Cloud-based Online Concert Ticketing System

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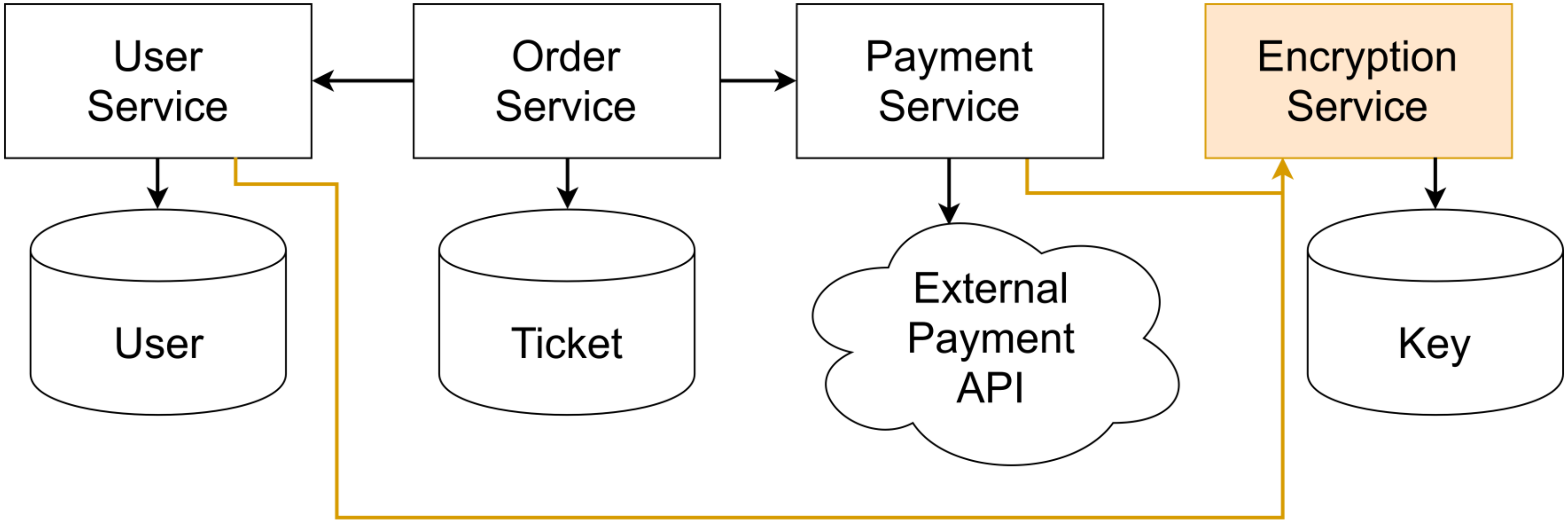
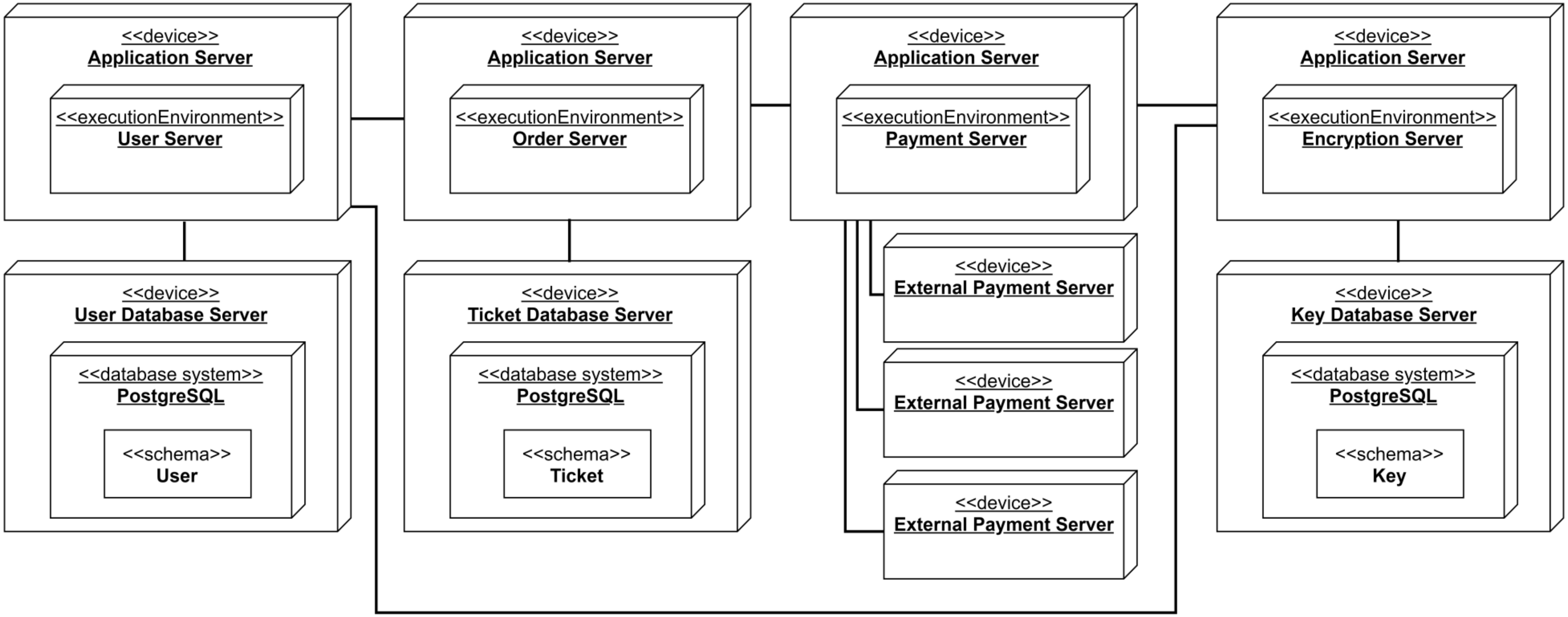
Architecture Overview

General Overview

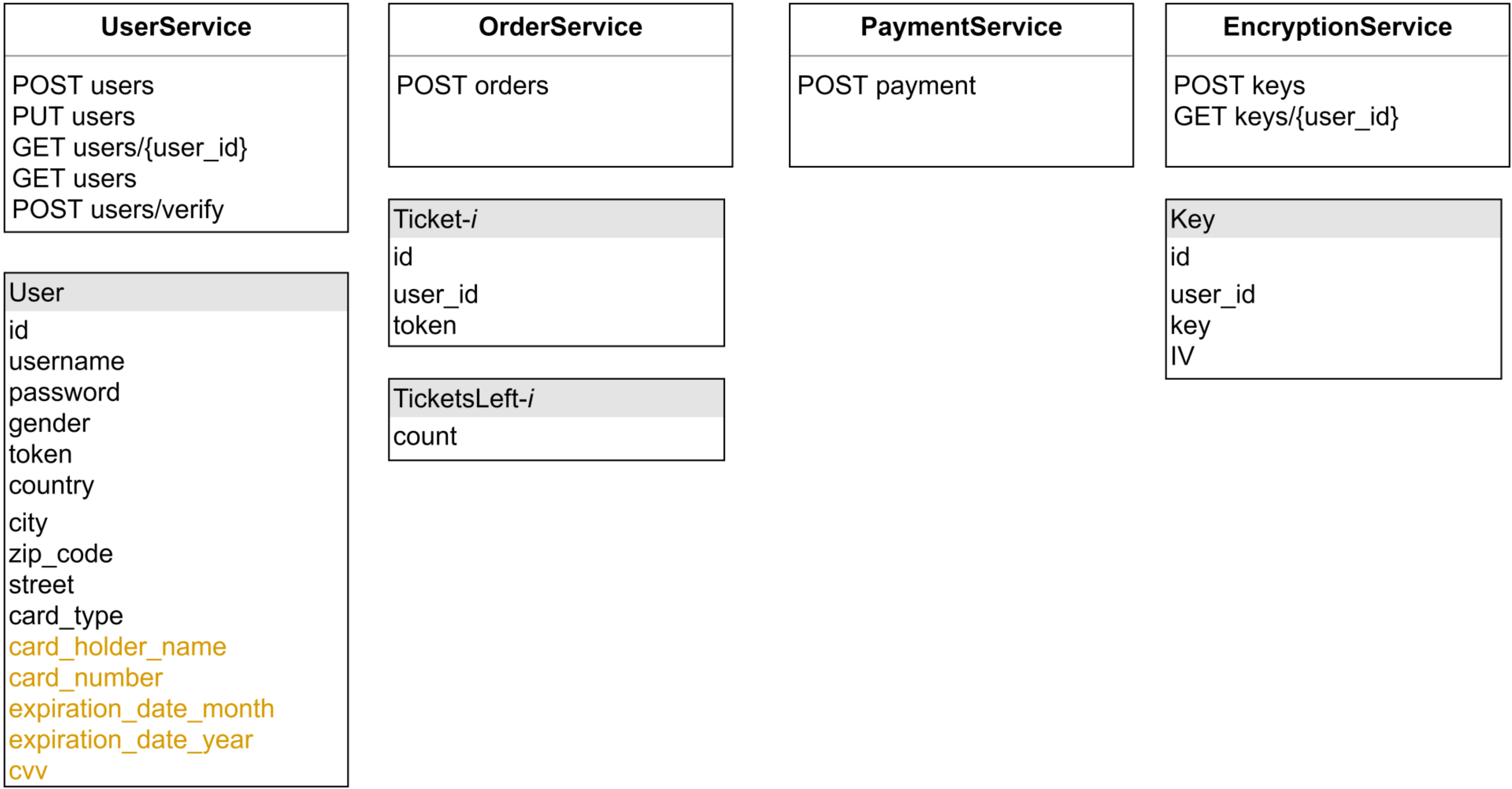


Deployment Diagram



Https (REST API)

Class Diagram and Database Schemas



UserService

POST users
PUT users
GET users/{user_id}
GET users
POST users/verify

User

id
username
password
gender
token
country
city
zip_code
street
card_type
card_holder_name
card_number
expiration_date_month
expiration_date_year
cvv

OrderService

POST orders

Ticket-*i*

id
user_id
token

TicketsLeft-*i*

count

PaymentService

POST payment

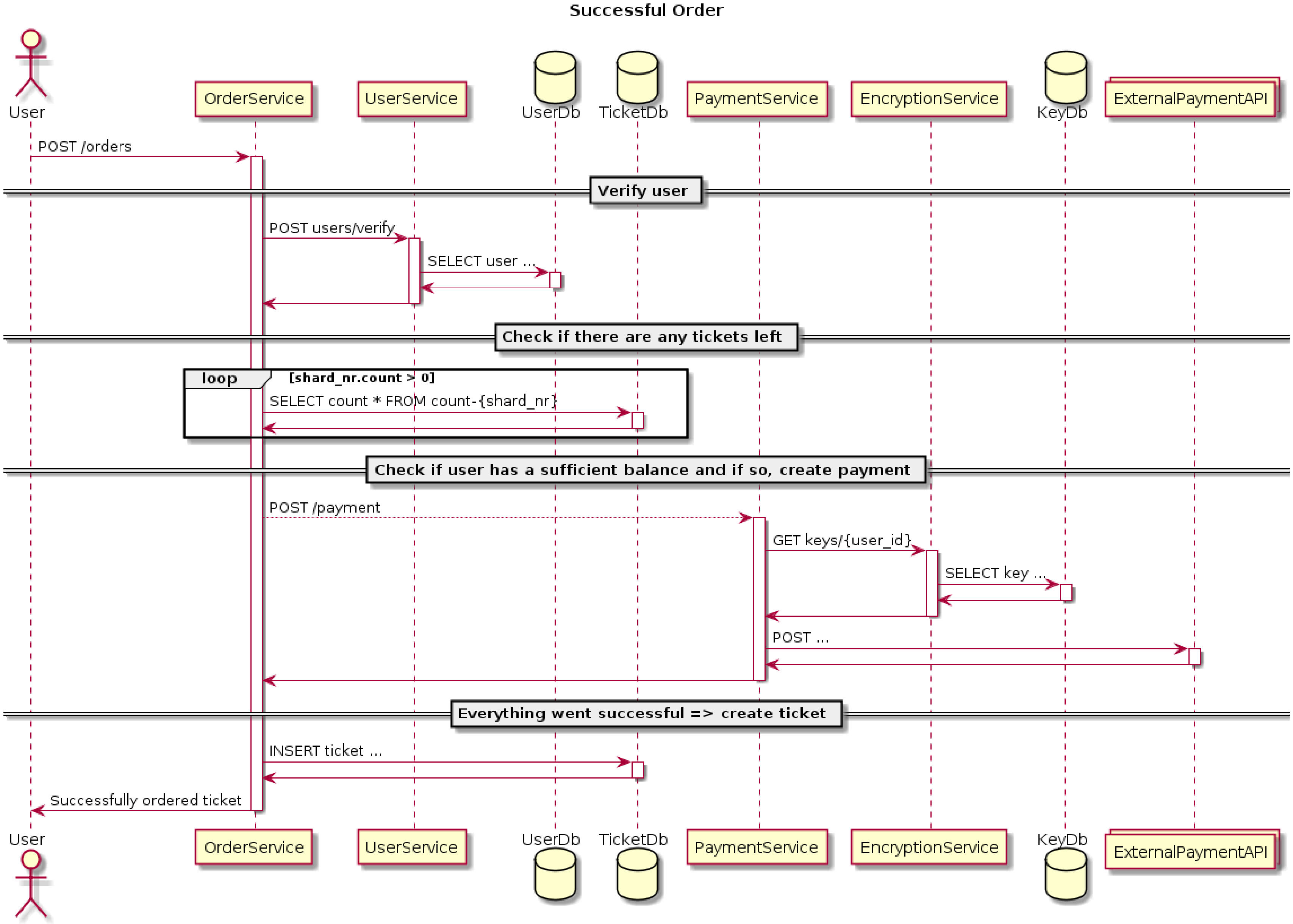
EncryptionService

POST keys
GET keys/{user_id}

Key

id
user_id
key
IV

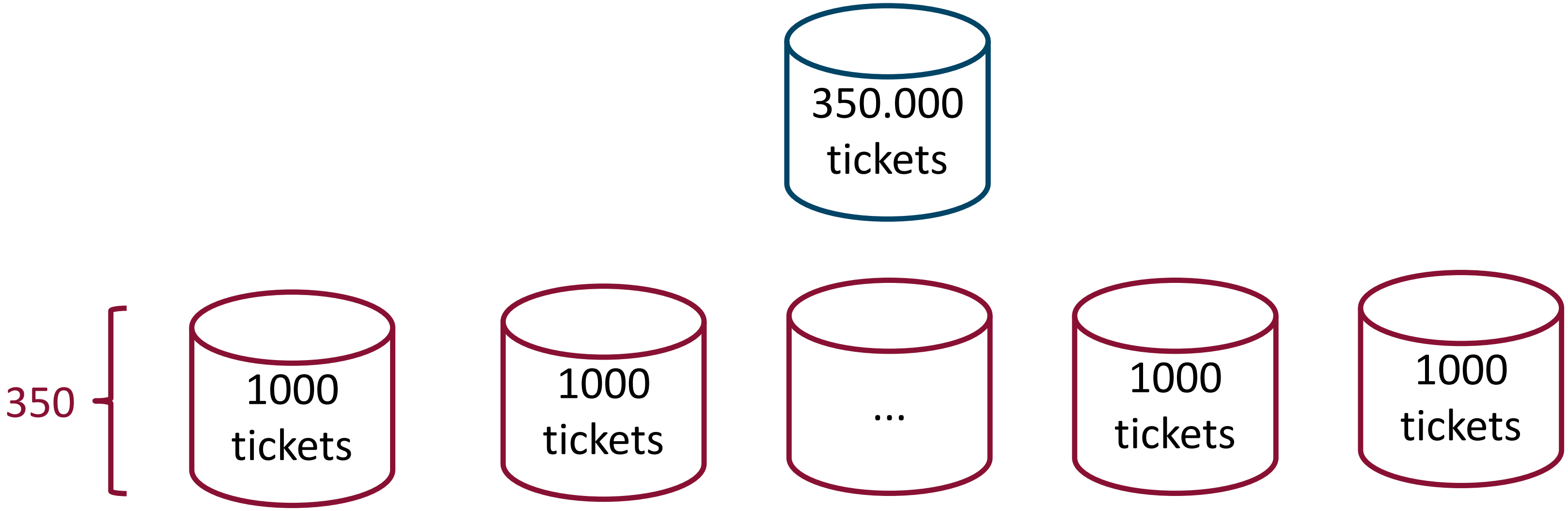
Sequence Diagram



Revisiting Old Conclusions

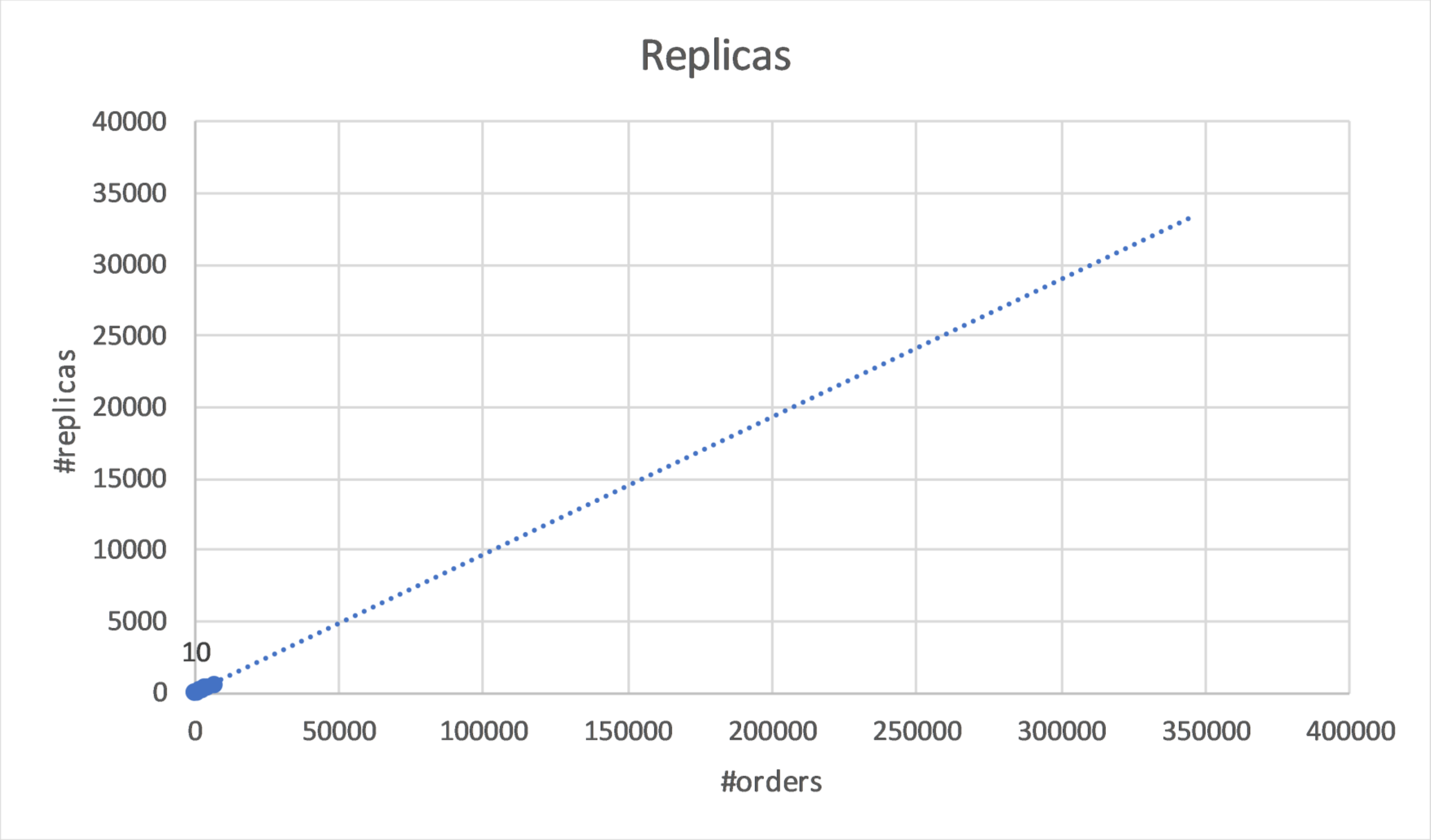
Bottlenecks

- Database => database sharding



- External payment API => solution?

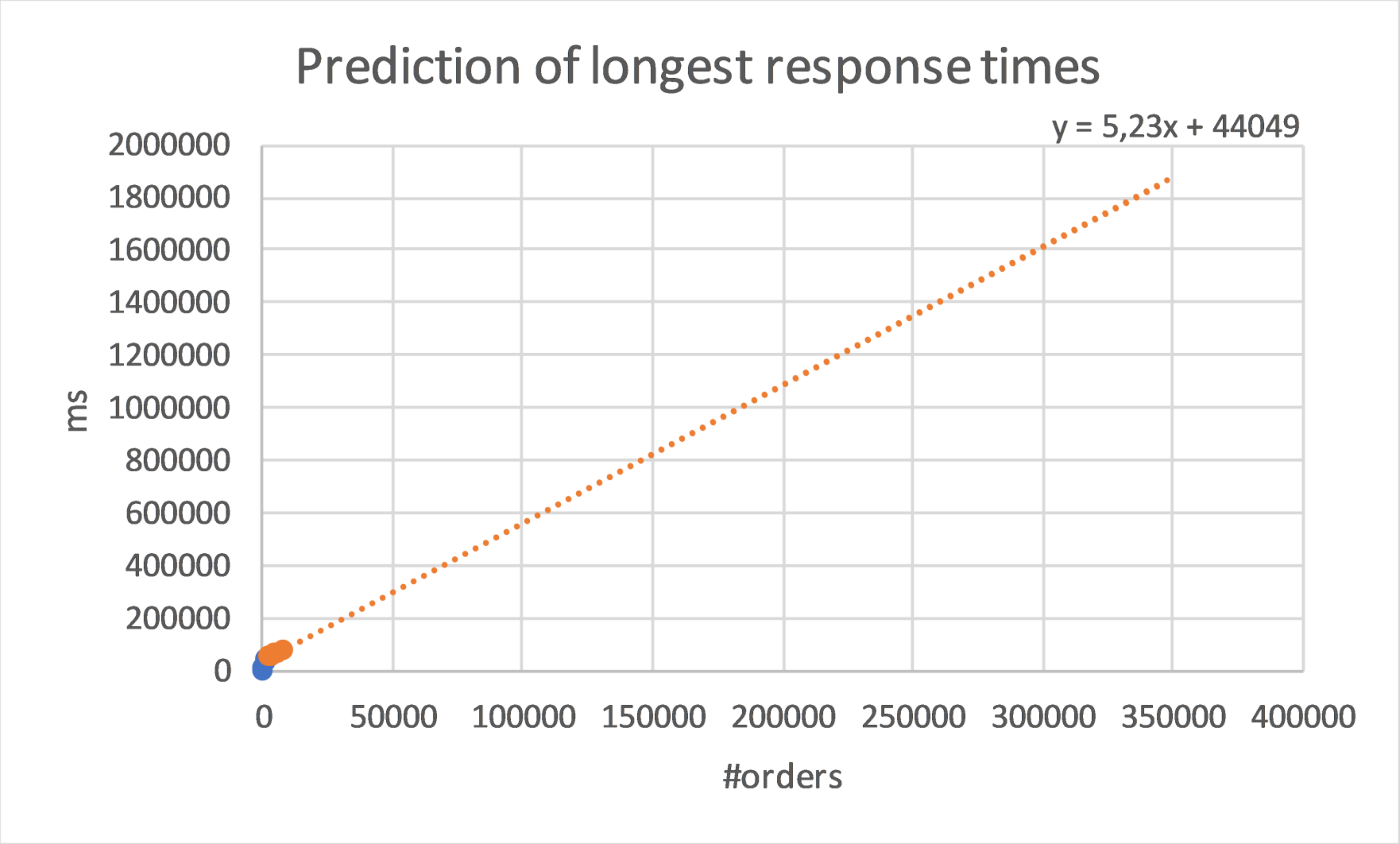
Prediction number of replicas



Prediction number of replicas

- 35.000 replicas?
- Probably only **350** (or more?) replicas = 350 shards
- Maybe even less, one replica can handle **multiple requests concurrently**
- Note: replica ≠ server

Prediction response times

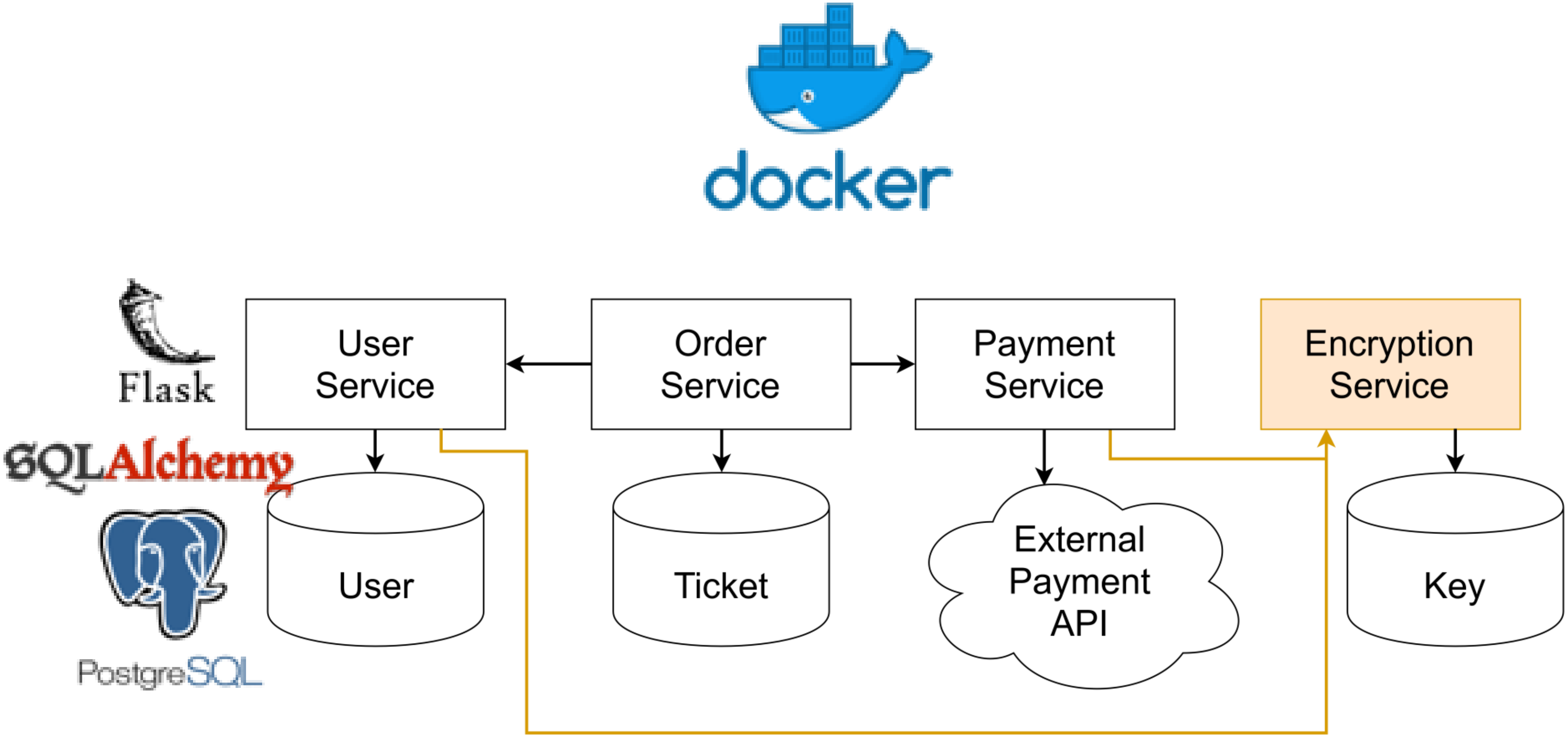


Ordering 350.000 tickets at same time => longest response time = 1.874.549ms ≈ 31min.

Ordering **106.300 tickets** at same time => longest response time ≈ 600.000ms = **10 min.**

Set up

Architecture

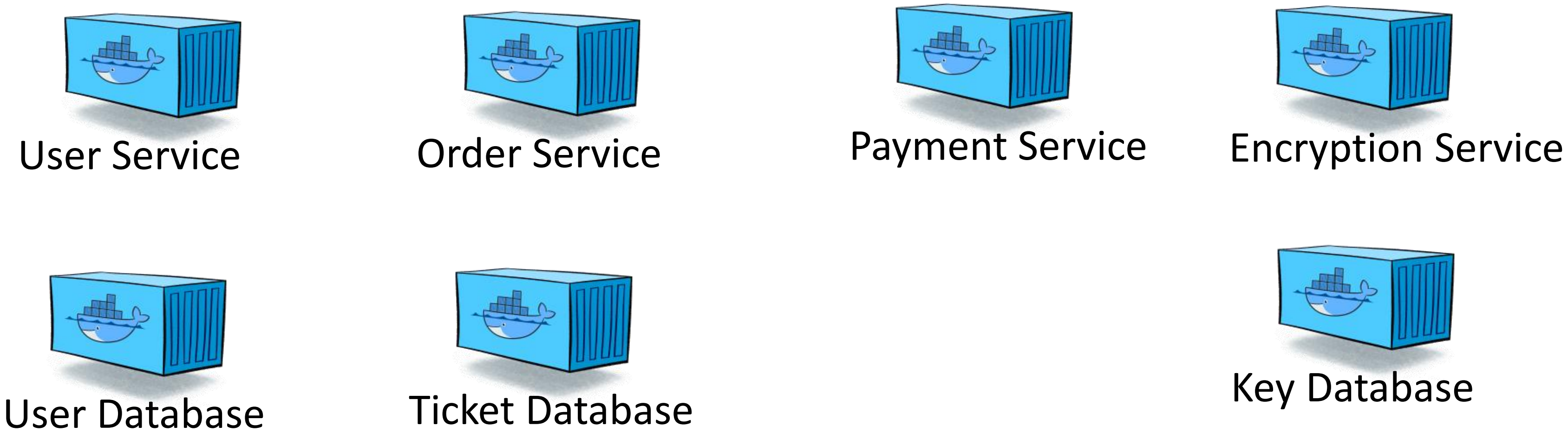


Docker containers

kubernetes

minikube

Note: Everything ran on just **one machine**



User Service

Order Service

Payment Service

Encryption Service

User Database

Ticket Database

Key Database

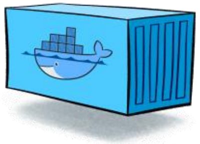
Autoscaler

- Kubernetes **Horizontal Pod Autoscaler** (HPA)

```
desiredReplicas =
  ceil[currentReplicas * ( currentMetricValue / desiredMetricValue )]
```

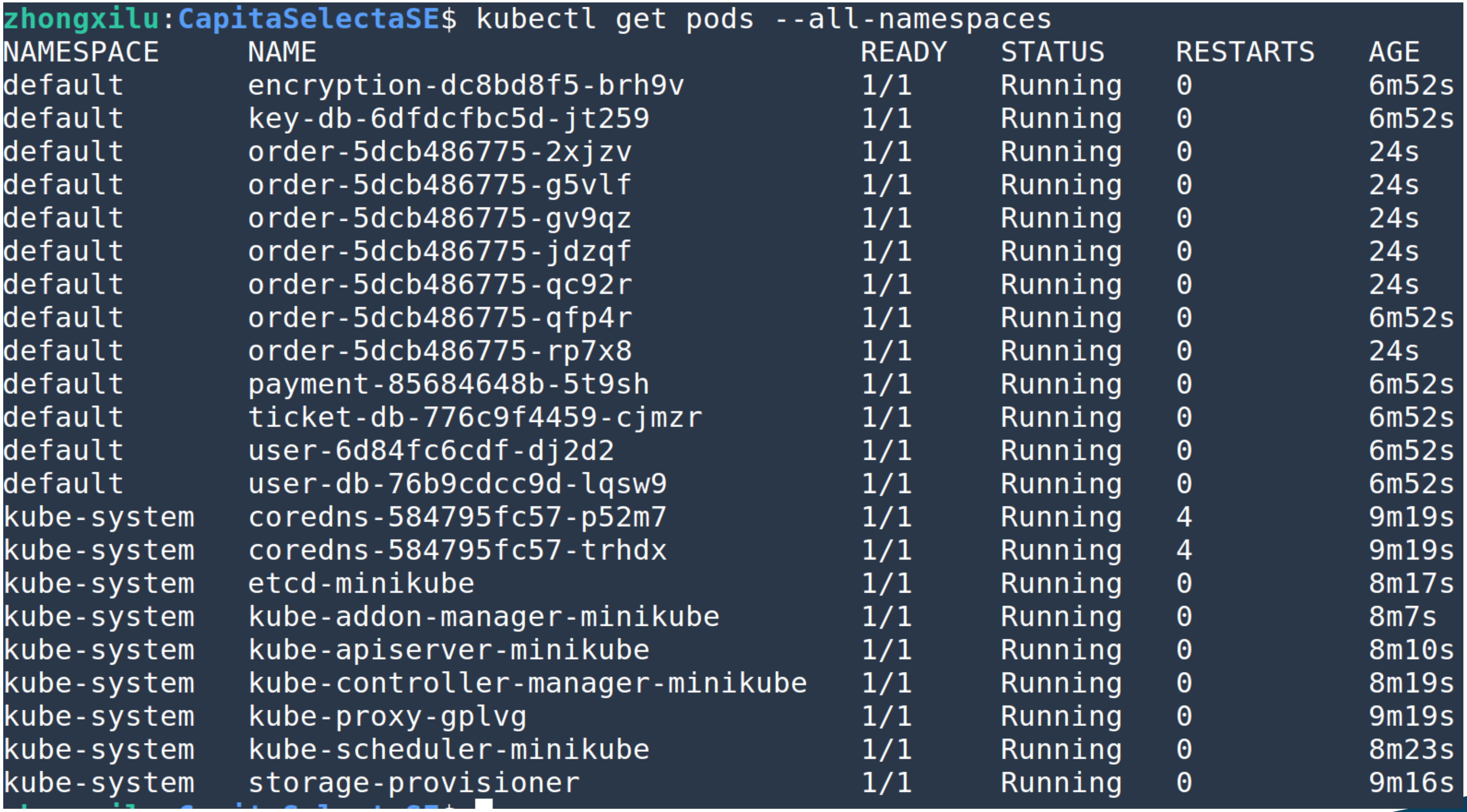
(https://kubernetes.io/docs/tasks/run-application/horizontal-pod-autoscale/#algorithm-details)

- However, best **scale to maximum at start**
- Scale Order Service



Order Service

Minikube Setup



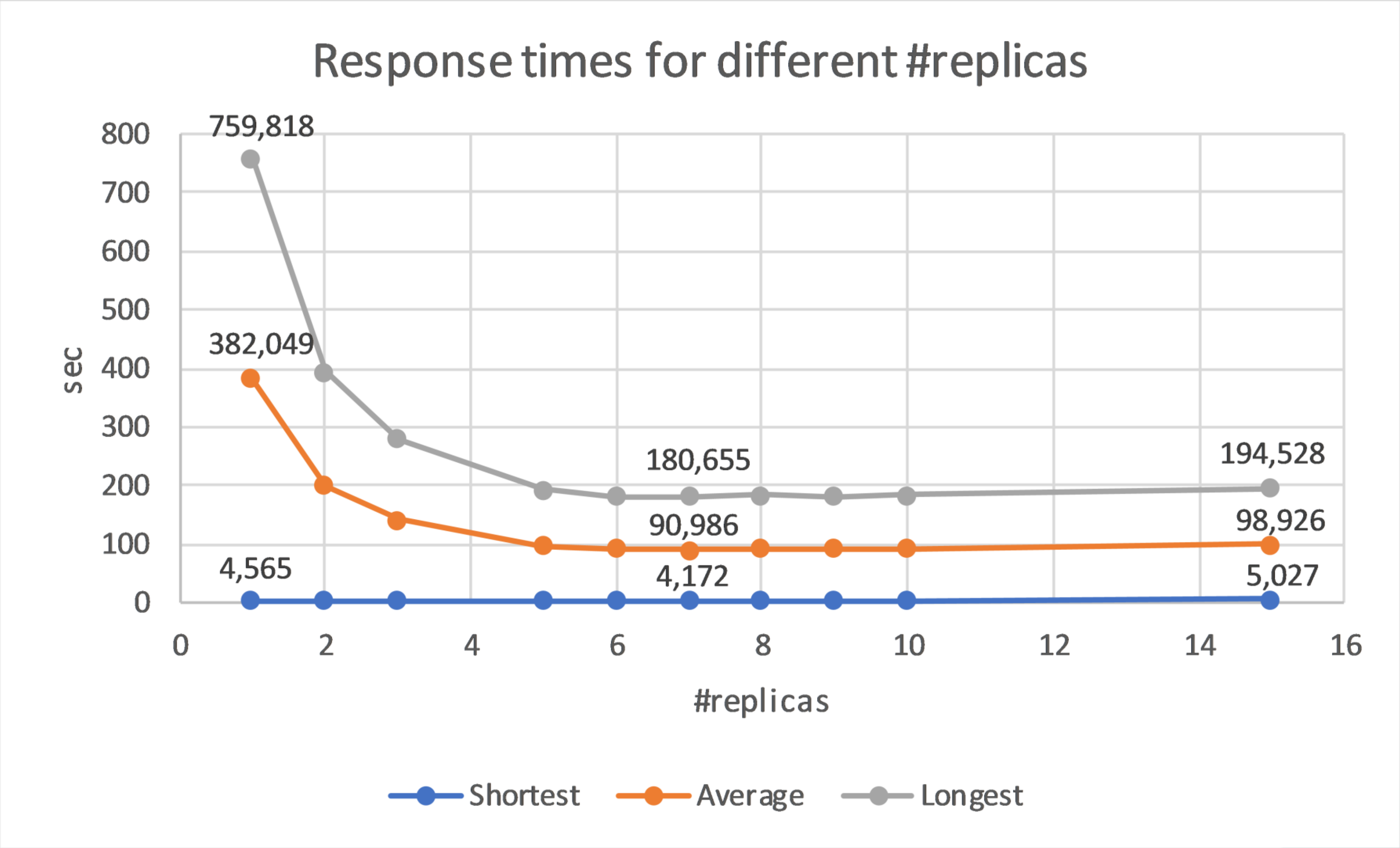
```
zhongxilu:CapitaSelectaSE$ kubectl get pods --all-namespaces
NAMESPACE     NAME                                READY   STATUS    RESTARTS   AGE
default       encryption-dc8bd8f5-brh9v           1/1     Running   0          6m52s
default       key-db-6dfdcfbc5d-jt259             1/1     Running   0          6m52s
default       order-5dcb486775-2xjzv              1/1     Running   0          24s
default       order-5dcb486775-g5vlf              1/1     Running   0          24s
default       order-5dcb486775-gv9qz              1/1     Running   0          24s
default       order-5dcb486775-jdzqf              1/1     Running   0          24s
default       order-5dcb486775-qc92r              1/1     Running   0          24s
default       order-5dcb486775-qfp4r              1/1     Running   0          6m52s
default       order-5dcb486775-rp7x8              1/1     Running   0          24s
default       payment-85684648b-5t9sh             1/1     Running   0          6m52s
default       ticket-db-776c9f4459-cjmzr          1/1     Running   0          6m52s
default       user-6d84fc6cdf-dj2d2               1/1     Running   0          6m52s
default       user-db-76b9cdcc9d-lqsw9            1/1     Running   0          6m52s
kube-system   coredns-584795fc57-p52m7            1/1     Running   4          9m19s
kube-system   coredns-584795fc57-trhdx            1/1     Running   4          9m19s
kube-system   etcd-minikube                       1/1     Running   0          8m17s
kube-system   kube-addon-manager-minikube         1/1     Running   0          8m7s
kube-system   kube-apiserver-minikube             1/1     Running   0          8m10s
kube-system   kube-controller-manager-minikube    1/1     Running   0          8m19s
kube-system   kube-proxy-gplvg                    1/1     Running   0          9m19s
kube-system   kube-scheduler-minikube             1/1     Running   0          8m23s
kube-system   storage-provisioner                 1/1     Running   0          9m16s
zhongxilu:CapitaSelectaSE$
```

Results

Load Test Script

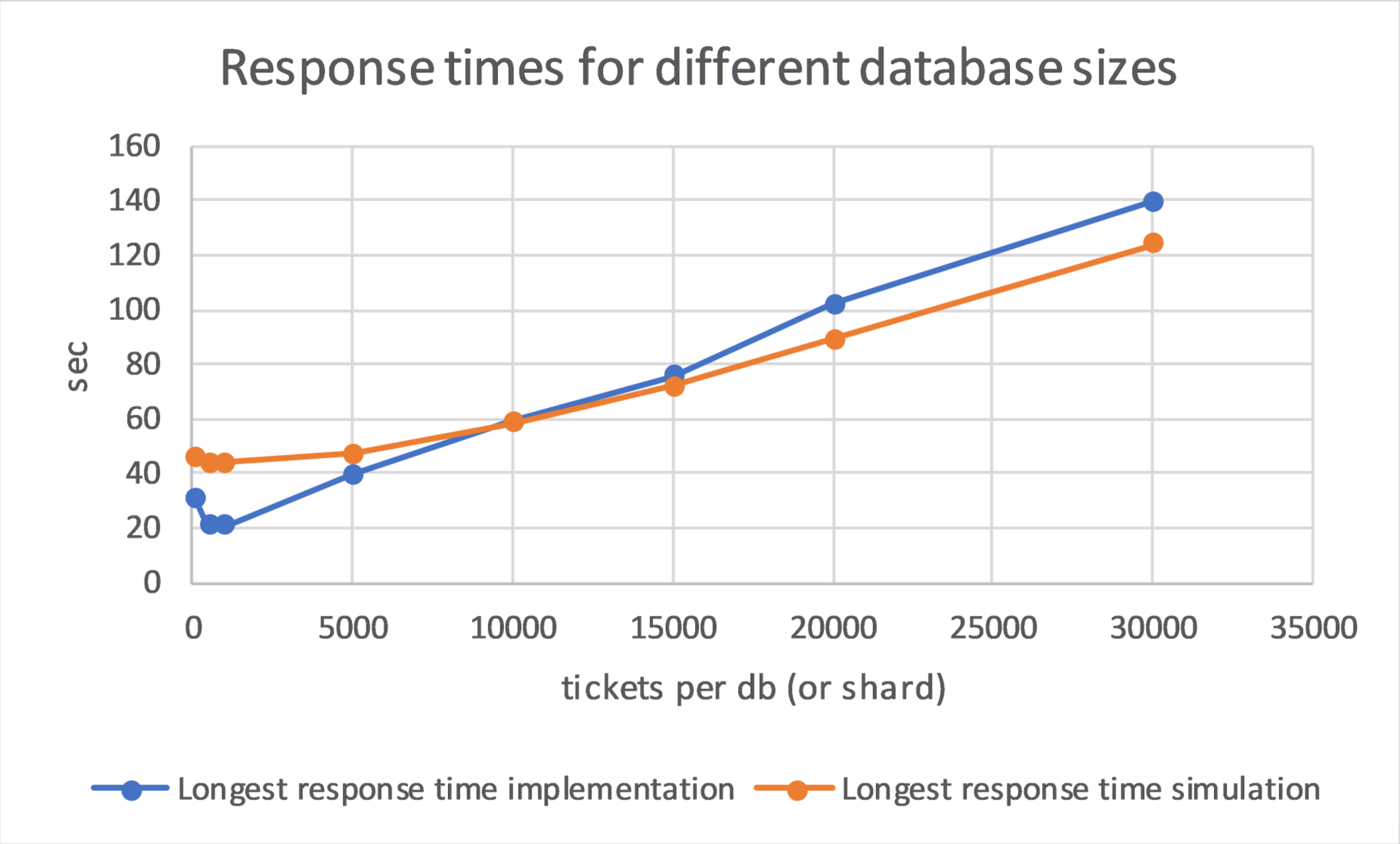
- Before: *n* registered users
- Retrieve all users
- Order ticket for each registered user at the same time (***n* requests**)

Number of replicas for Order service



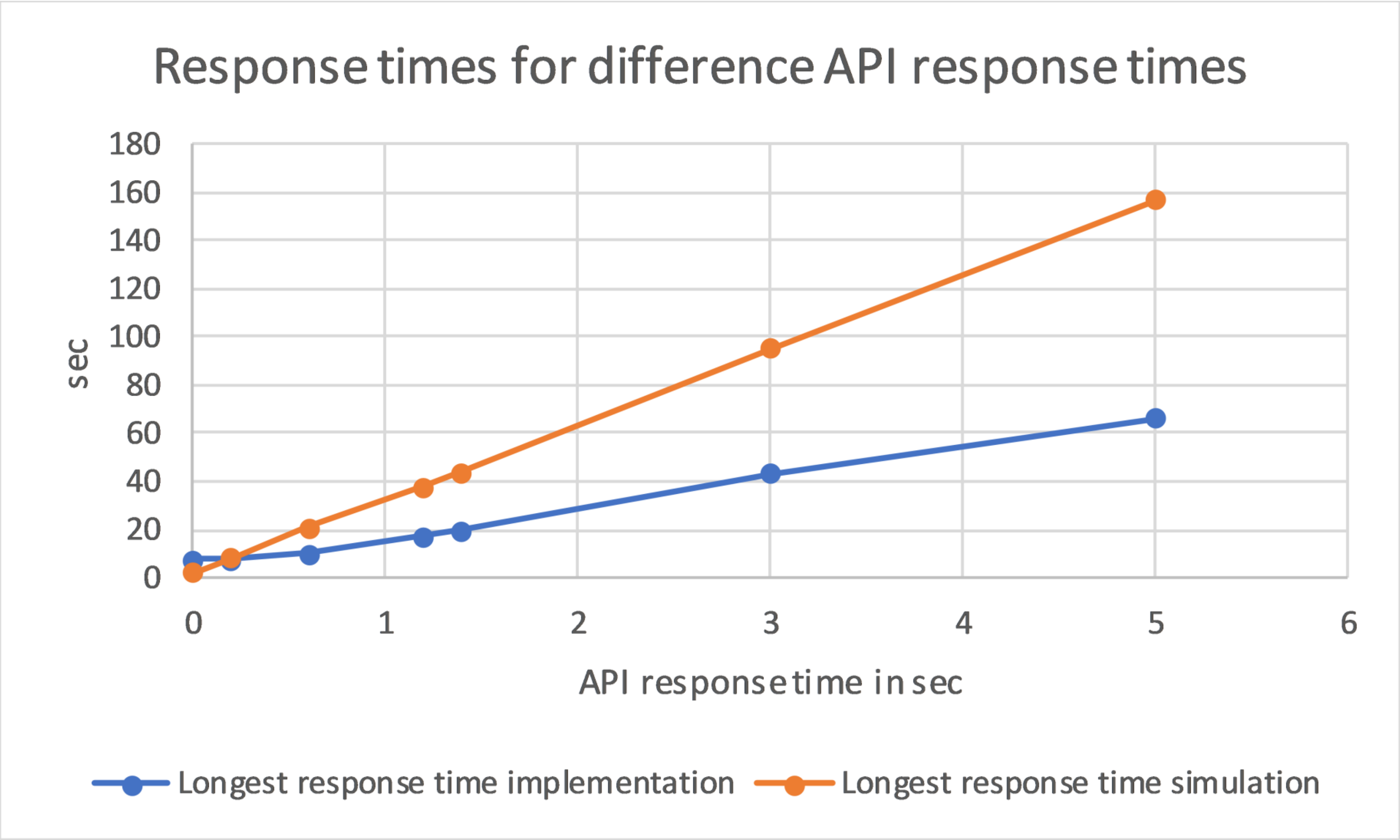
Ordering 10.000 tickets

Number of shards



Ordering 1000 tickets

External API bottleneck



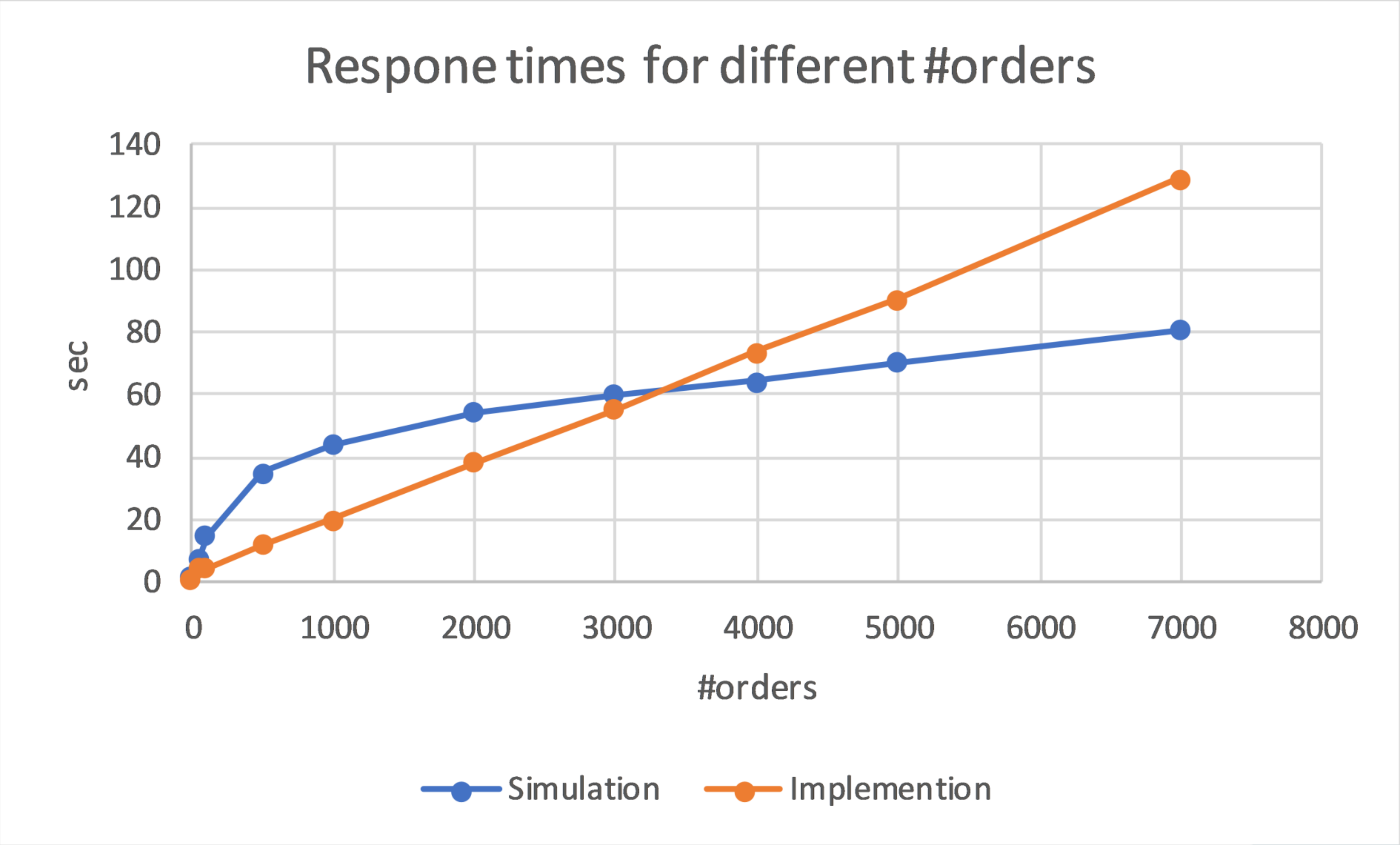
Ordering 1000 tickets

Encryption

- Ordering 10.000 tickets at the same time:

	w/ encryptions	w/o encryptions
Shortest response time	4.5 sec	4.29 sec
Average response time	90.57 sec	87.711 sec
Longest response time	178.023 sec	172.408 sec

Comparison with ABS simulations



Peak Load

- **31.186 tickets** ordered at same time for response time less than 10 min
- *Important*: only using **one machine**

Conclusion (again)

- So does it respond in less than 10 min during peak load?
  - *It depends...*
    - *How much is the actual **peak load**?*
    - *How much **resources** available?*
    - *Processing time **external payment API**?*
  - But system **scales dynamically** on cloud