Booking.com

Autopsy of an automation disaster

Jean-François Gagné - Saturday, February 4, 2017
FOSDEM MySQL & Friends Devroom

To err is human

To really foul things up requires a computer[1]

(or a script)

[1]: http://quoteinvestigator.com/2010/12/07/foul-computer/

Booking.com

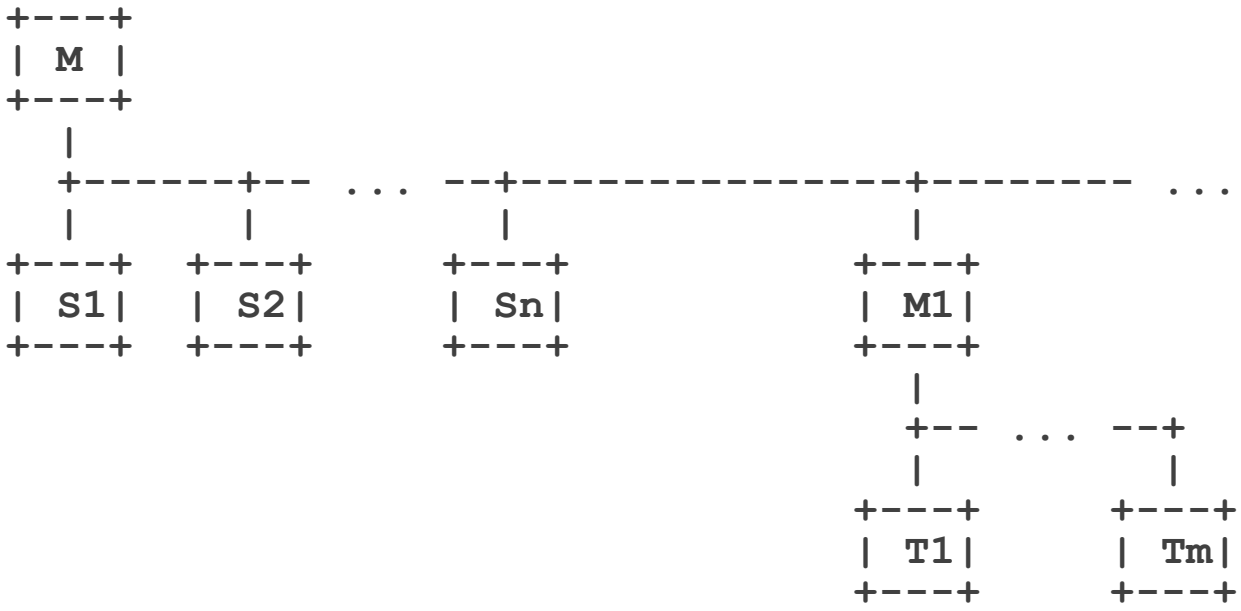
- Based in Amsterdam since 1996
- Online Hotel/Accommodation/Travel Agent (OTA):
  - +1.134.000 properties in 225 countries
  - +1.200.000 room nights reserved daily
  - +40 languages (website and customer service)
  - +13.000 people working in 187 offices worldwide
- Part of the Priceline Group
- And we use MySQL:
  - Thousands (1000s) of servers, ~90% replicating
  - >150 masters: ~30 >50 slaves & ~10 >100 slaves

Session Summary

1. MySQL replication at Booking.com
2. Automation disaster: external eye
3. Chain of events: analysis
4. Learning / takeaway

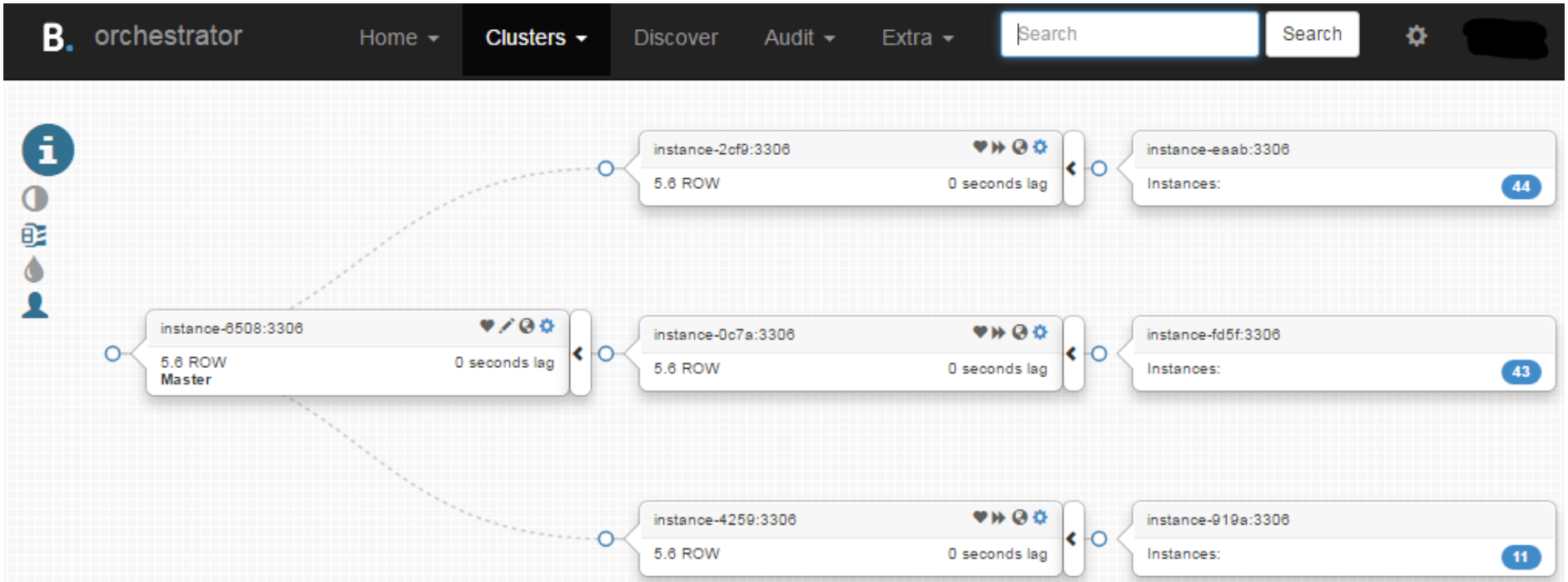
MySQL replication at Booking.com

- Typical MySQL replication deployment at Booking.com:



MySQL replication at Booking.com’

- And we use Orchestrator:

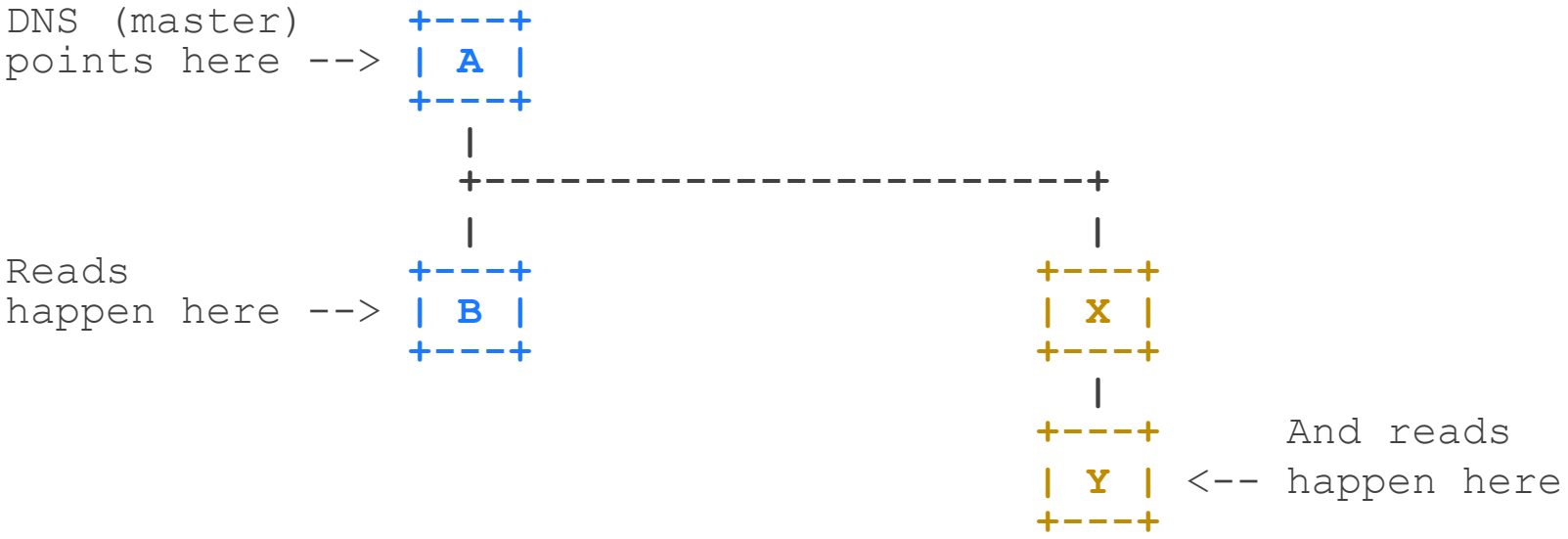


MySQL replication at Booking.com”

- Orchestrator allows us to:
  - Visualize our replication deployments
  - Move slaves for planned maintenance of an intermediate master
  - Automatically replace an intermediate master in case of its unexpected failure (thanks to pseudo-GTIDs when we have not deployed GTIDs)
  - Automatically replace a master in case of a failure (failing over to a slave)
- But Orchestrator cannot replace a master alone:
  - Booking.com uses DNS for master discovery
  - So Orchestrator calls a homemade script to repoint DNS (and to do other magic)

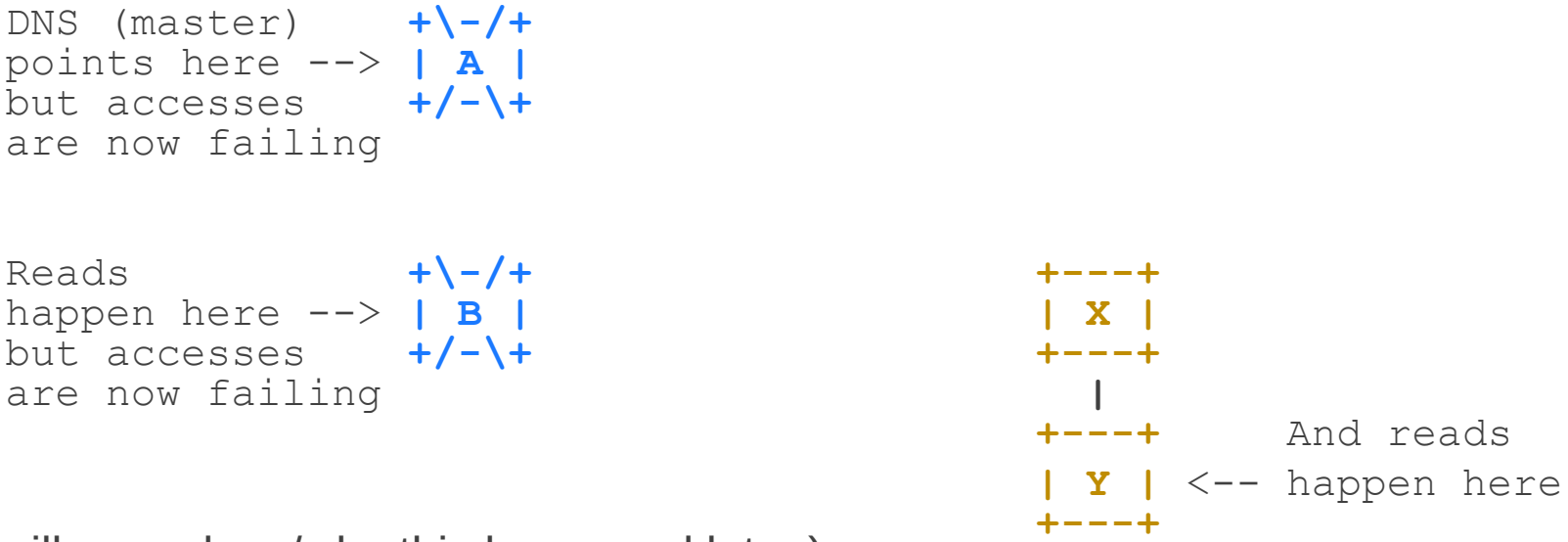
Our subject database

- Simple replication deployment (in two data centers):



Split brain: 1st event

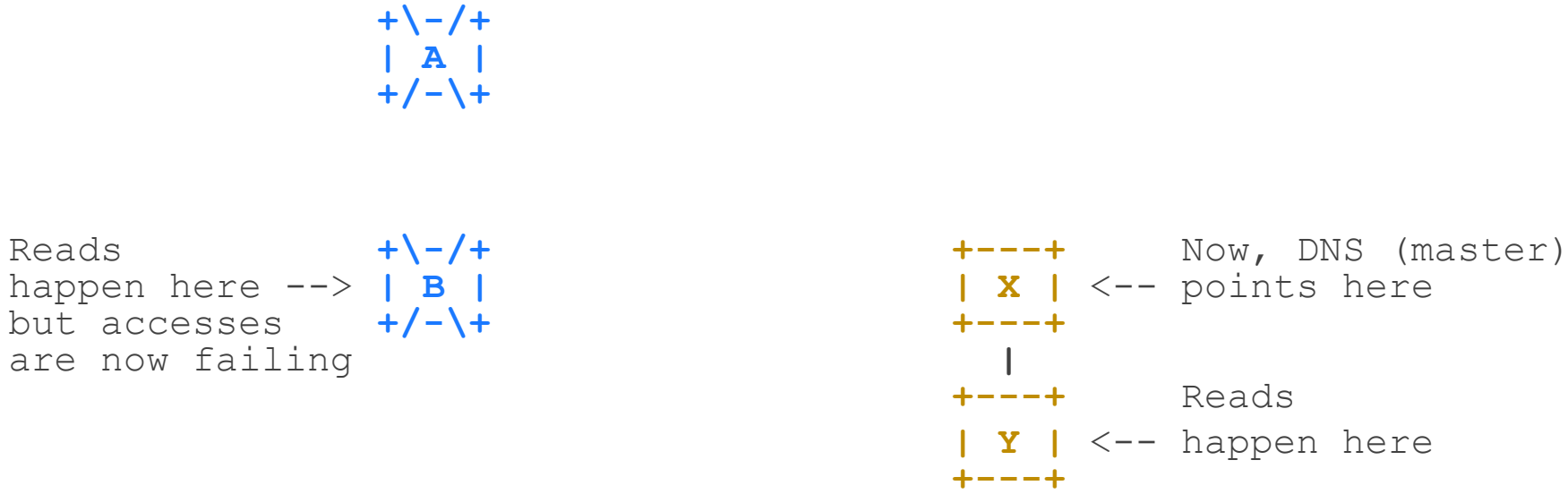
- A and B (two servers in same data center) fail at the same time:



(I will cover how/why this happened later.)

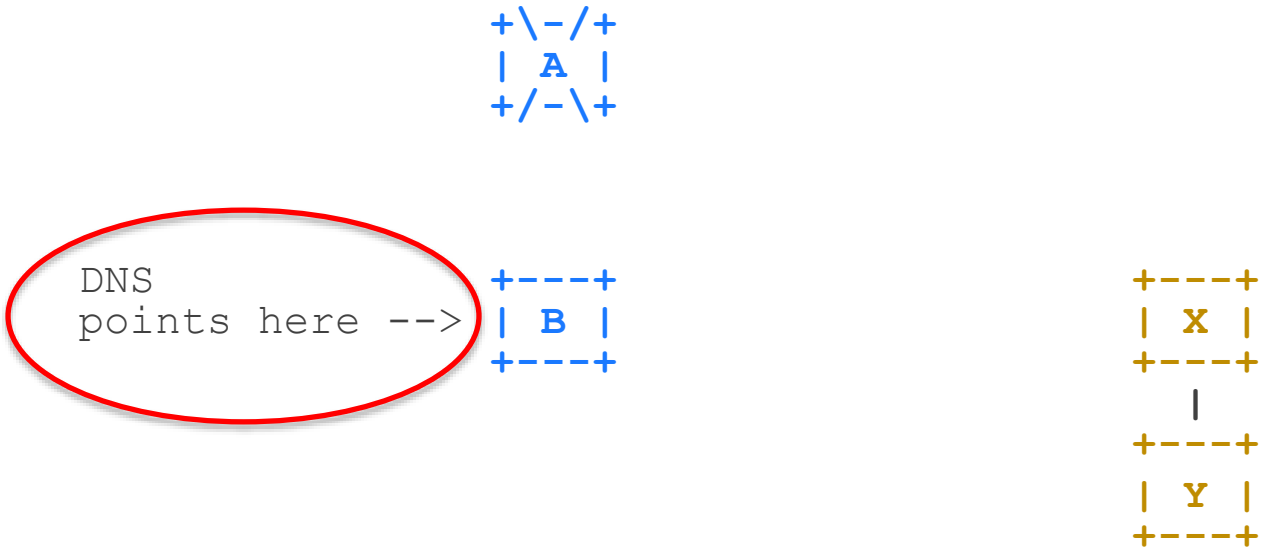
Split brain: 1st event'

- Orchestrator fixes things:



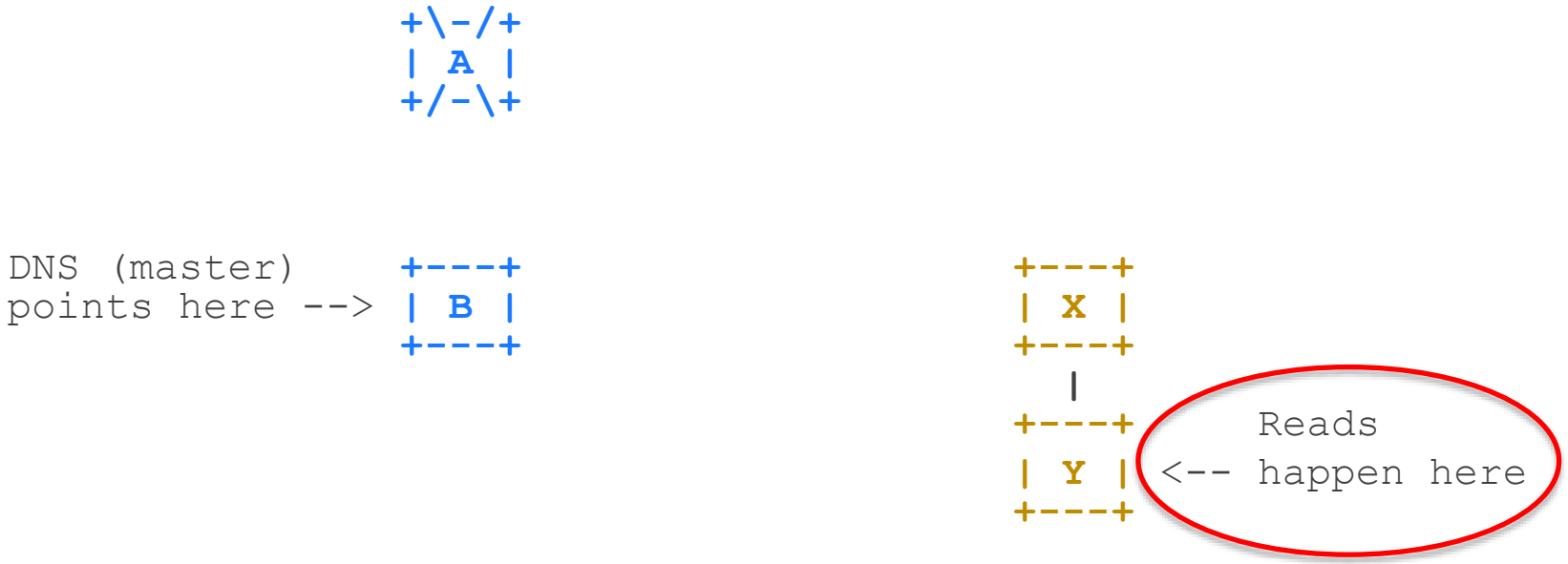
Split brain: disaster

- A few things happen in this day and night, and I wake-up to this:



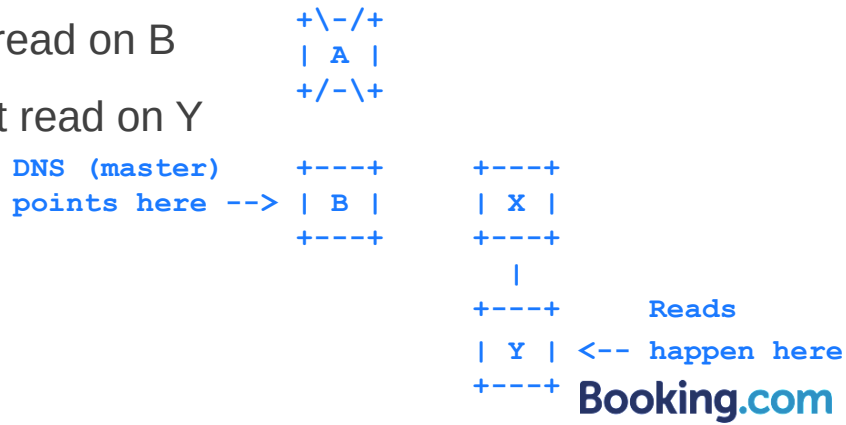
Split brain: disaster’

- And to make things worse, reads are still happening on Y:



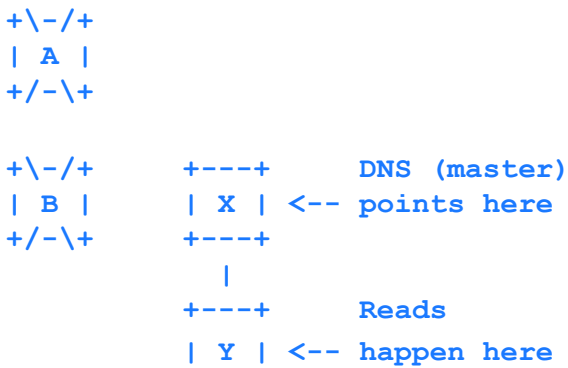
Split brain: disaster”

- This is not good:
  - When A and B failed, X was promoted as the new master
  - Something made DNS point to B (we will see what later)
    → writes are now happening on B
  - But B is outdated: all writes to X (after the failure of A) did not reach B
  - So we have data on X that cannot be read on B
  - And we have new data on B that is not read on Y



Split-brain: analysis

- Digging more in the chain of events, we find that:
  - After the 1st failure of A, a 2nd one was detected and Orchestrator failed over to B
  - So after their failures, A and B came back and formed an isolated replication chain



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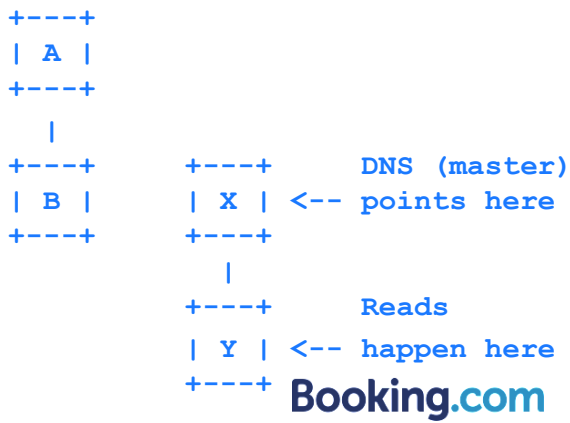

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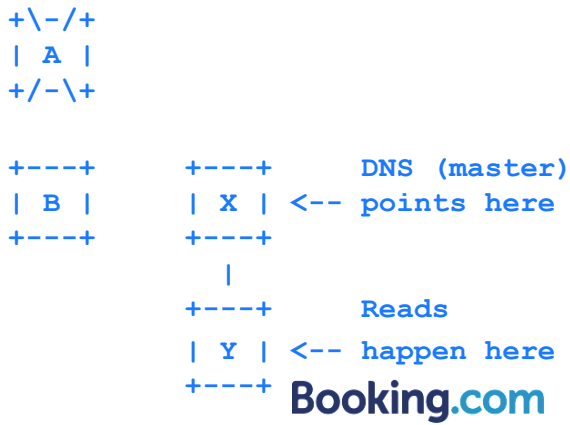
- But how did DNS end-up pointing to B ?
  - The failover to B called the DNS repointing script
  - The script stole the DNS entry from X and pointed it to B



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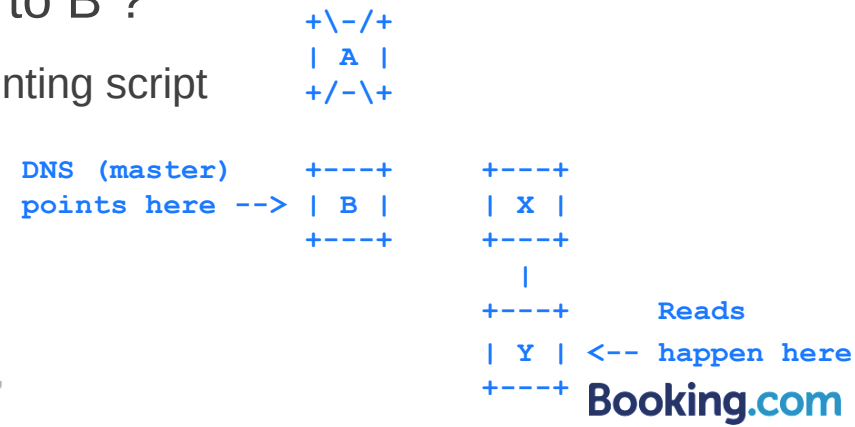
  - But is that all: what made A fail ?



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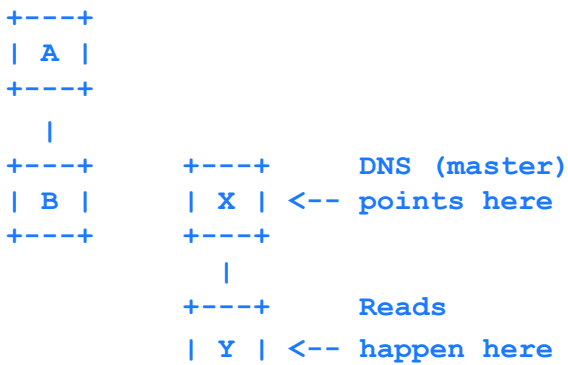

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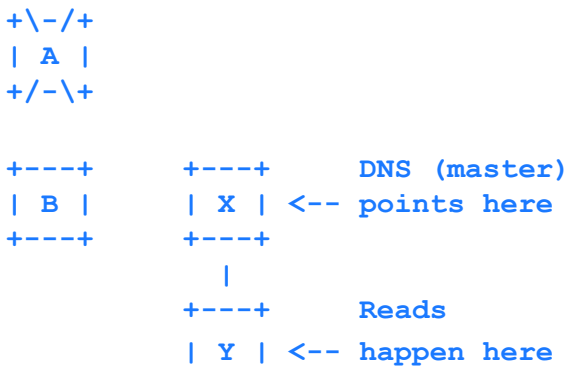

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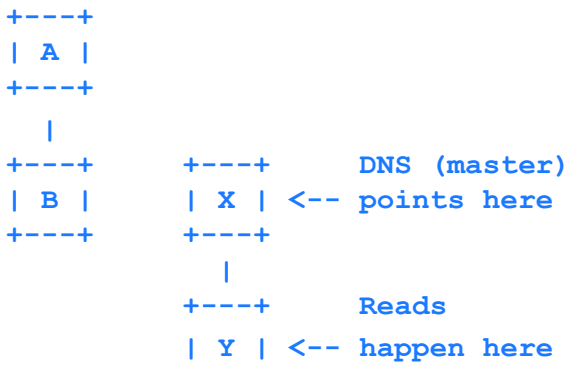

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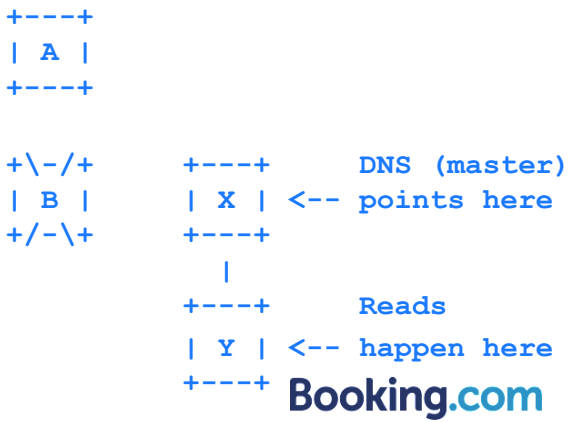

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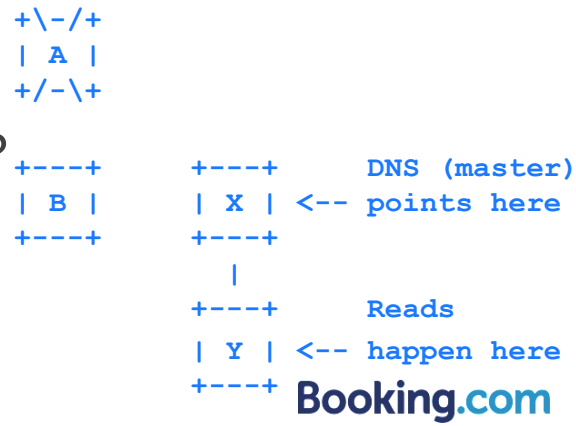
  - Then B could have been re-cloned without problems
  - But A was re-cloned instead (human error #1)
- Why did Orchestrator not fail over right away ?
  - B was promoted hours after A was brought down…
  - Because A was downed time only for 4 hours (human error #2)



Orchestrator anti-flapping

- Orchestrator has a failover throttling/acknowledgment mechanism[1]:
  - Automated recovery will happen
    - for an instance in a cluster that has not recently been recovered
    - unless such recent recoveries were acknowledged.
- In our case:
  - the recovery might have been acknowledged too early (human error #0 ?)
  - or the “recently” timeout might have been too short
  - and maybe Orchestrator should not have failed over the second time

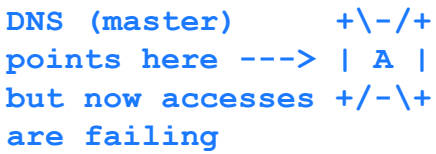
[1]: https://github.com/github/orchestrator/blob/master/docs/topology-recovery.md#blocking-acknowledgments-anti-flapping

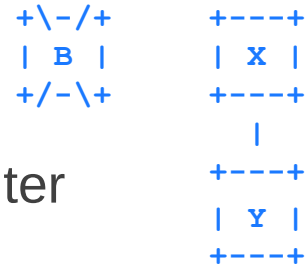
Split brain: summary

- So in summary, this disaster was caused by:
  1. A fancy failure: 2 servers failing in the same data center at the same time
  2. A debatable premature acknowledgment in Orchestrator
     and probably too short a timeout for recent failover
  3. Edge-case recovery: both servers forming a new replication topology
  4. Re-cloning of the wrong server (A instead of B)
  5. Too short downtime for the re-cloning
  6. Orchestrator failing over something that it should not have
  7. DNS repointing script not defensive enough

Fancy failure: more details

- Why did A and B fail at the same time ?
  - Deployment error: the two servers in the same rack/failure domain ?
  - And/or very unlucky ?





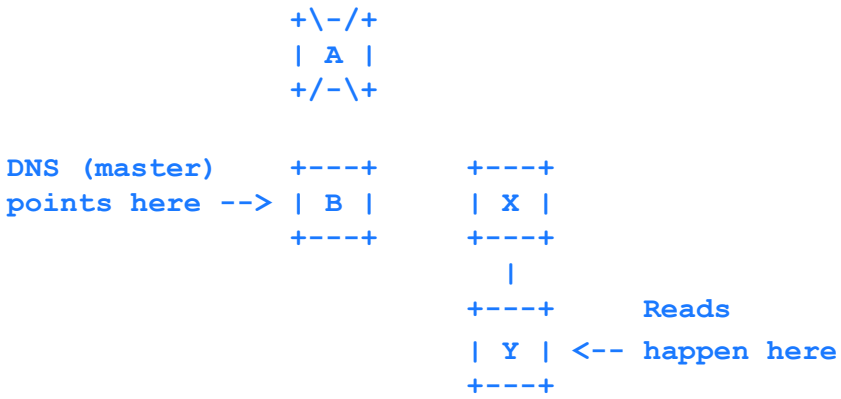
- Very unlucky because…

  10 to 20 servers failed that day in the same data center

  Because human operations and sensitive hardware

How to fix such situation ?

- Fixing non-intersecting data on B and X is hard.
- Some solutions are:
  - Kill B or X (and lose data)
  - Replay writes from B on X (manually or with replication)
  - But AUTO_INCREMENTs are in the way:
    - up to i used on A before 1st failover
    - i-n to j_1 used on X after recovery
    - i to j_2 used on B after 2nd failover



Takeaway

- Twisted situations happen
- Automation (including failover) is not simple:
  → code automation scripts defensively
- Be mindful for premature acknowledgment
- Downtime more than less
- Shutdown slaves first
- Try something else than AUTO-INCREMENTs for PK (monotonically increasing UUID[1] [2] ?)

[1]: https://www.percona.com/blog/2014/12/19/store-uuid-optimized-way/
[2]: http://mysql.rjweb.org/doc.php/uuid

Improvements in Orchestrator

- Orchestrator failed over something that it should not have
- Should Orchestrator be changed ?
  - I do not know…
  - Not easy to define what should be changed
  - Suggestions welcome
    https://github.com/github/orchestrator/issues

Links

- Booking.com Blog: https://blog.booking.com/
- GitHub Orchestrator: https://github.com/github/orchestrator/
- UUID as Primary Key:
  - https://www.percona.com/blog/2014/12/19/store-uuid-optimized-way/
  - http://mysql.rjweb.org/doc.php/uuid/
- Myself:
  - https://jfg-mysql.blogspot.com/
  - https://www.linkedin.com/in/jfg956/

Thanks

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