CSCI 2270: Advanced Topics in Database Management

Zephyr: Live Migration In Shared Nothing Databases For Elastic Cloud Platforms

"Cut Me Some Slack": Latency-Aware Live Migration For Databases

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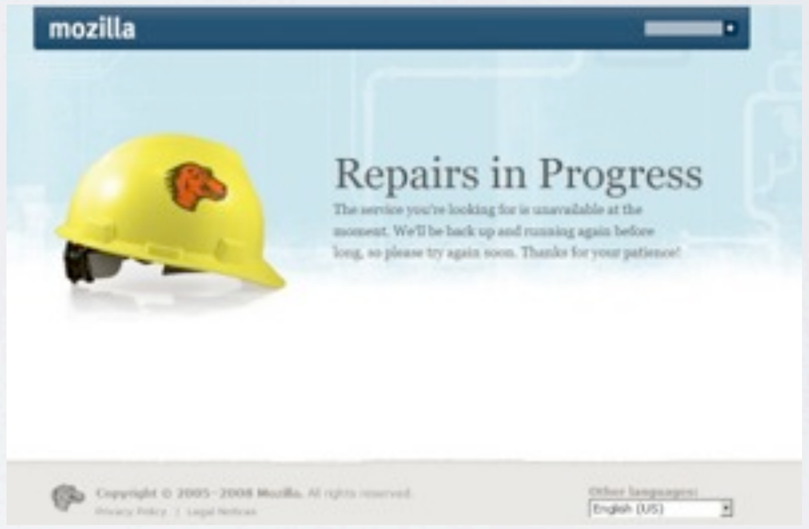
BACKGROUND

- Infrastructures for large cloud platforms is challenged by applications that has **small data footprint** and **unpredictable load patterns**
- **System's operating cost** becomes critical if it's built on a **pay-per-use infrastructure**
- We want to minimize **cost** and guarantee **service** at the same time
- Elastic load balancing is wanted: 1)scale **up and down** based on the load 2) low cost to migrate data between hosts
- How can we achieve this ?

LIVE MIGRATION

- Why Live Migration?
- (Against **Stop & Copy**)



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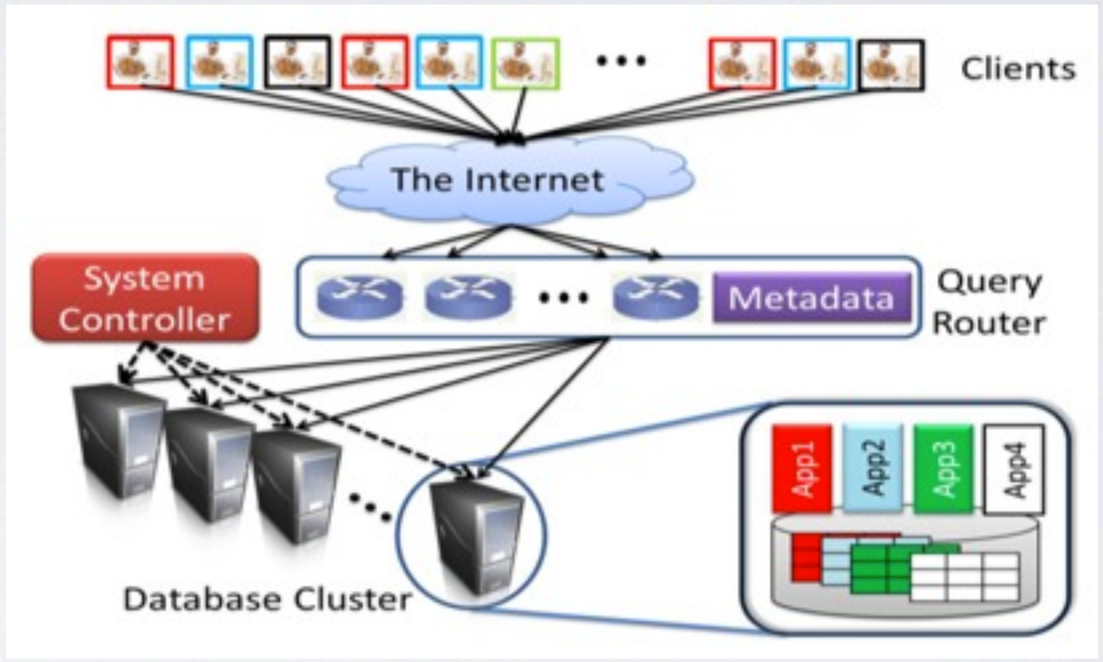
English (US)

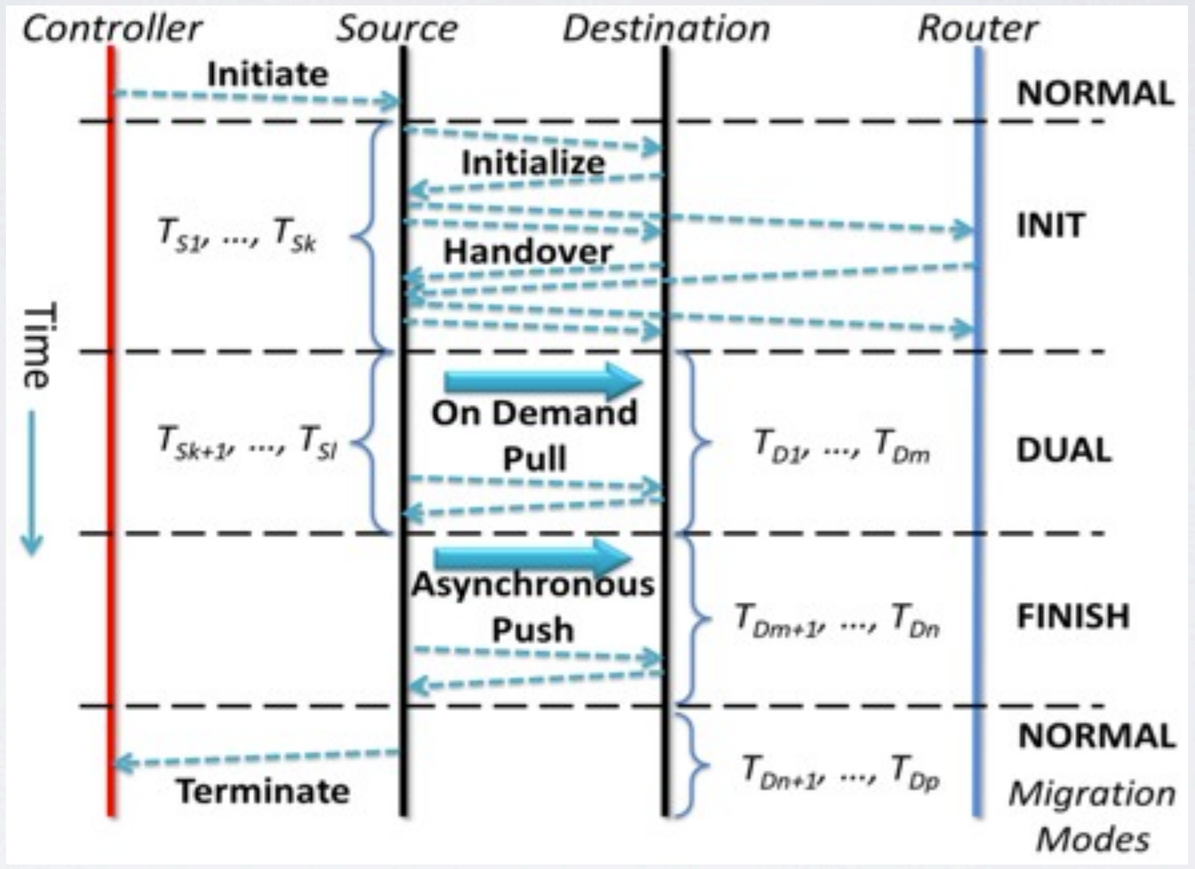
WHAT IS ZEPHYR

- Implemented in an open source RDBMS
- First complete end-to-end solution for live migration in a shared nothing database architecture
- Very light-weighted



HOW ZEPHYR WORKS

- Normal Mode
- Init Mode
- Dual Mode
- Finish Mode



KEY IDEAS

- Init Mode

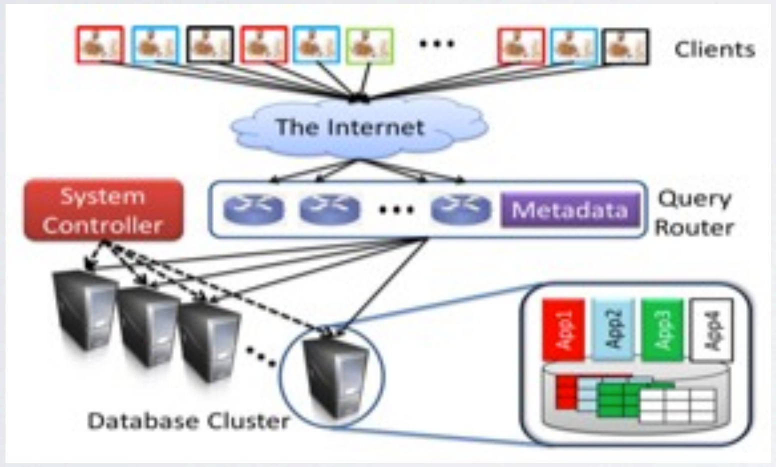
- Source node bootstraps destination node by sending wireframe (schema, data definitions, etc.)
- Source node is still the unique owner of Dm

- Dual Mode

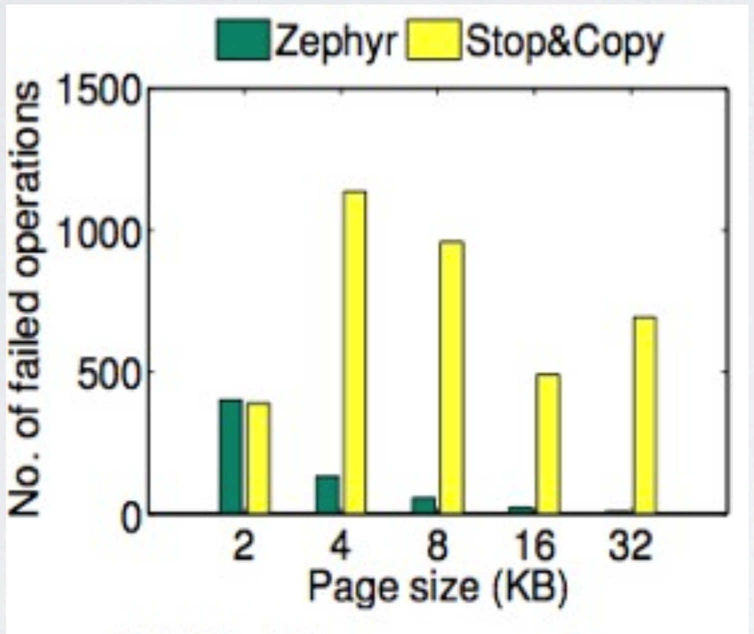
- Destination node notifies the source node about the completion of initialization
- Source node tells the query router to direct all new txns to destination node
- Both Source node and Destination node are the owner of Dm
- Pages are transferred to destination node on-demand
- Source node give up the ownership of Dm and destination owns Dm itself

- Finish Mode

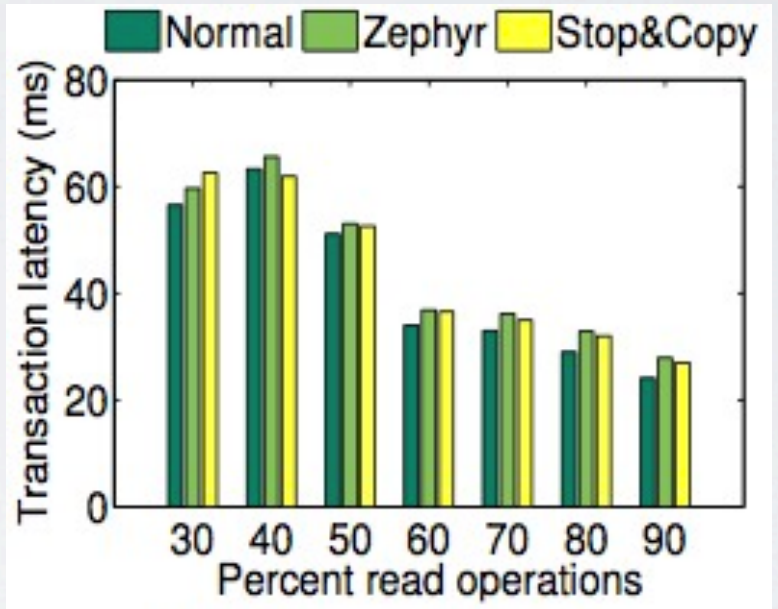
- Source node transfers the remaining pages of Dm to the destination node
- Source node initiates the termination of migration
- Source node and destination node work on normal mode



EXPERIMENTAL RESULTS



(b) Database page size

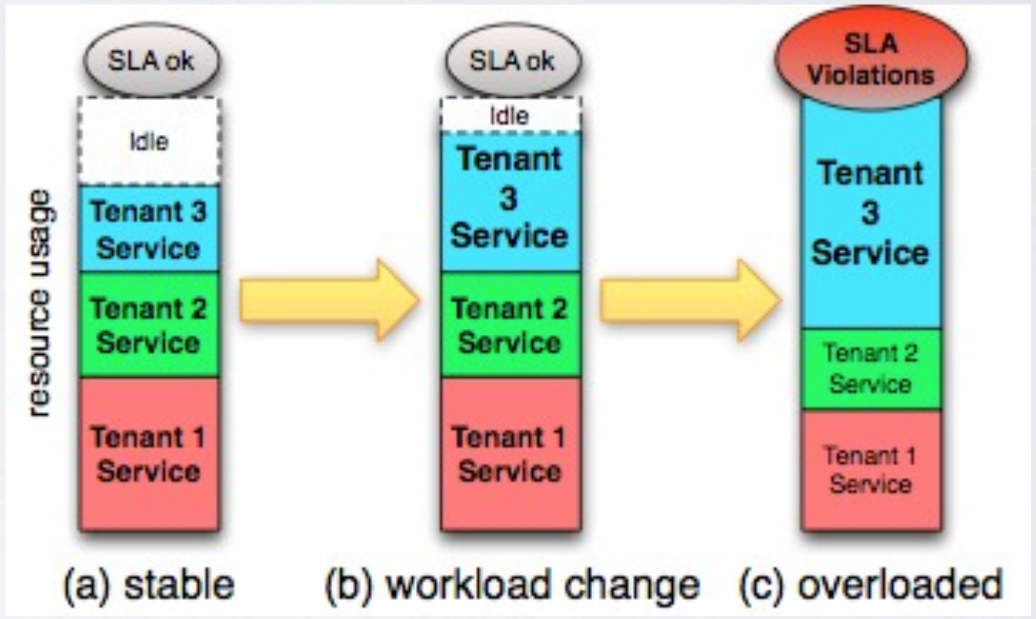


(c) Average latency

ANY QUESTIONS?

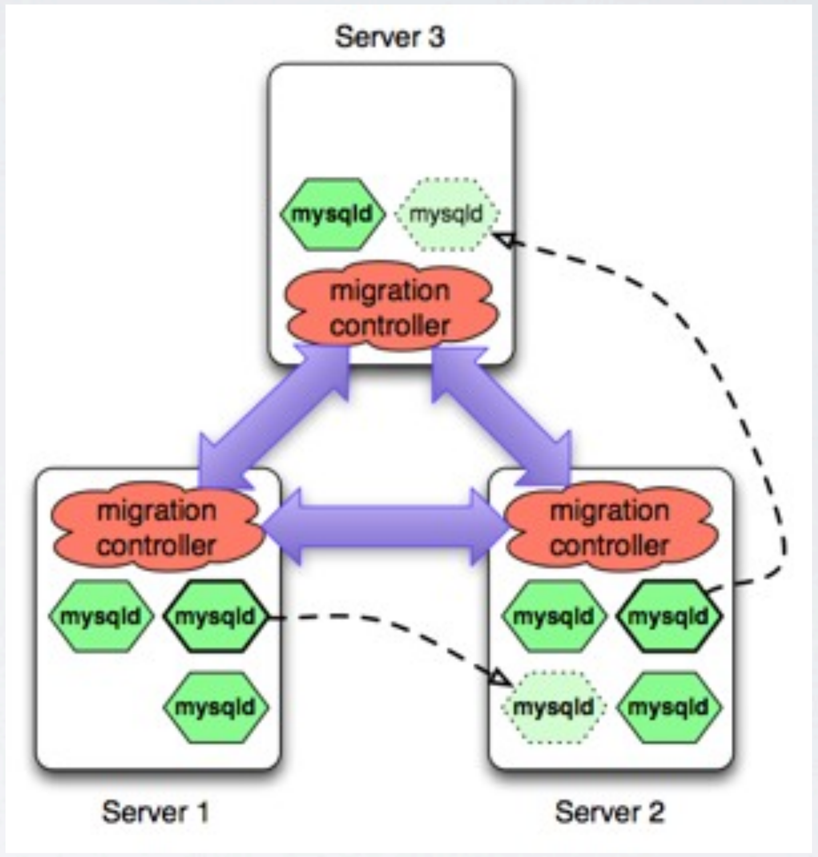
"Cut Me Some Slack": Latency-Aware Live Migration For Databases

- "Shared something database"
- Migrating data elegantly
- Can be implemented outside of a database product
- Used several existing tools, like XtraBackup, pv



SLACKER KEY IDEAS

- Slacker Architecture
  - Each server runs an instance of Slacker
  - Slackers migrates MySQL instances between servers that run Slacker

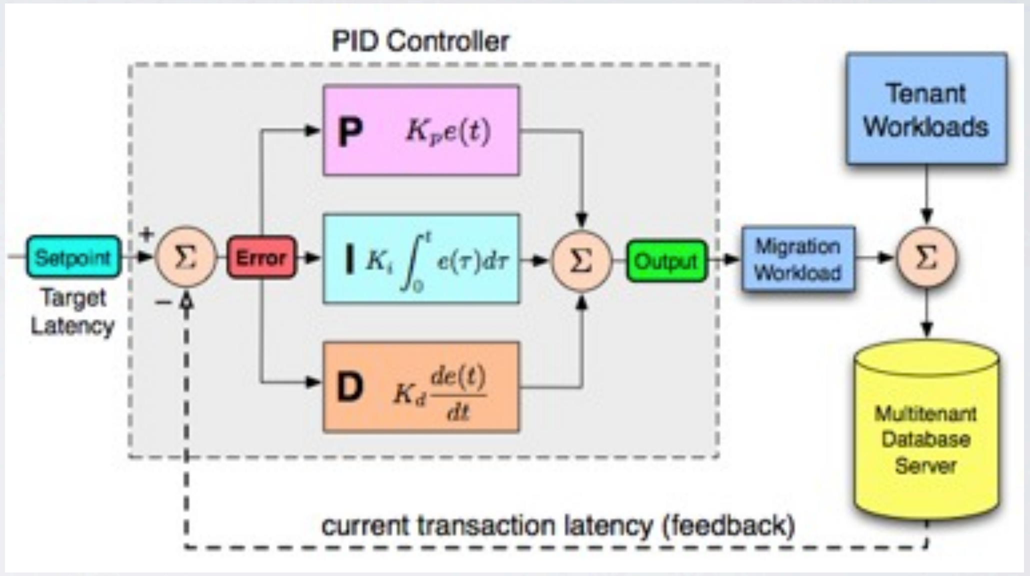


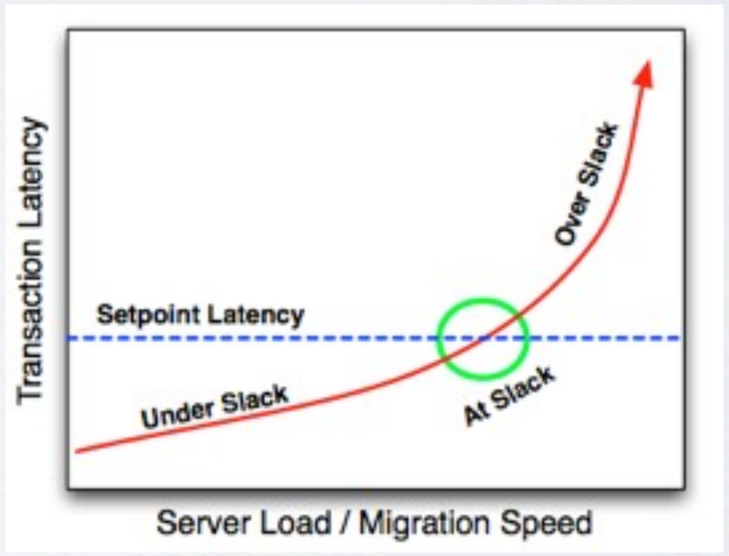
SLACKER KEY IDEAS

- Migration Slack & Setpoint Latency
    - Resources can be used for migration
    - The latency that maintains acceptable query performance
    - Migration throttling: control the cost of each migration
    - Need to adjust the cost on-the-fly (based on workloads)

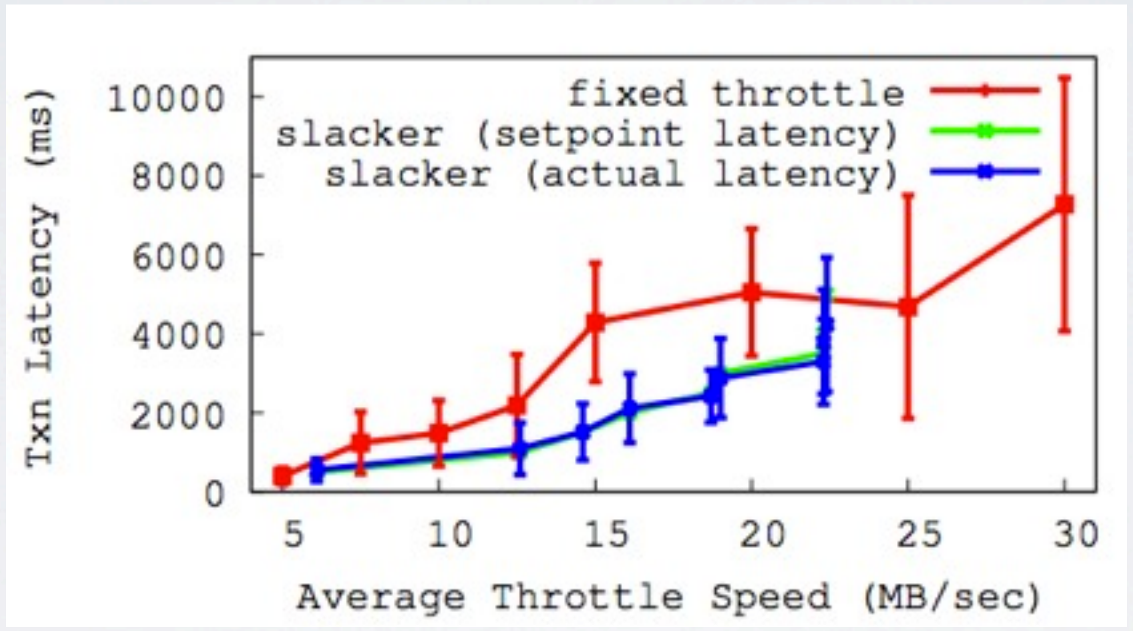
SLACKER KEY IDEAS

- Adaptive Dynamic Throttling
    - Determine the speed of migration according to the slack
    - Adjust the speed of migration according to the slack in real time
    - Speed of migration is controlled by PID
        - Control the migration speed to make the transaction latency as close as the setpoint latency





EXPERIMENTAL RESULTS



CONCLUSION

- Zephyr: how to do migration
- Slacker: how to migrate data as fast as possible
- Zephyr + Slacker = Live Migration in H-Store (Hopefully...)

ANY QUESTIONS?

THANKS!