)
feed_at_friend v1 v2	0.03% (2)	0.10% (69)	0.09% (71)
harvest v1 v2	0.10% (7)	0.11% (71)	0.10% (78)
client.LoadSingleConfigurationCommand v1 v2		0.10% (69)	0.09% (69)
mission_accomplished v1 v2	0.26% (19)	0.11% (73)	0.12% (92)
add v1 v2	0.39% (28)	0.03% (18)	0.06% (46)
accepted v1 v2	0.06% (4)	0.05% (36)	0.05% (40)
ready v1 v2	0.08% (6)	0.07% (48)	0.07% (54)
update v1 v2	0.03% (2)	0.05% (36)	0.05% (38)
client.SetupRequestCommand v1 v2		0.10% (66)	0.09% (66)
move v1 v2	0.15% (11)	0.05% (31)	0.06% (42)
trade v1 v2		0.01% (10)	0.01% (10)
visit v1 v2	0.03% (2)	0.07% (44)	0.06% (46)
buy v1 v2	0.08% (6)	0.01% (10)	0.02% (16)
client.Bootstrap v1 v2		0.02% (13)	0.02% (13)
craft v1 v2	0.03% (2)	0.04% (24)	0.03% (26)
place v1 v2	0.01% (1)	0.01% (9)	0.01% (10)
buy_to_garden v1 v2	0.06% (4)	0.01% (6)	0.01% (10)
feed v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
get_dry v1 v2	0.03% (2)	0.03% (20)	0.03% (22)
sell v1 v2	0.03% (2)	0.01% (9)	0.01% (11)
set_level v1 v2	0.04% (3)	0.02% (13)	0.02% (16)
unlock_product v1 v2	0.26% (19)		0.03% (19)
client.LoadFeatureDependentModuleCommand v1 v2	0.01% (1)		0.00% (1)
eat v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
fertilize_at_friend v1 v2		0.03% (20)	0.03% (20)
finish_factory v1 v2	0.03% (2)		0.00% (2)
water v1 v2	0.03% (2)	0.02% (12)	0.02% (14)
accept v1 v2	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

client\_swf

v1:MonsterBootstrap.swf v2:Bootstrap.swf

action/user	10 Minutes ↻		
	NEW	OLD	total
<b>v1:MonsterBootstrap.swf v2:Bootstrap</b>	<b>9.69%</b>	<b>90.23%</b>	<b>100.00%</b>
<b>user distribution:</b>	<b>(7265)</b>	<b>(67619)</b>	<b>(74939)</b>
client.connection v1 v2			
client.timeout v1 v2	0.43% (31)	0.50% (336)	0.49% (367)
plant v1 v2	0.19% (14)	0.22% (148)	0.22% (162)
gift_at_friend v1 v2	0.03% (2)	0.22% (150)	0.20% (152)
feed_at_friend v1 v2	0.03% (2)	0.10% (69)	0.09% (71)
harvest v1 v2	0.10% (7)	0.11% (71)	0.10% (78)
client.LoadSingleConfigurationCommand v1 v2		0.10% (69)	0.09% (69)
mission_accomplished v1 v2	0.26% (19)	0.11% (73)	0.12% (92)
add v1 v2	0.39% (28)	0.03% (18)	0.06% (46)
accepted v1 v2	0.06% (4)	0.05% (36)	0.05% (40)
ready v1 v2	0.08% (6)	0.07% (48)	0.07% (54)
update v1 v2	0.03% (2)	0.05% (36)	0.05% (38)
client.SetupRequestCommand v1 v2		0.10% (66)	0.09% (66)
move v1 v2	0.15% (11)	0.05% (31)	0.06% (42)
trade v1 v2		0.01% (10)	0.01% (10)
visit v1 v2	0.03% (2)	0.07% (44)	0.06% (46)
buy v1 v2	0.08% (6)	0.01% (10)	0.02% (16)
client.Bootstrap v1 v2		0.02% (13)	0.02% (13)
craft v1 v2	0.03% (2)	0.04% (24)	0.03% (26)
place v1 v2	0.01% (1)	0.01% (9)	0.01% (10)
buy_to_garden v1 v2	0.06% (4)	0.01% (6)	0.01% (10)
feed v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
get_dry v1 v2	0.03% (2)	0.03% (20)	0.03% (22)
sell v1 v2	0.03% (2)	0.01% (9)	0.01% (11)
set_level v1 v2	0.04% (3)	0.02% (13)	0.02% (16)
unlock_product v1 v2	0.26% (19)		0.03% (19)
client.LoadFeatureDependentModuleCommand v1 v2	0.01% (1)		0.00% (1)
eat v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
fertilize_at_friend v1 v2		0.03% (20)	0.03% (20)
finish_factory v1 v2	0.03% (2)		0.00% (2)
water v1 v2	0.03% (2)	0.02% (12)	0.02% (14)
accept v1 v2	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

client\_swf

v1:MonsterBootstrap.swf v2:Bootstrap.swf

action/user	10 Minutes ↻		
	NEW	OLD	total
<b>v1:MonsterBootstrap.swf v2:Bootstrap</b>	<b>9.69%</b>	<b>90.23%</b>	<b>100.00%</b>
<b>user distribution:</b>	<b>(7265)</b>	<b>(67619)</b>	<b>(74939)</b>
client.connection v1 v2			
client.timeout v1 v2	0.43% (31)	0.50% (336)	0.49% (367)
plant v1 v2	0.19% (14)	0.22% (148)	0.22% (162)
gift_at_friend v1 v2	0.03% (2)	0.22% (150)	0.20% (152)
feed_at_friend v1 v2	0.03% (2)	0.10% (69)	0.09% (71)
harvest v1 v2	0.10% (7)	0.11% (71)	0.10% (78)
client.LoadSingleConfigurationCommand v1 v2		0.10% (69)	0.09% (69)
mission_accomplished v1 v2	0.26% (19)	0.11% (73)	0.12% (92)
add v1 v2	0.39% (28)	0.03% (18)	0.06% (46)
accepted v1 v2	0.06% (4)	0.05% (36)	0.05% (40)
ready v1 v2	0.08% (6)	0.07% (48)	0.07% (54)
update v1 v2	0.03% (2)	0.05% (36)	0.05% (38)
client.SetupRequestCommand v1 v2		0.10% (66)	0.09% (66)
move v1 v2	0.15% (11)	0.05% (31)	0.06% (42)
trade v1 v2		0.01% (10)	0.01% (10)
visit v1 v2	0.03% (2)	0.07% (44)	0.06% (46)
buy v1 v2	0.08% (6)	0.01% (10)	0.02% (16)
client.Bootstrap v1 v2		0.02% (13)	0.02% (13)
craft v1 v2	0.03% (2)	0.04% (24)	0.03% (26)
place v1 v2	0.01% (1)	0.01% (9)	0.01% (10)
buy_to_garden v1 v2	0.06% (4)	0.01% (6)	0.01% (10)
feed v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
get_dry v1 v2	0.03% (2)	0.03% (20)	0.03% (22)
sell v1 v2	0.03% (2)	0.01% (9)	0.01% (11)
set_level v1 v2	0.04% (3)	0.02% (13)	0.02% (16)
unlock_product v1 v2	0.26% (19)		0.03% (19)
client.LoadFeatureDependentModuleCommand v1 v2	0.01% (1)		0.00% (1)
eat v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
fertilize_at_friend v1 v2		0.03% (20)	0.03% (20)
finish_factory v1 v2	0.03% (2)		0.00% (2)
water v1 v2	0.03% (2)	0.02% (12)	0.02% (14)
accept v1 v2	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

client\_swf

v1:MonsterBootstrap.swf v2:Bootstrap.swf

action/user	10 Minutes ↻		
	NEW	OLD	total
<b>v1:MonsterBootstrap.swf v2:Bootstrap</b>	<b>9.69%</b>	<b>90.23%</b>	<b>100.00%</b>
<b>user distribution:</b>	<b>(7265)</b>	<b>(67619)</b>	<b>(74939)</b>
client.connection v1 v2			
client.timeout v1 v2	0.43% (31)	0.50% (336)	0.49% (367)
plant v1 v2	0.19% (14)	0.22% (148)	0.22% (162)
gift_at_friend v1 v2	0.03% (2)	0.22% (150)	0.20% (152)
feed_at_friend v1 v2	0.03% (2)	0.10% (69)	0.09% (71)
harvest v1 v2	0.10% (7)	0.11% (71)	0.10% (78)
client.LoadSingleConfigurationCommand v1 v2			
mission_accomplished v1 v2	0.26% (19)	0.11% (73)	0.12% (92)
add v1 v2	0.39% (28)	0.03% (18)	0.06% (46)
accepted v1 v2			
ready v1 v2	0.08% (6)	0.07% (48)	0.07% (54)
update v1 v2	0.03% (2)	0.05% (36)	0.05% (38)
client.SetupRequestCommand v1 v2		0.10% (66)	0.09% (66)
move v1 v2	0.15% (11)	0.05% (31)	0.06% (42)
trade v1 v2		0.01% (10)	0.01% (10)
visit v1 v2	0.03% (2)	0.07% (44)	0.06% (46)
buy v1 v2	0.08% (6)	0.01% (10)	0.02% (16)
client.Bootstrap v1 v2		0.02% (13)	0.02% (13)
craft v1 v2	0.03% (2)	0.04% (24)	0.03% (26)
place v1 v2	0.01% (1)	0.01% (9)	0.01% (10)
buy_to_garden v1 v2	0.06% (4)	0.01% (6)	0.01% (10)
feed v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
get_dry v1 v2	0.03% (2)	0.03% (20)	0.03% (22)
sell v1 v2	0.03% (2)	0.01% (9)	0.01% (11)
set_level v1 v2	0.04% (3)	0.02% (13)	0.02% (16)
unlock_product v1 v2	0.26% (19)		0.03% (19)
client.LoadFeatureDependentModuleCommand v1 v2	0.01% (1)		0.00% (1)
eat v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
fertilize_at_friend v1 v2		0.03% (20)	0.03% (20)
finish_factory v1 v2	0.03% (2)		0.00% (2)
water v1 v2	0.03% (2)	0.02% (12)	0.02% (14)
accept v1 v2	0.02% (15)	0.04% (9)	0.03% (71)

# Faults Reloaded

client\_swf

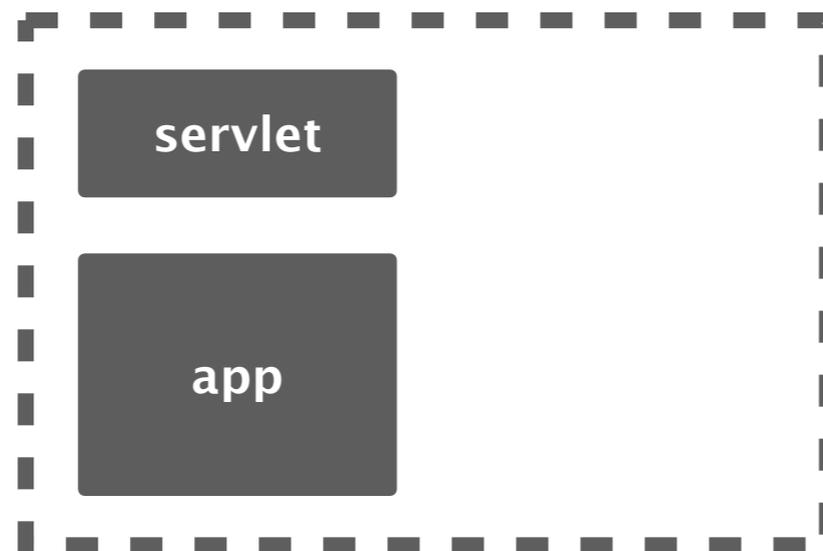
v1:MonsterBootstrap.swf v2:Bootstrap.swf

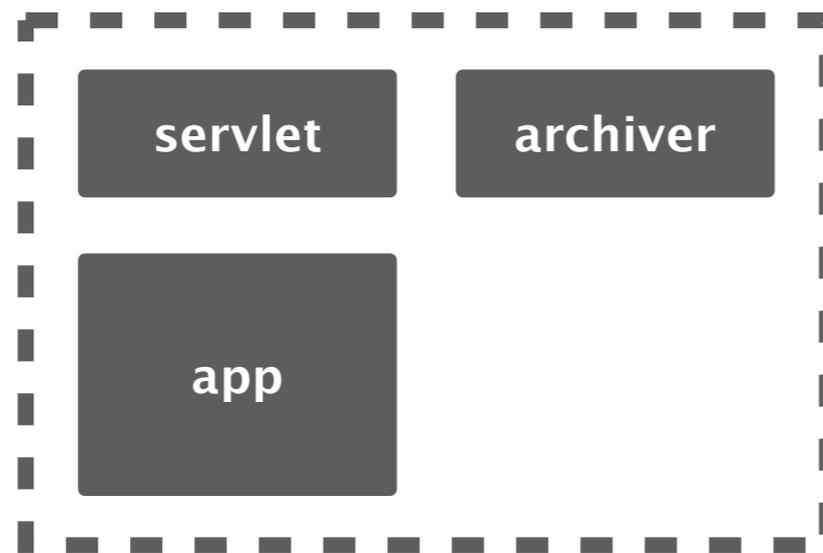
10 Minutes ↻			
action/user	NEW	OLD	total
v1:MonsterBootstrap.swf v2:Bootstrap.swf	<b>9.69%</b>	<b>90.23%</b>	<b>100.00%</b>
user distribution:	<b>(7265)</b>	<b>(67619)</b>	<b>(74939)</b>
client.connection v1 v2			
client.timeout v1 v2	0.43% (31)	0.50% (336)	0.49% (367)
plant v1 v2	0.19% (14)	0.22% (148)	0.22% (162)
gift_at_friend v1 v2	0.03% (2)	0.22% (150)	0.20% (152)
feed_at_friend v1 v2	0.03% (2)	0.10% (69)	0.09% (71)
harvest v1 v2	0.10% (7)	0.11% (71)	0.10% (78)
client.LoadSingleConfigurationCommand v1 v2	0.26% (19)	0.11% (73)	0.12% (92)
mission_accomplished v1 v2	0.39% (28)	0.03% (18)	0.06% (46)
add v1 v2			
accepted v1 v2	0.06% (4)	0.05% (36)	0.05% (40)
ready v1 v2	0.08% (6)	0.07% (48)	0.07% (54)
update v1 v2	0.03% (2)	0.05% (36)	0.05% (38)
client.SetupRequestCommand v1 v2		0.10% (66)	0.09% (66)
move v1 v2	0.15% (11)	0.05% (31)	0.06% (42)
trade v1 v2		0.01% (10)	0.01% (10)
visit v1 v2	0.03% (2)	0.07% (44)	0.06% (46)
buy v1 v2	0.08% (6)	0.01% (10)	0.02% (16)
client.Bootstrap v1 v2		0.02% (13)	0.02% (13)
craft v1 v2	0.03% (2)	0.04% (24)	0.03% (26)
place v1 v2	0.01% (1)	0.01% (9)	0.01% (10)
buy_to_garden v1 v2	0.06% (4)	0.01% (6)	0.01% (10)
feed v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
get_dry v1 v2	0.03% (2)	0.03% (20)	0.03% (22)
sell v1 v2	0.03% (2)	0.01% (9)	0.01% (11)
set_level v1 v2	0.04% (3)	0.02% (13)	0.02% (16)
unlock_product v1 v2	0.26% (19)		0.03% (19)
client.LoadFeatureDependentModuleCommand v1 v2	0.01% (1)		0.00% (1)
eat v1 v2	0.01% (1)	0.02% (12)	0.02% (13)
fertilize_at_friend v1 v2		0.03% (20)	0.03% (20)
finish_factory v1 v2	0.03% (2)		0.00% (2)
water v1 v2	0.03% (2)	0.02% (12)	0.02% (14)
accept v1 v2	0.02% (15)	0.04% (9)	0.03% (71)

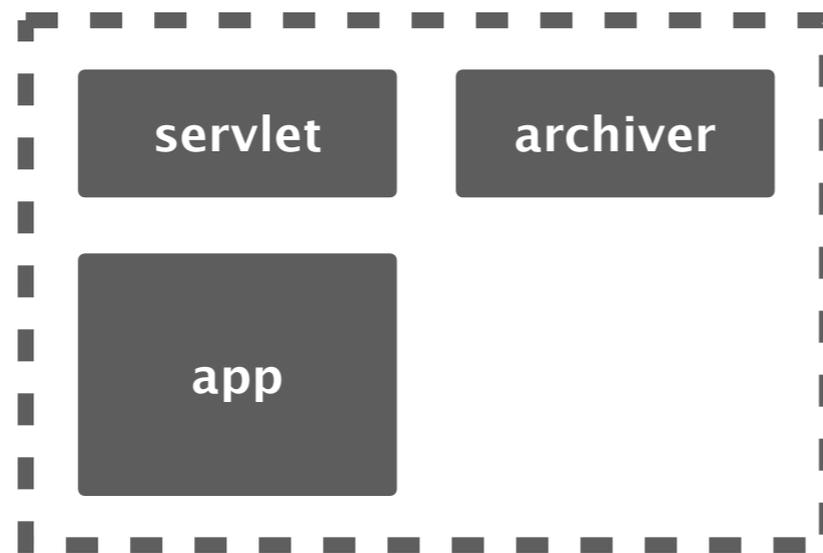
# Life cycle

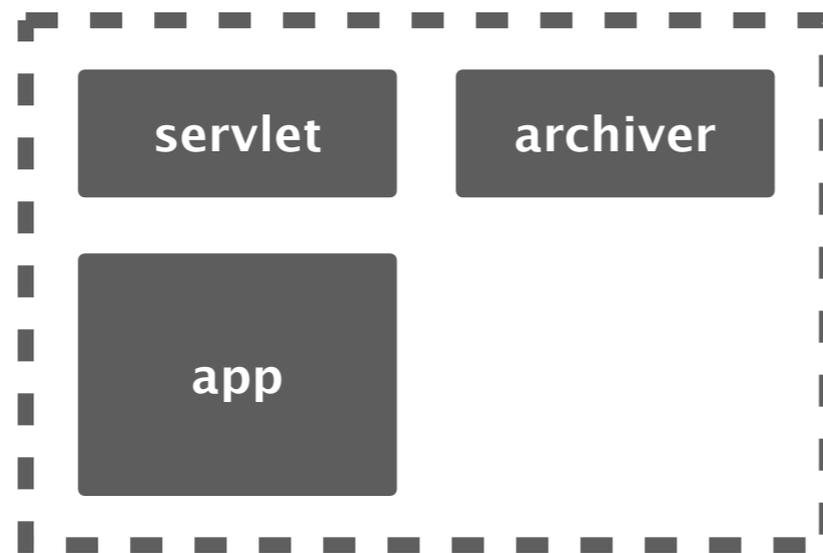
app

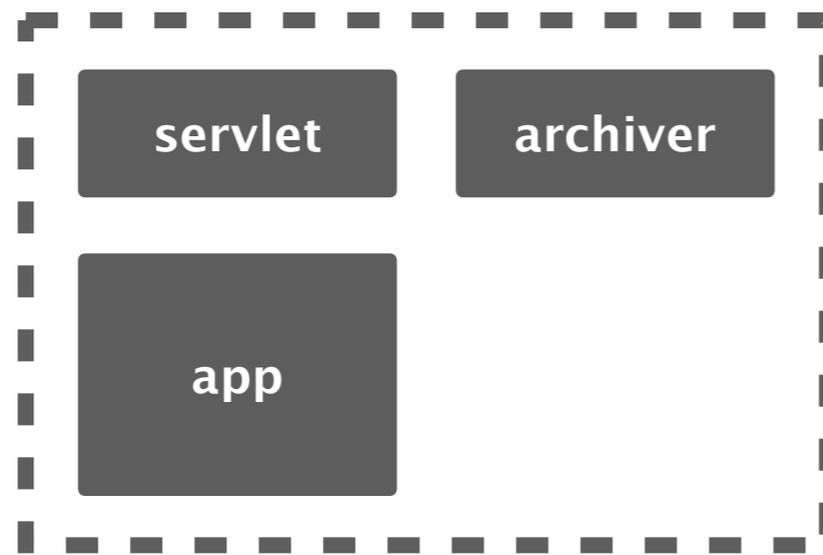


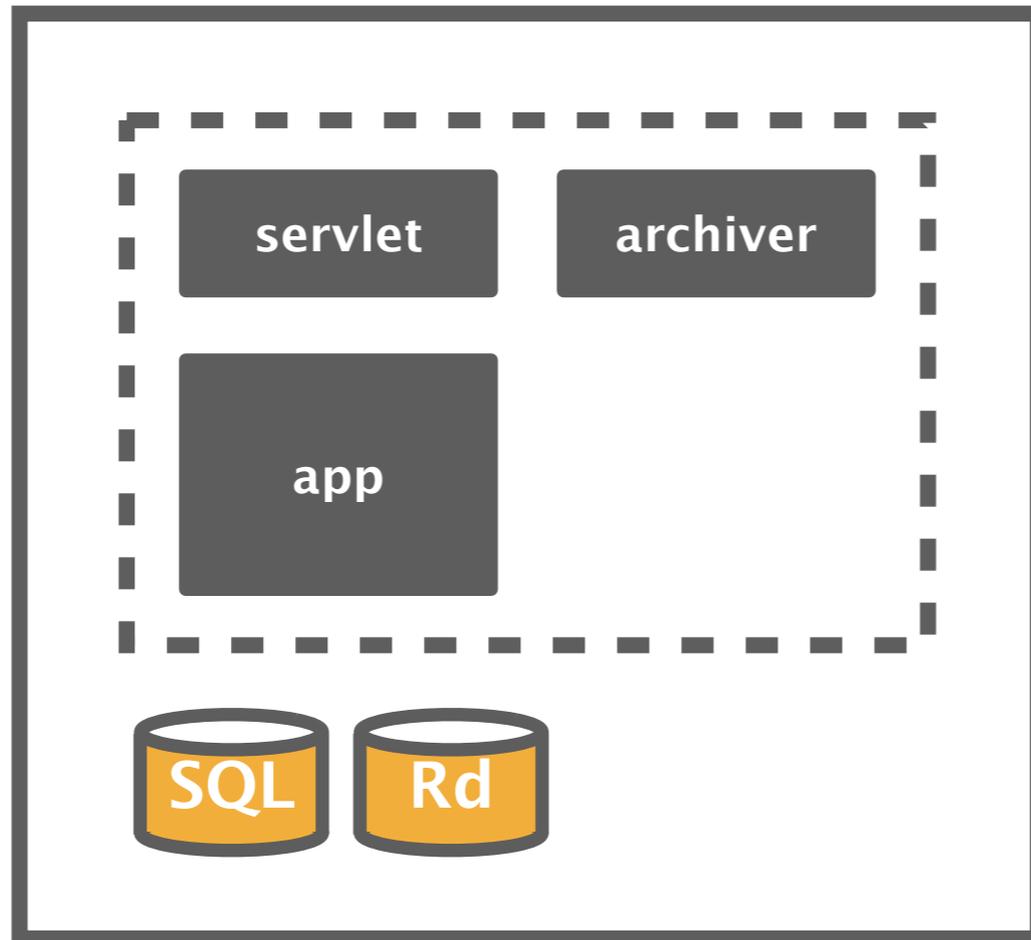


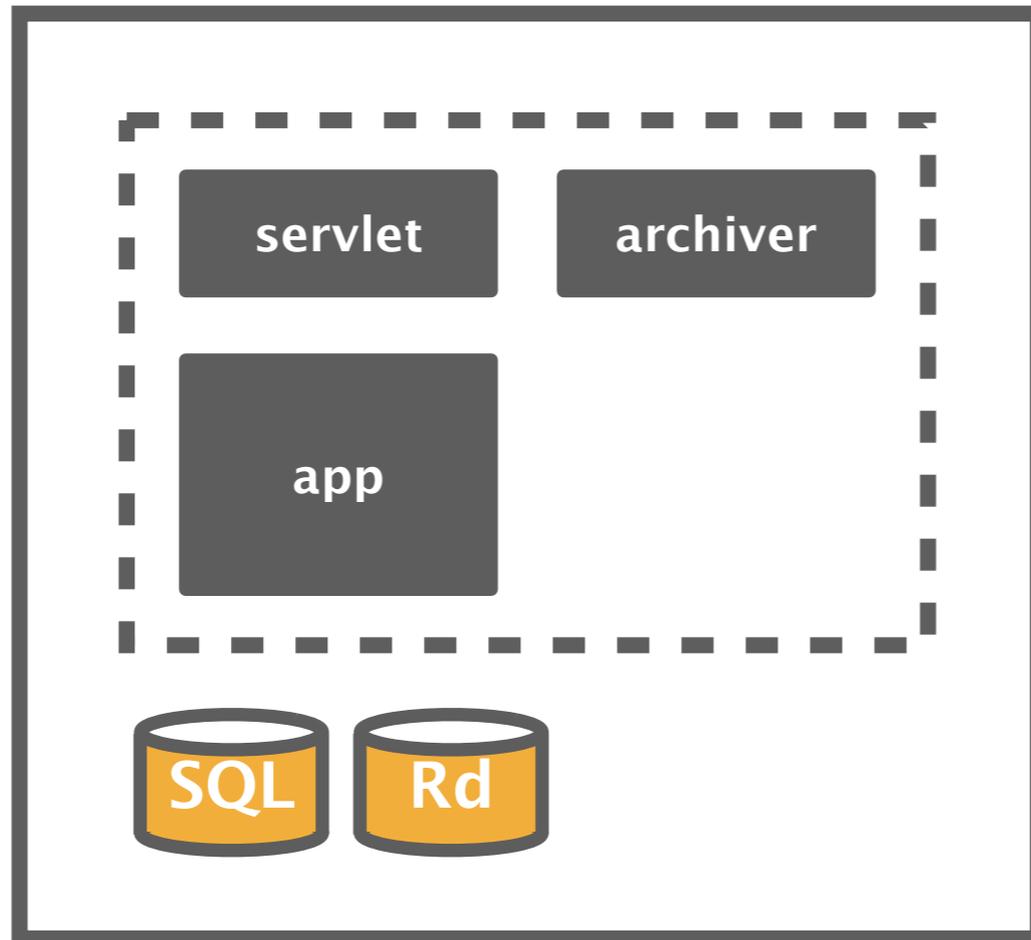




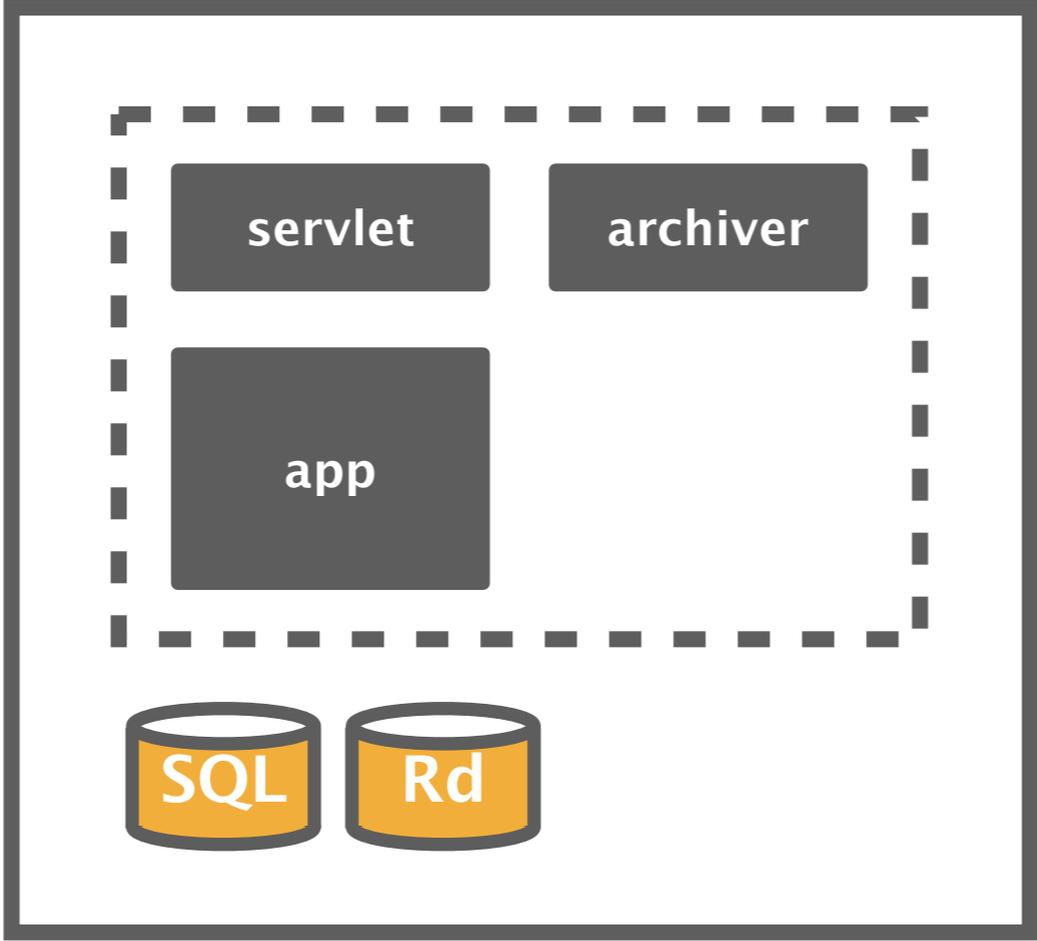




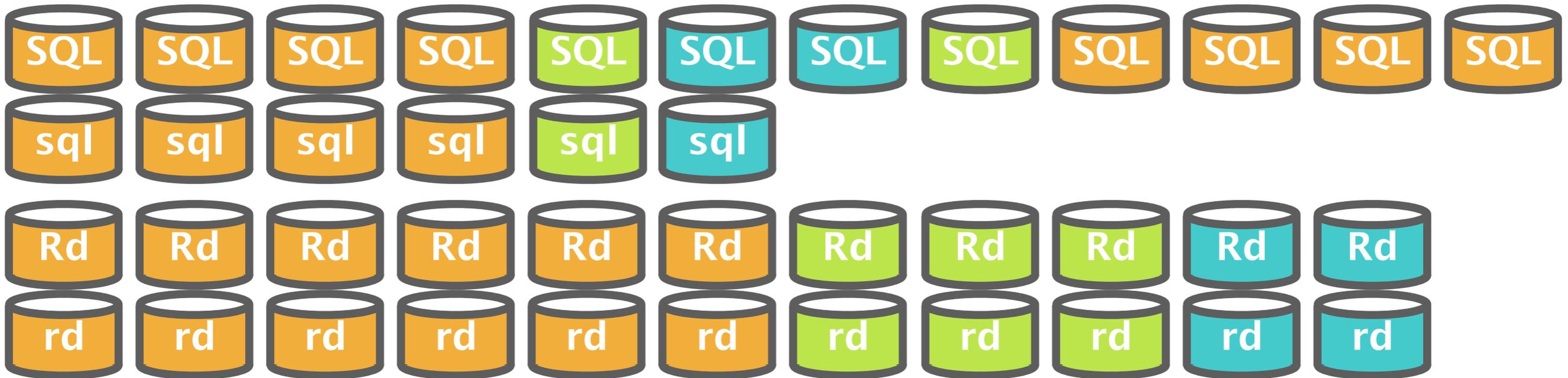




# Load Balancer



lb lb lb lb



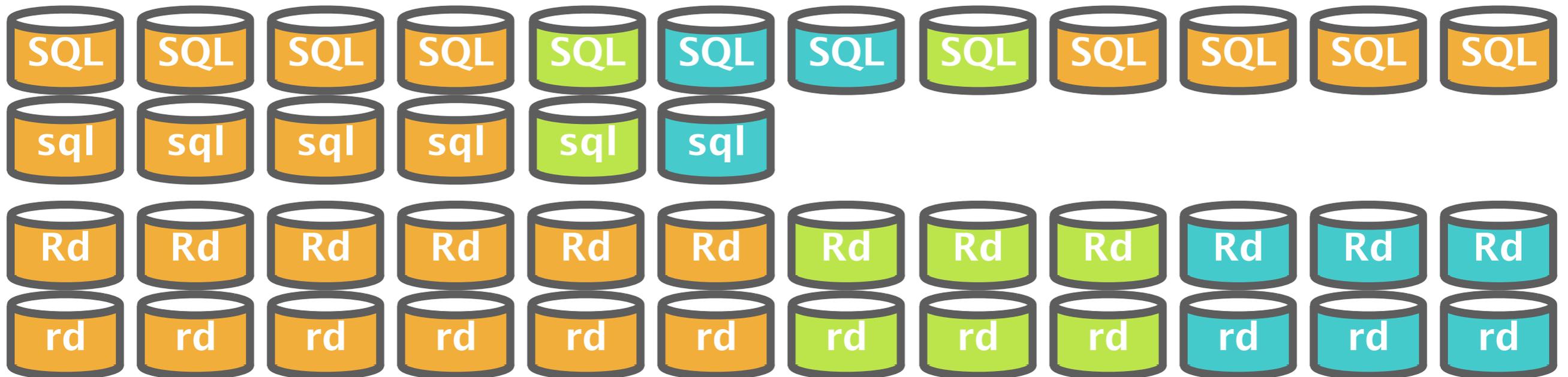
lb lb lb lb

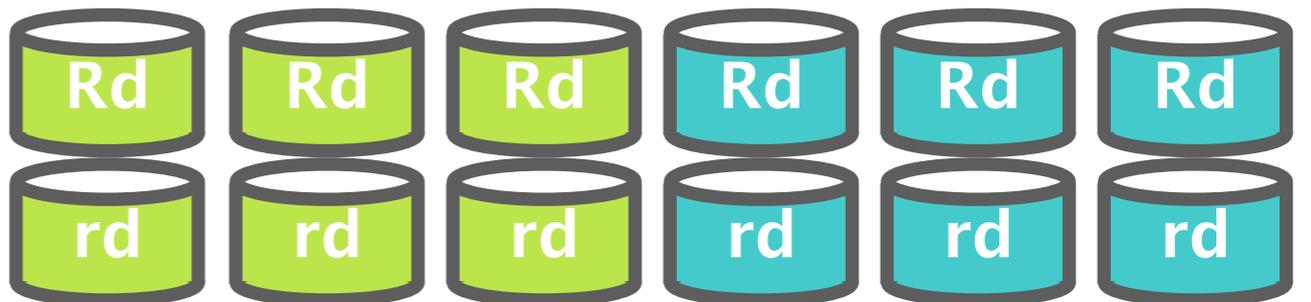
ap														
ap														
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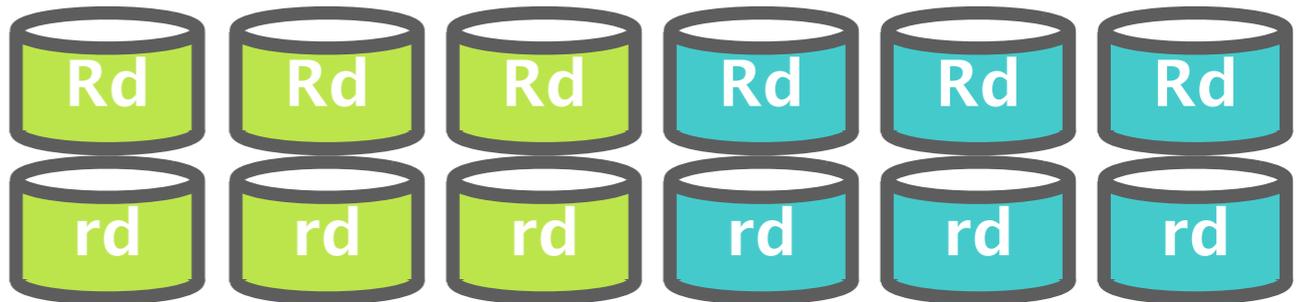
SQL												
sql	sql	sql	sql	sql	sql							
Rd												
rd												

# Removing DBs

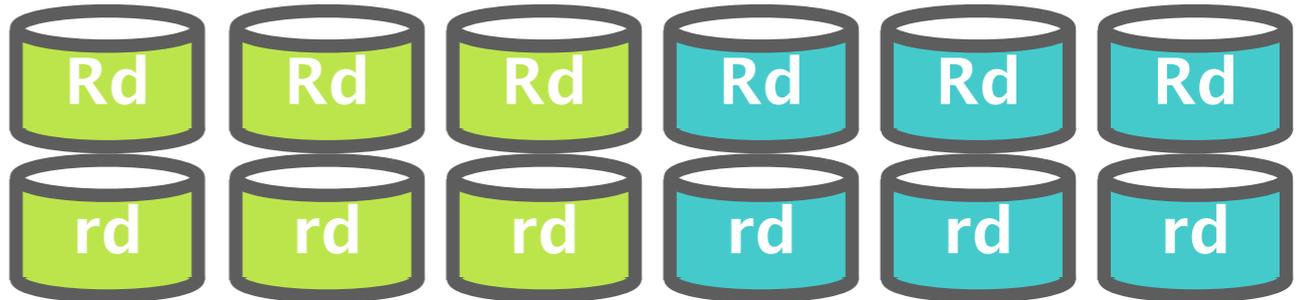
lb lb lb lb



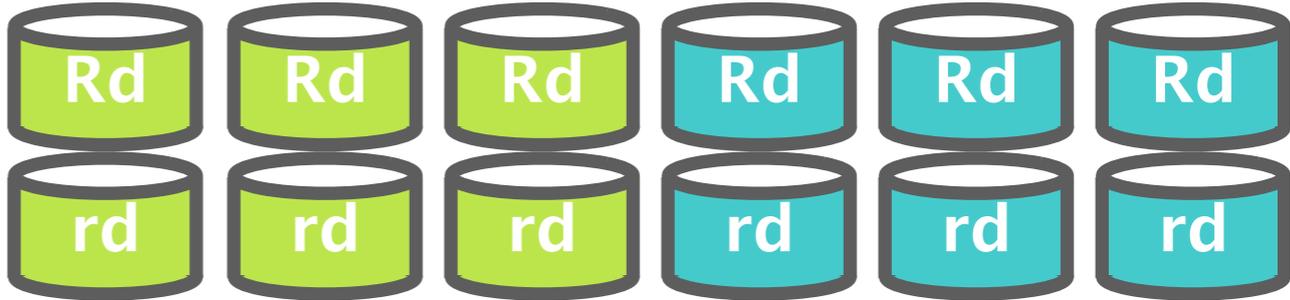




**Enjoy**



lb lb lb lb



lb lb lb lb

ap														
ap														
ap														
ap														
ap														
ap														
ap														

Rd	Rd	Rd	Rd	Rd	Rd
rd	rd	rd	rd	rd	rd



[http://www.flickr.com/photos/aigle\\_dore/](http://www.flickr.com/photos/aigle_dore/)

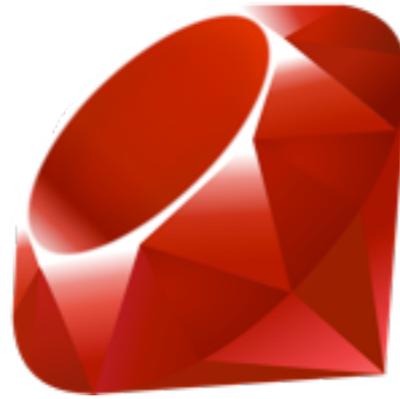
Monday, 18 March 13

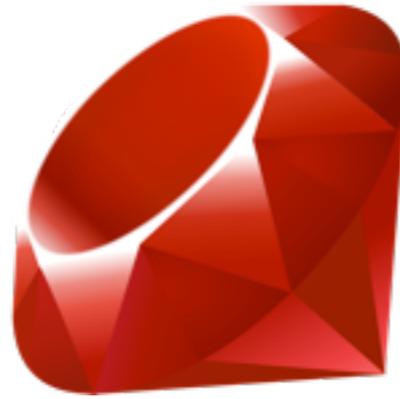


[http://www.flickr.com/photos/aigle\\_dore/](http://www.flickr.com/photos/aigle_dore/)

# Looking Back

**What is the right  
software stack?**



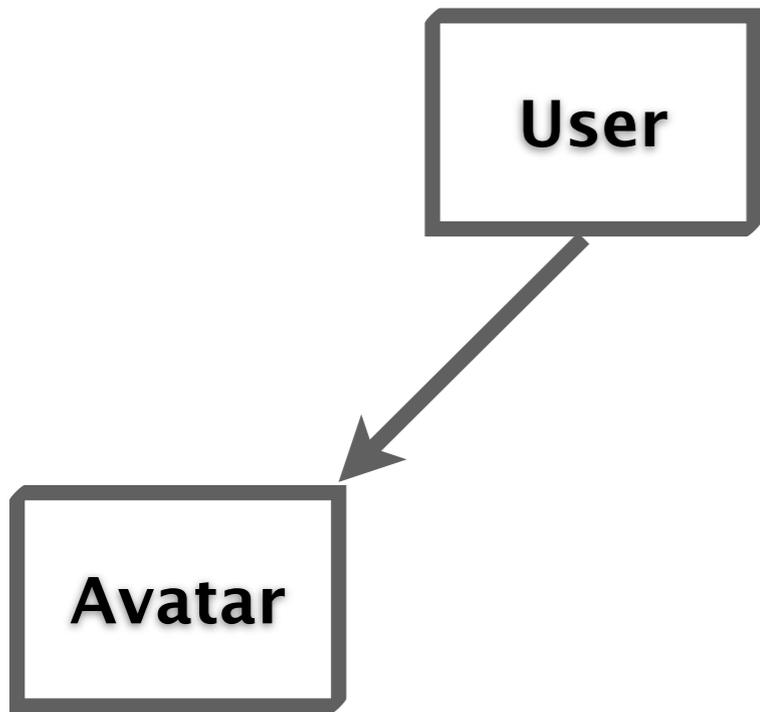


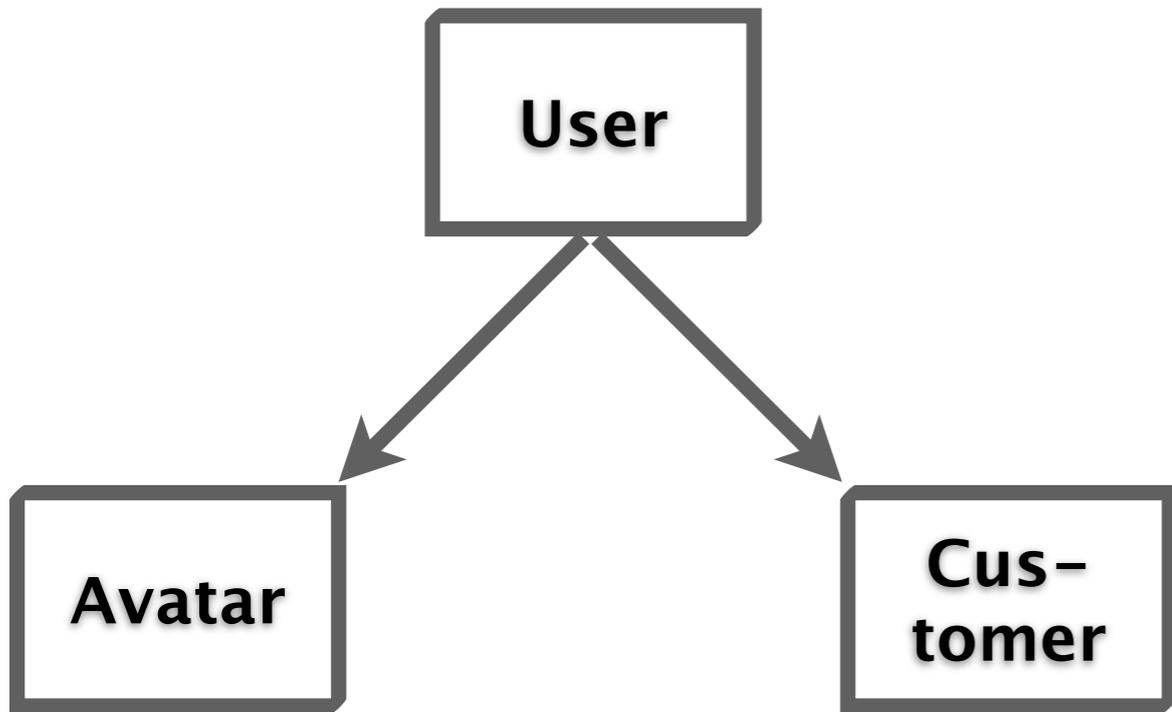
**What is the right  
software stack?**

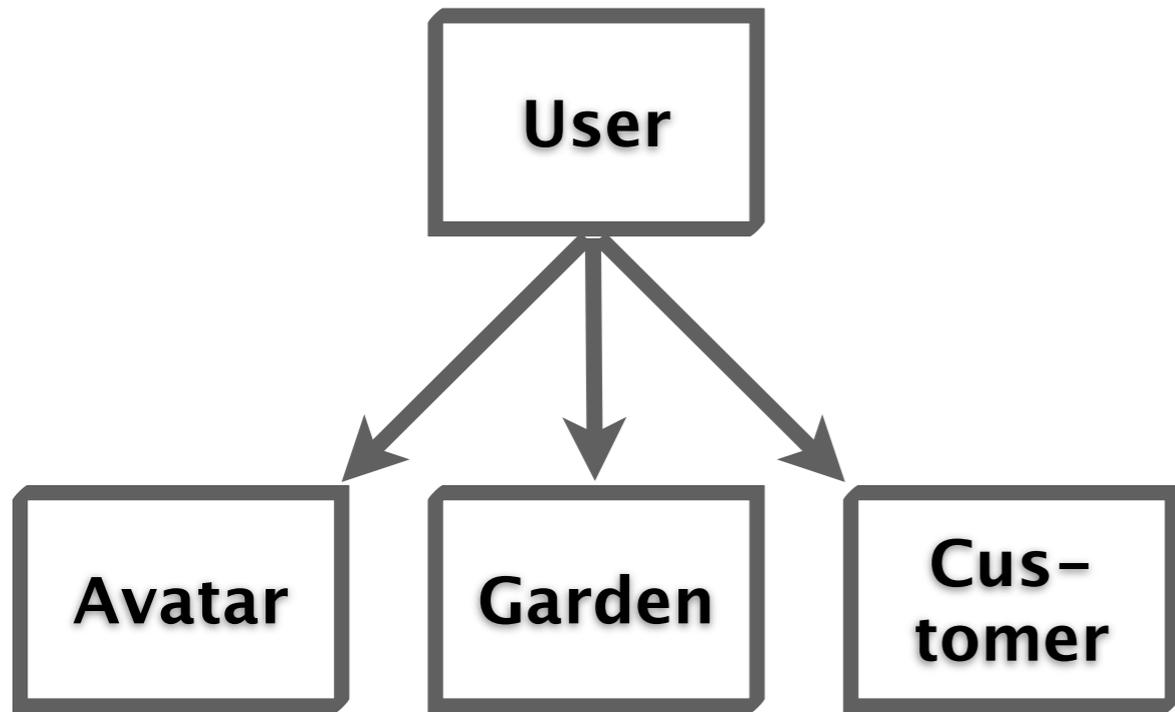
~~What is the right  
software stack?~~

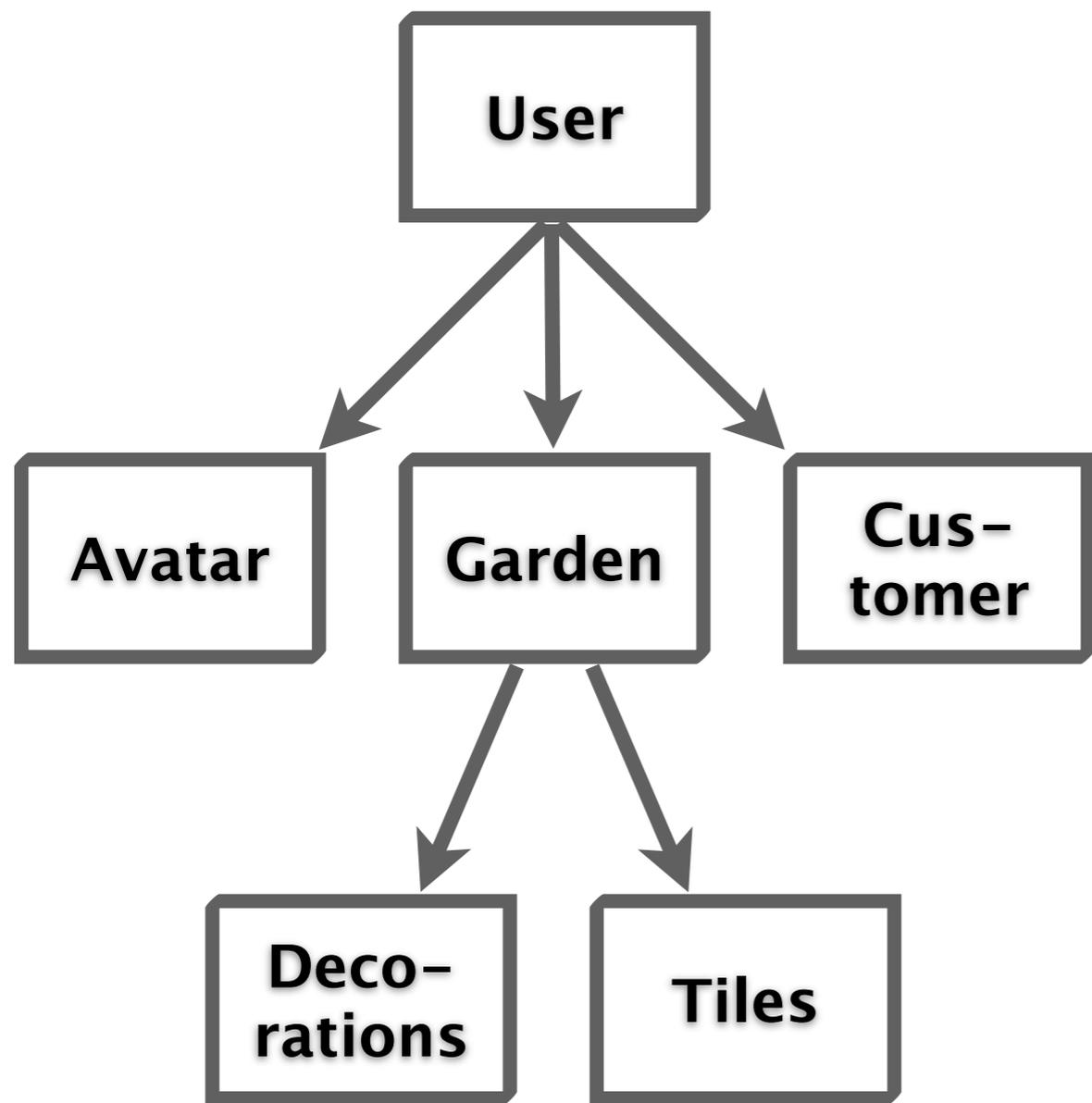
**What kind of application  
are we building?**

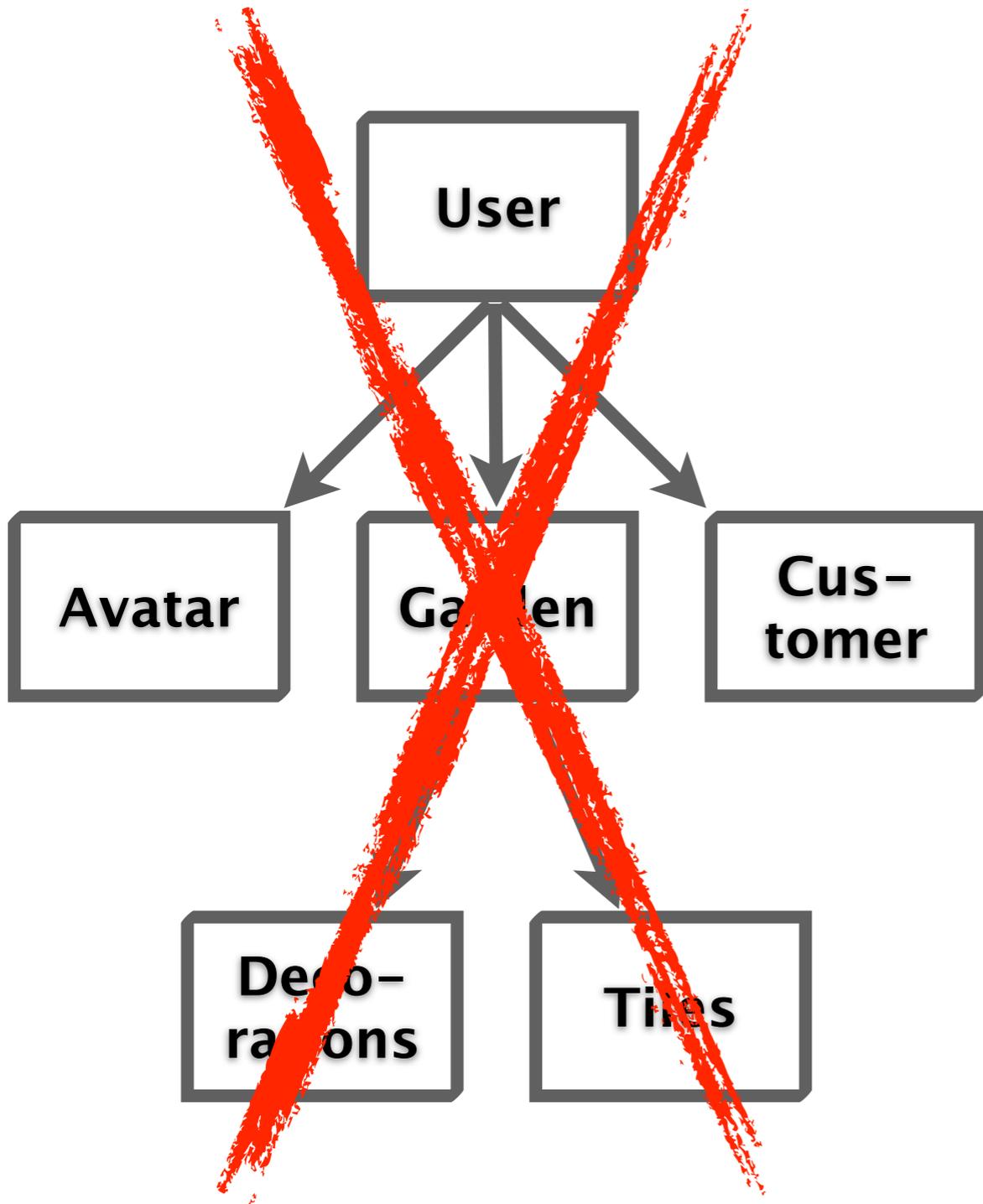
**User**

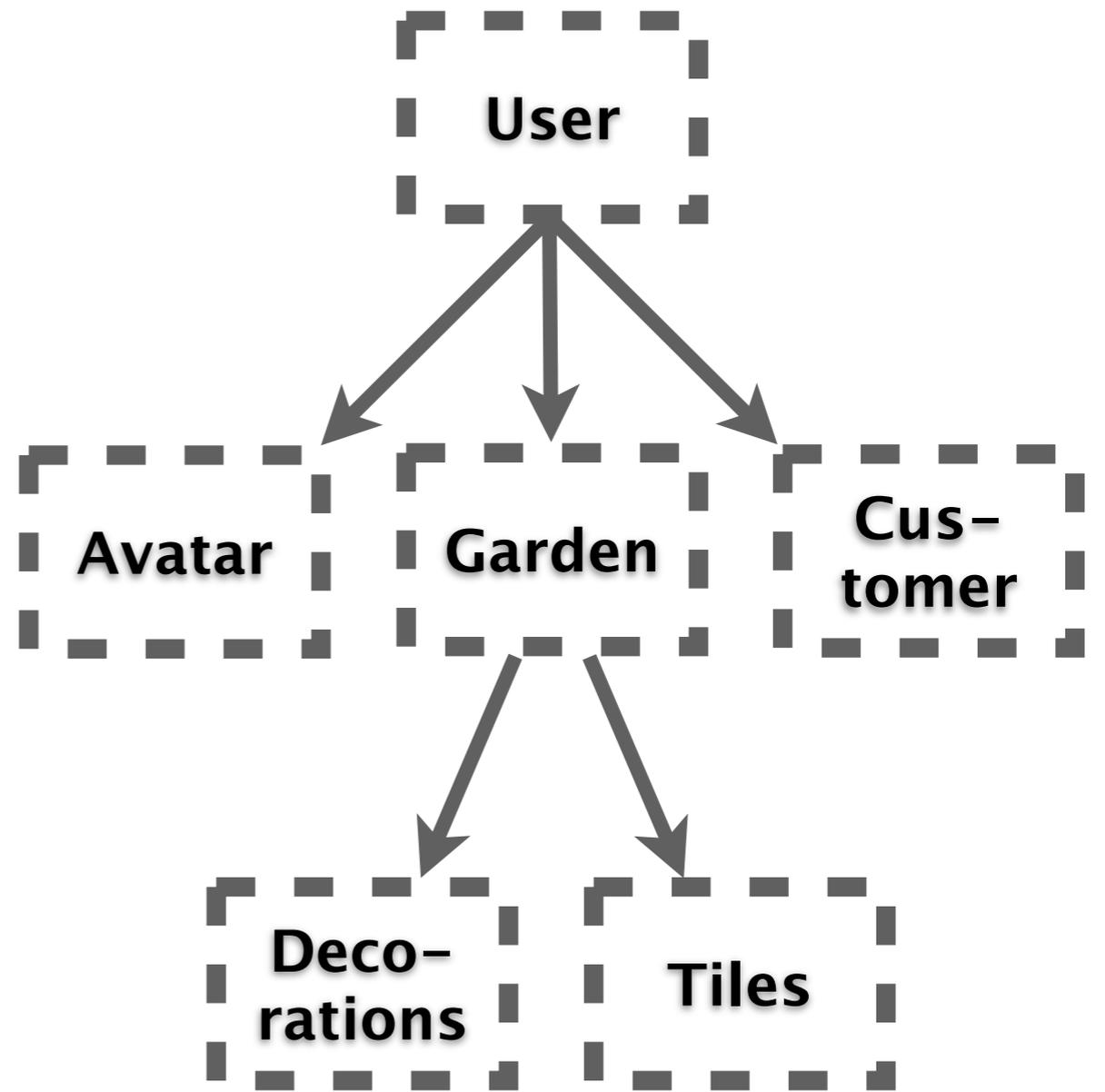
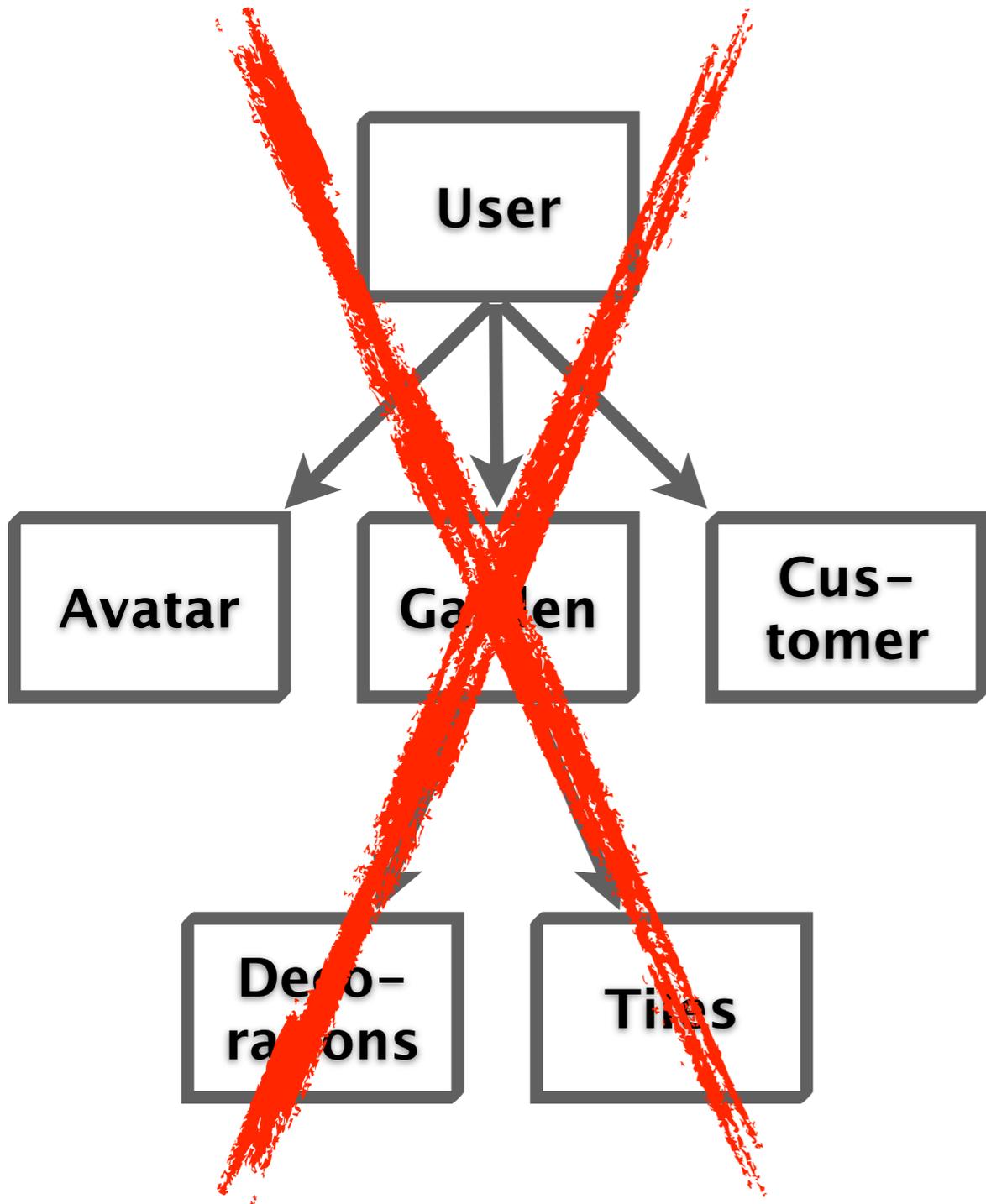


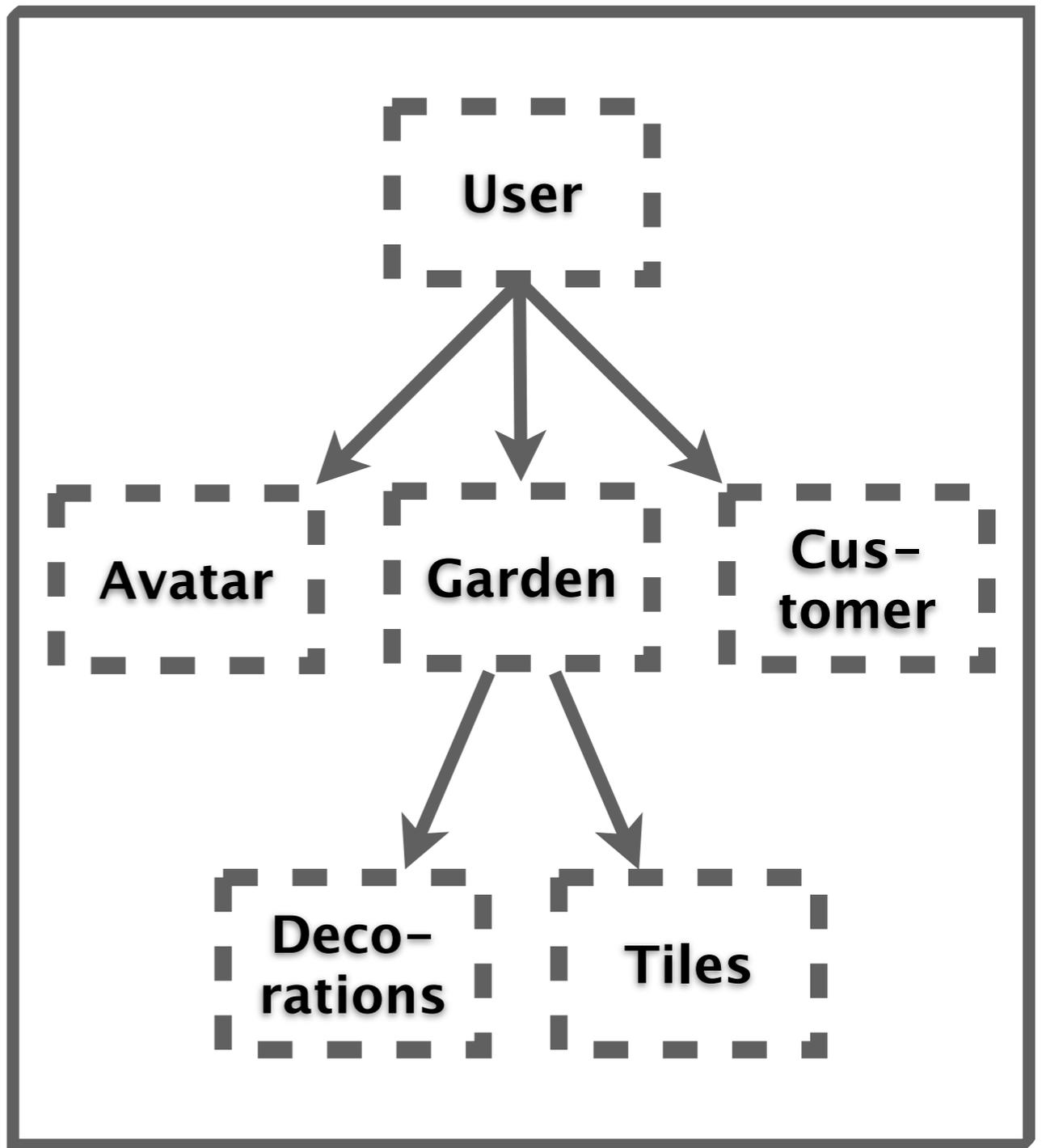
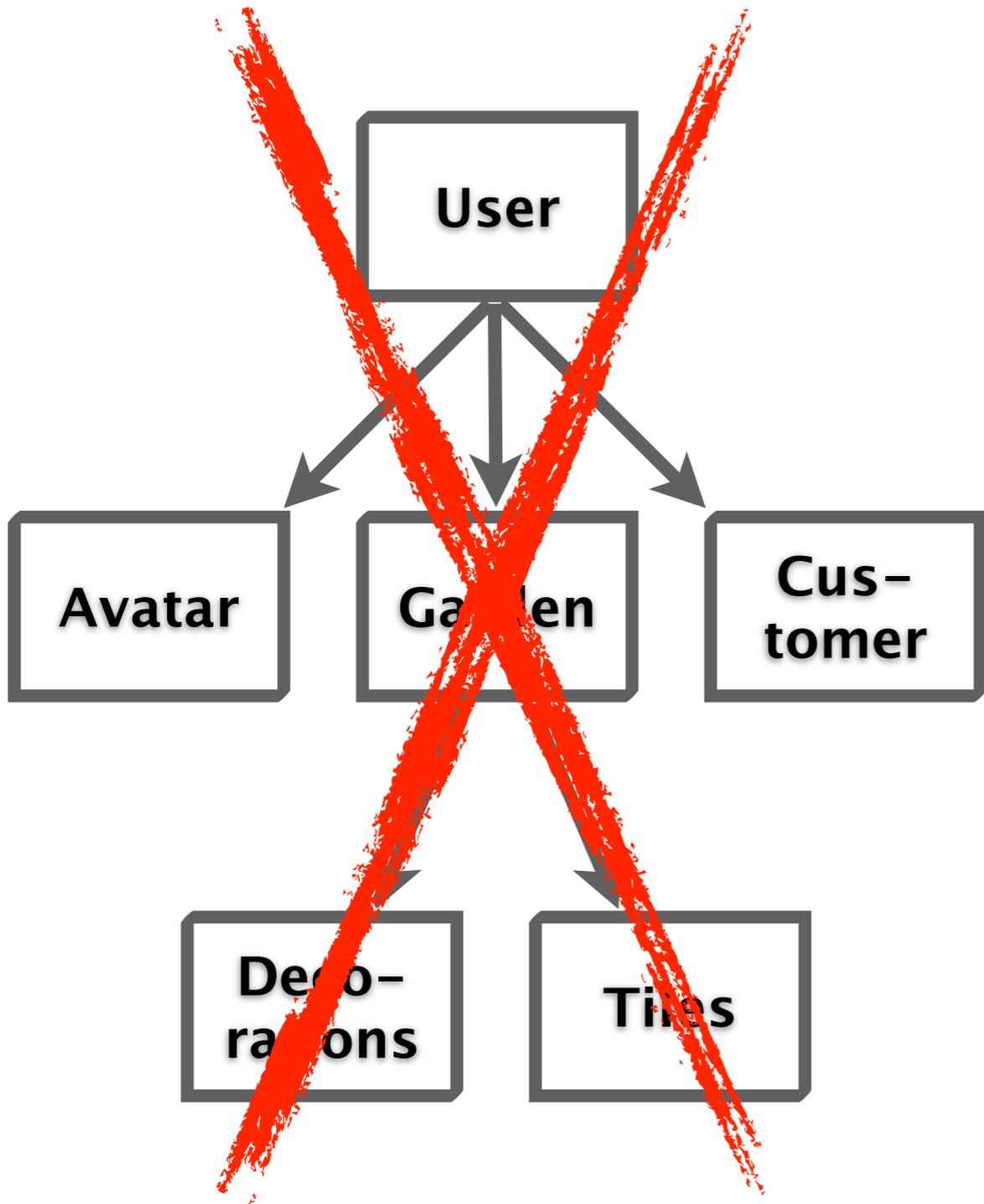














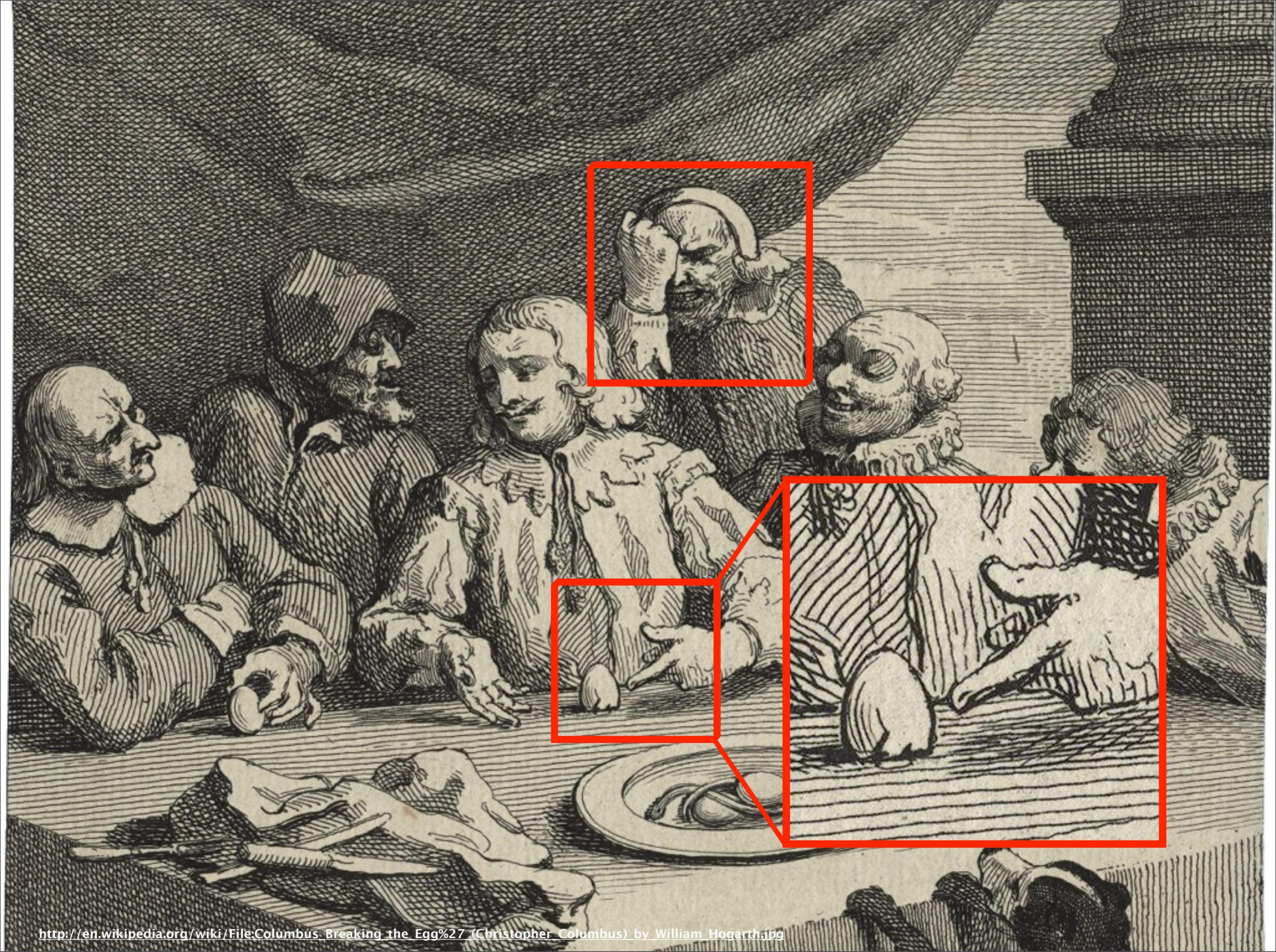
[http://en.wikipedia.org/wiki/File:Columbus\\_Breaking\\_the\\_Egg%27\\_\(Christopher\\_Columbus\)\\_by\\_William\\_Hogarth.jpg](http://en.wikipedia.org/wiki/File:Columbus_Breaking_the_Egg%27_(Christopher_Columbus)_by_William_Hogarth.jpg)



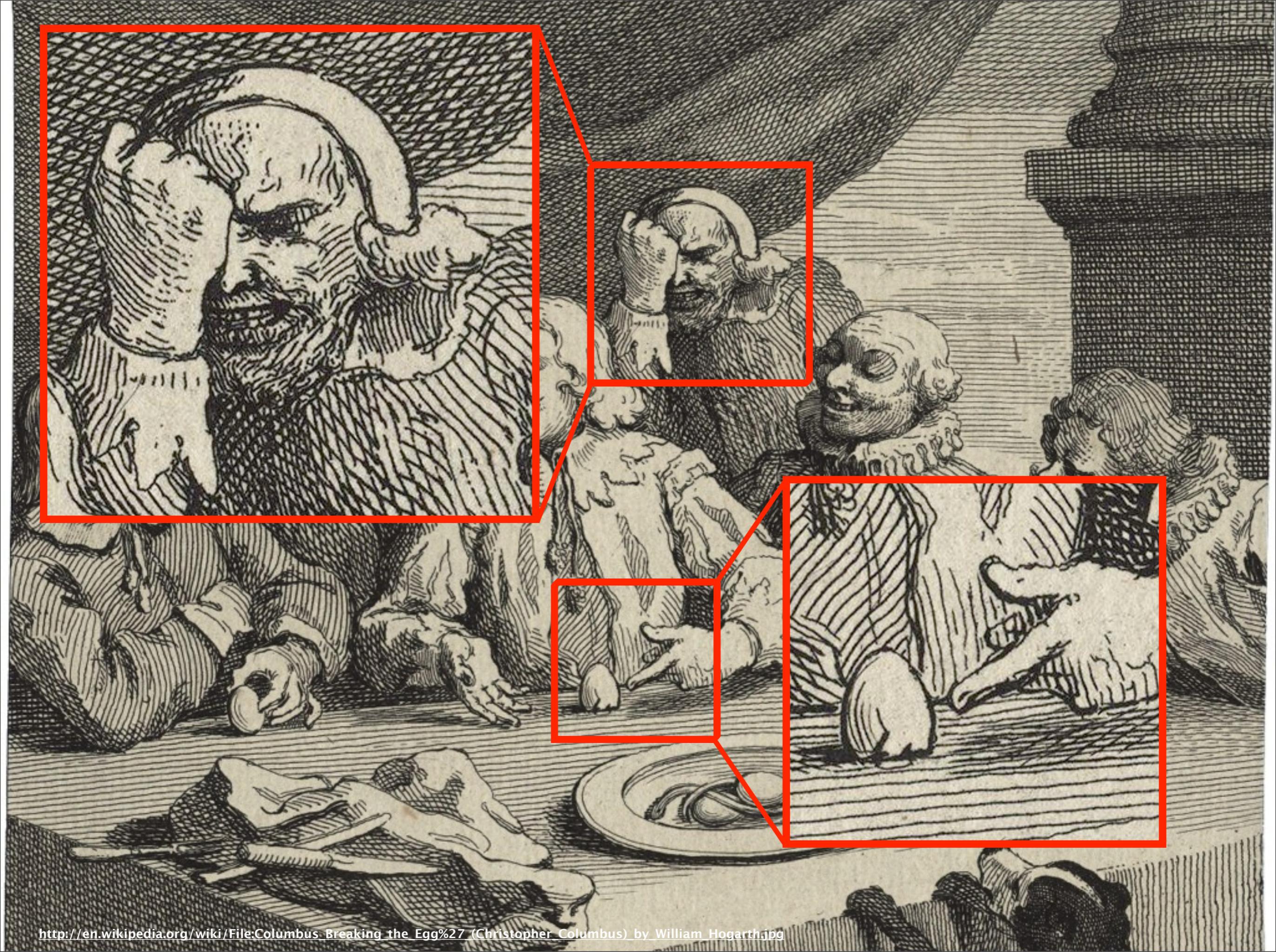
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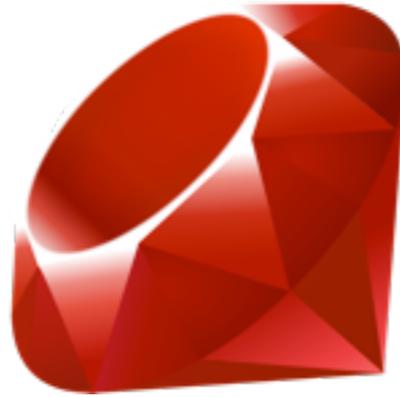


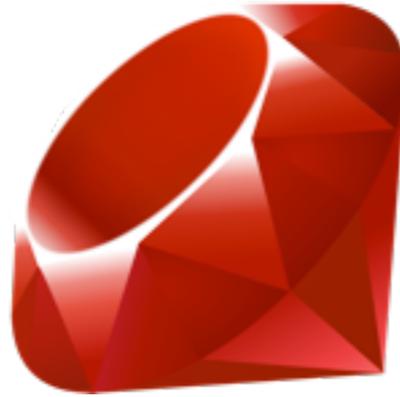
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[http://en.wikipedia.org/wiki/File:Columbus\\_Breaking\\_the\\_Egg%27\\_\(Christopher\\_Columbus\)\\_by\\_William\\_Hogarth.jpg](http://en.wikipedia.org/wiki/File:Columbus_Breaking_the_Egg%27_(Christopher_Columbus)_by_William_Hogarth.jpg)

**What kind of application  
are we building?**

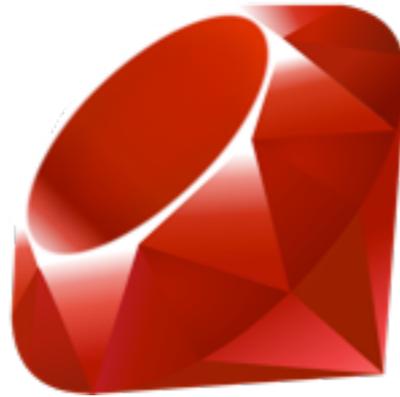






**Magic  
Land**





**velia.net**

 **riak**



Plain File System



**Handle *state*  
the right way!**

## Lesson 3:

**Software is easy,  
data is hard!**

## Lesson 2:

**You will make  
mistakes!**

## Lesson 1:

**Always check back  
on reality!**

## Lesson 1:

**Always check back  
on your assumptions!**

**Thank you**

**Jesper Richter-Reichhelm**

**@jrirei**

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