

# Web-scale Data Management

Group 2 - Pragmatic Project

# Technologies used

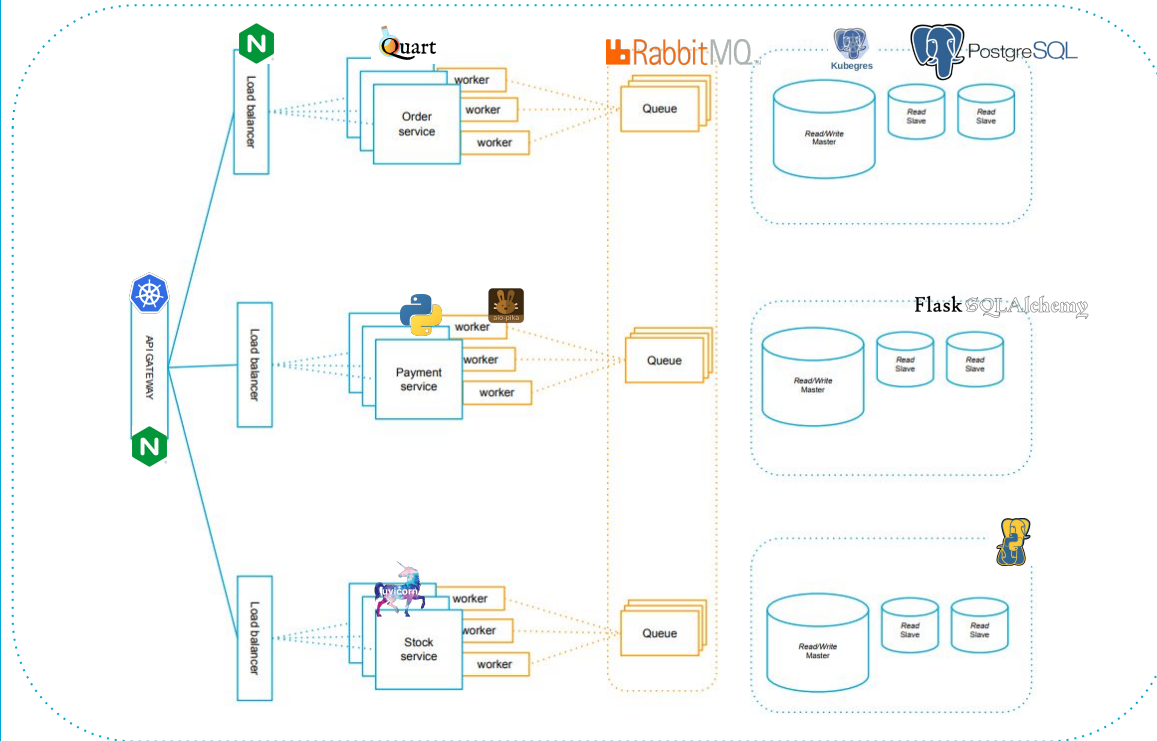


Flask SQLAlchemy



web development,  
one drop at a time

# Architecture Diagram



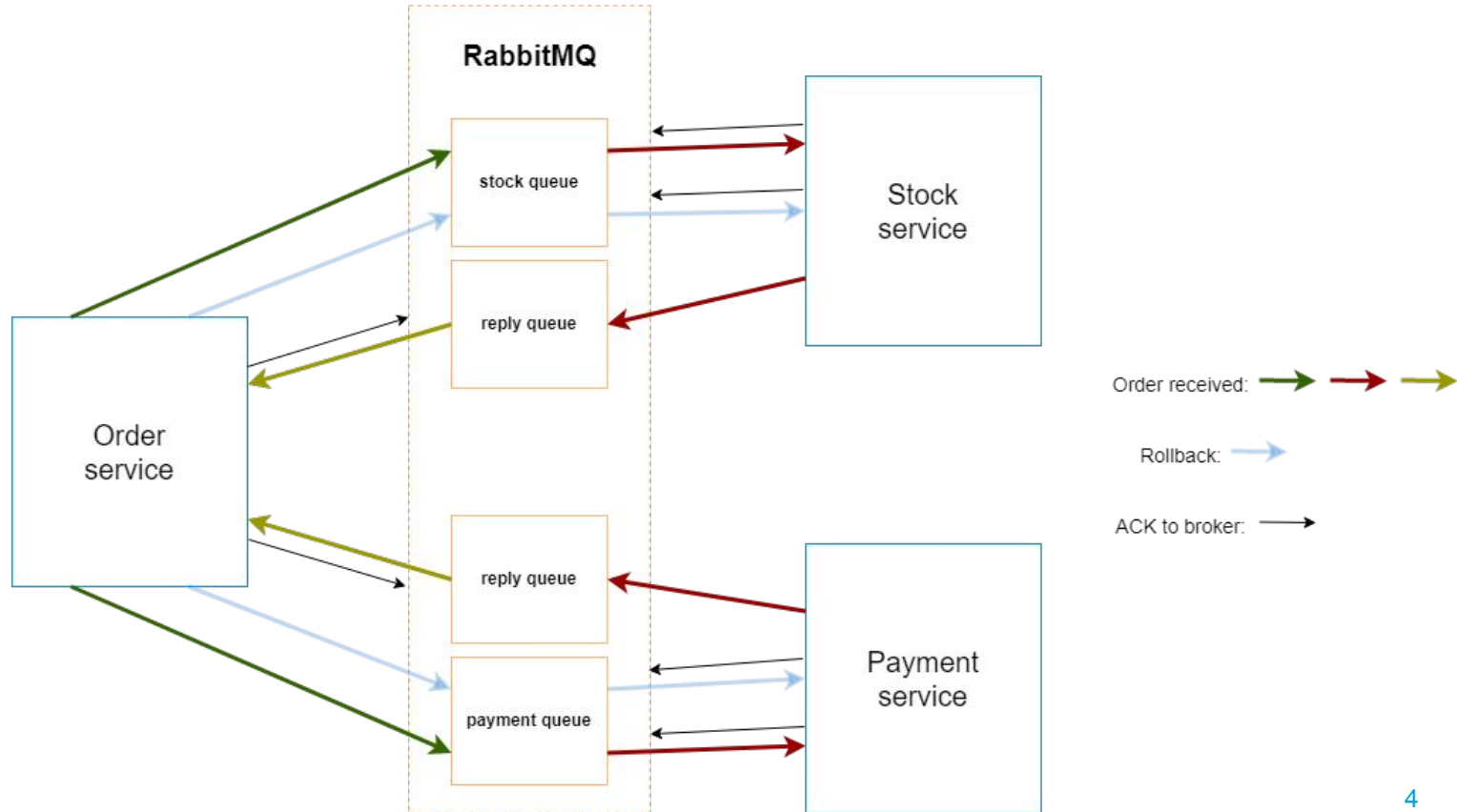
## Deployment



## Monitoring & Observing

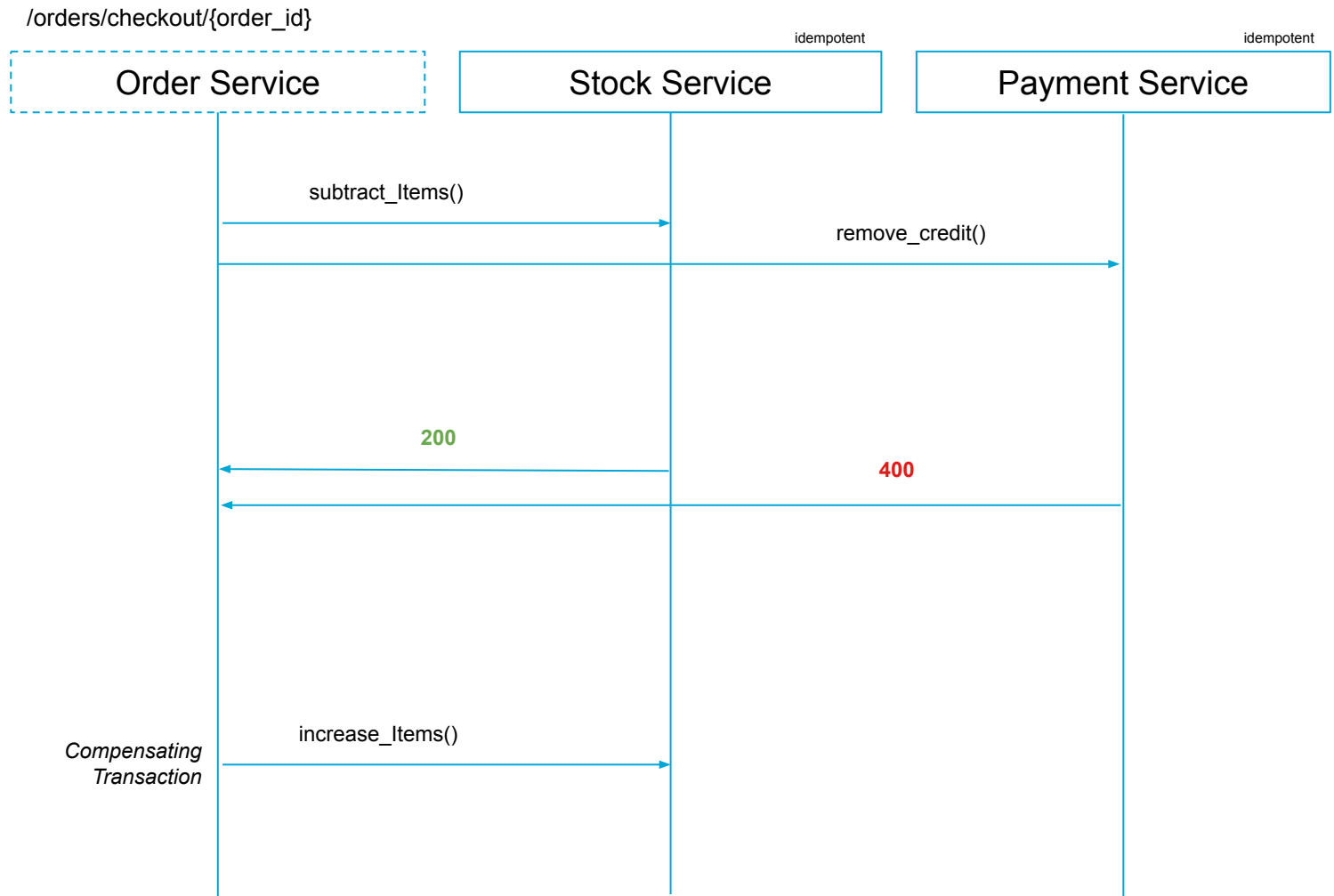


# Messaging



# Orchestration based SAGA

## Method of transaction execution



# SAGA Guarantees

## ACID

Atomicity: 

Consistency: 

Isolation: 

Durability: 

## BASE

Base Availability: 

Soft state: 

Eventual Consistency: 

# Consistency

## Eventual consistency

- Eventual consistency using SAGA [1], see SAGA guarantees
- BASE guarantees: Basic Availability, Soft State, Eventual Consistency [2]

## PostgreSQL consistency

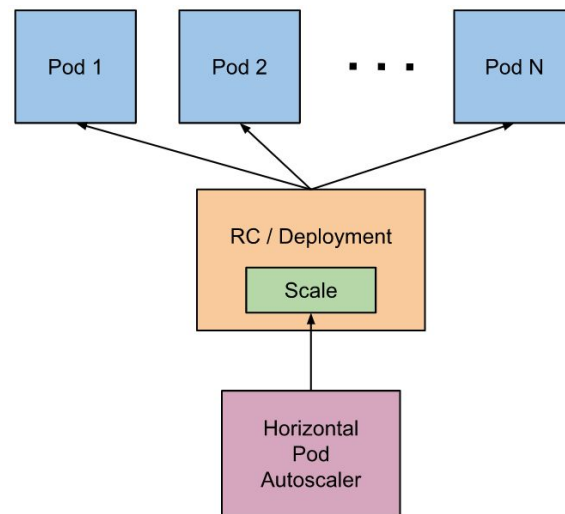
- Enforcing correct data using database constraints [3]
- “READ COMMITTED” transaction level [4]
  - Read sees snapshot of database, dirty read not possible
  - Write waits for concurrent transactions on target rows

## Correctness of transactions

- Correctness through code checks
- Distributed Transactions possible through acknowledgements using RabbitMQ

# Scalability

- Kubernetes Horizontal Pod Autoscaling
- Kubeegres for PostgreSQL clusters + replicas
- Load balancing using Ingress
- Asynchronous messaging
- **No sharding and multiple masters**





# Fault Tolerance

## Database Fault Tolerance

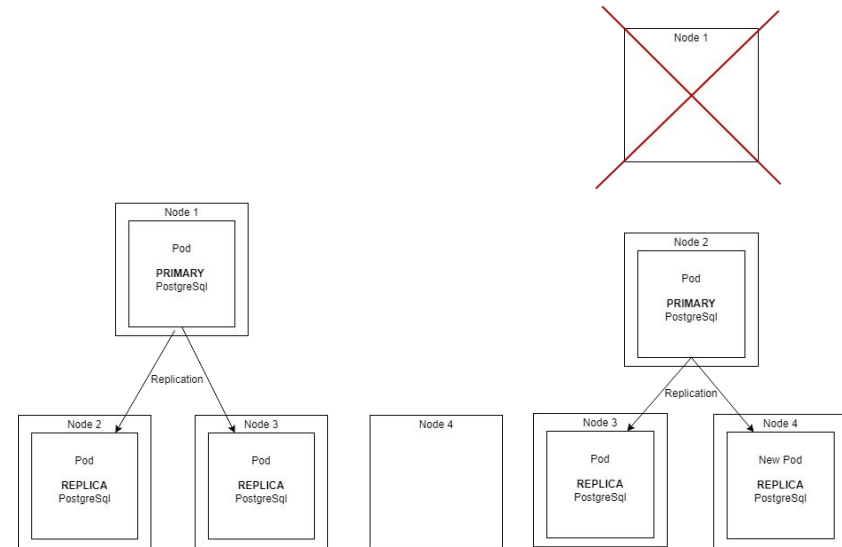
- Pod-anti affinity [5]
- Failover [5]

## Microservice Fault Tolerance

- Stateless and replicated
- Self-healing [6]

## Communication Fault Tolerance

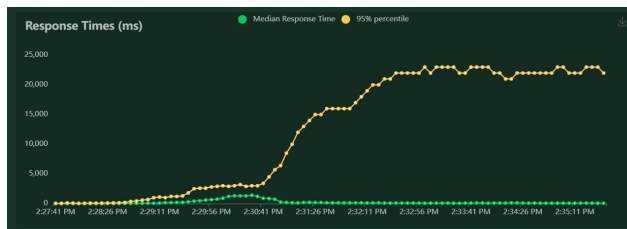
- Acknowledgements [7]
- Quorum Queues [8]
- RabbitMQ Cluster [9]



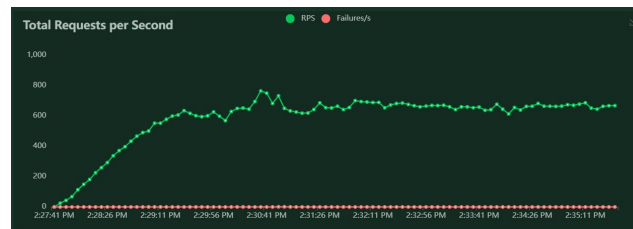
# Results

Method	Name	# Requests	# Fails	Average (ms)	Min (ms)	Max (ms)	Average size (bytes)	RPS	Failures/s
	Aggregated	282031	30	1391	3	25278	30	594.7	0.1

• Latency: 110ms



• Throughput: 595/s



# Limitations

- *Kubegres* does not allow sharding or multi-master replication. An example which does, is *BDR* [10].
- There is probably a bug somewhere, causing slow response times.

# References

- [1] <https://medium.com/trendyol-tech/saga-pattern-briefly-5b6cf22dfabc>
- [2] <https://www.scylladb.com/glossary/database-consistency/>
- [3] <https://stackoverflow.com/questions/14225998/flask-sqlalchemy-column-constraint-for-positive-integer>
- [4] <https://www.postgresql.org/docs/current/transaction-iso.html#XACT-READ-COMMITTED>
- [5] <https://www.kubegres.io/doc/replication-and-failover.html>
- [6] <https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/>
- [7] <https://www.rabbitmq.com/confirmations.html>
- [8] <https://www.rabbitmq.com/quorum-queues.html#usage>
- [9] <https://www.rabbitmq.com/kubernetes/operator/operator-overview.html>
- [10] <https://www.linkedin.com/pulse/multi-master-replication-relational-databases-scaling-ran-bechor/>