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ANALISIS KINERJA *MICROSERVICES* DENGAN POLA *COMMAND QUERY RESPONSIBILITY SEGREGATION* PADA BERAGAM JENIS BASIS DATA

SKRIPSI

diajukan untuk memenuhi sebagian syarat memperoleh gelar
Sarjana Komputer Program Studi Rekayasa Perangkat Lunak

Oleh :

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PROGRAM STUDI REKAYASA PERANGKAT LUNAK

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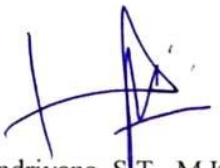
ANALISIS KINERJA *MICROSERVICES* DENGAN POLA
COMMAND QUERY RESPONSIBILITY SEGREGATION
PADA BERAGAM JENIS BASIS DATA

disetujui dan disahkan oleh pembimbing:

Pembimbing I



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LEMBAR PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul "**Analisis Kinerja Microservices Dengan Pola Command Query Responsibility Segregation Pada Beragam Jenis Basis Data**" ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung risiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

Bandung, Januari 2023

Yang membuat pernyataan

Muhammad Raihan Satrio Putra Pamungkas

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KATA PENGANTAR

Bismillahirrahmanirrahim

Puji dan syukur kehadirat Allah *subhanahu wa ta'ala* atas segala rahmat, karunia, keberkahan dan hidayah-Nya, sehingga penulis dapat menyelesaikan seluruh proses penelitian hingga penyusunan karya tulis skripsi yang berjudul "Analisis Kinerja Microservices Dengan Pola Command Query Responsibility Segregation Pada Beragam Jenis Basis Data".

Sebagai mahasiswa yang berperan untuk memberikan perubahan ke arah yang lebih baik melalui kontribusi keilmuan serta keterampilan, maka penulis menyadari fenomena perkembangan teknologi yang kian pesat terjadi bersamaan dengan adanya kesenjangan pengetahuan ataupun keterampilan. Khususnya pada kajian keilmuan di bidang rekayasa perangkat lunak. Hal tersebut menjadi motivasi bagi penulis untuk memberikan kontribusi pengetahuan ataupun keterampilan sesuai dengan perkembangan saat ini, salah satunya melalui penelitian ini.

Penulis berharap bahwa hasil penelitian yang tercantum dalam karya tulis skripsi ini dapat memberikan kontribusi baru yang bermanfaat khususnya bagi keilmuan rekayasa perangkat lunak dan umumnya bagi agama, negara dan dunia. Penulis juga menyadari bahwa karya tulis ini masih jauh dari tingkatan yang sempurna. Sehingga penulis sangat mengharapkan adanya saran ataupun kritik dari pembaca yang dapat meningkatkan kualitas karya tulis ataupun keterampilan penulisan di masa yang akan datang.

Bandung, Januari 2023

Penulis

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Bandung, Januari 2023

Penulis

ANALISIS KINERJA *MICROSERVICES* DENGAN POLA *COMMAND QUERY RESPONSIBILITY SEGREGATION* PADA BERAGAM JENIS BASIS DATA

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ABSTRAK

Dengan meningkatnya jumlah pengguna aplikasi digital ternyata berdampak pada kebutuhan kinerja perangkat lunak yang tinggi. Tidak sedikit pengguna yang meninggalkan aplikasi karena waktu akses yang lama serta beberapa perusahaan terdampak karena meningkatnya biaya pemeliharaan kinerja perangkat lunak. Solusi terkini terhadap fenomena tersebut adalah arsitektur *microservices* dengan berbagai inovasi pola yang ada, salah satunya adalah pola CQRS. Perkembangan lainnya yaitu munculnya beragam jenis basis data seperti relasional, NoSQL dan NewSQL yang memiliki keunggulan dan kegunaannya masing-masing. Sehingga topik serta tujuan penelitian ini yaitu untuk menganalisis dan membandingkan kinerja dari jenis relasional, NoSQL dan NewSQL pada sistem *microservices* yang menerapkan pola CQRS. Adapun desain penelitian menggunakan studi kasus dengan prototipe sistem yang diuji bernama SatCommerce. Jenis basis data relasional diwakili oleh PostgreSQL, NoSQL oleh MongoDB dan NewSQL oleh CockroachDB. Aspek yang diuji meliputi waktu respons, *throughput*, penggunaan prosesor dan memori. Hasil menunjukan secara inferensial terbukti adanya perbedaan signifikan setiap kelompok sistem basis data terhadap keempat aspek yang diuji. Selain itu juga, sistem dengan basis data NoSQL memiliki keunggulan pada aspek waktu respon dan *throughput*. Sedangkan NewSQL unggul pada aspek penggunaan prosesor dan relasional unggul pada aspek penggunaan memori.

Kata kunci: *microservices, command query responsibility segregation,* basis data, kinerja

PERFORMANCE ANALYSIS OF MICROSERVICES WITH COMMAND QUERY RESPONSIBILITY SEGREGATION ACROSS MULTIPLE DATABASES

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ABSTRACT

With the increasing number of digital application users, it has an impact on high performance software requirements. Few users reportedly leaving application as a result of slow access time and also several companies are affected due to the increasing cost of software maintenance. Latest solution to this phenomenon is the microservices architecture with various pattern innovations, one of them is the CQRS pattern. Another recent development is the emergence of various type of databases such as relational, NoSQL and NewSQL which have their own advantages. Hence, topic and aims of this research is to analyze and compare performance of relational, NoSQL, and NewSQL database type on microservices that apply CQRS pattern. The research design uses a case study with a prototype system that being measured is SatCommerce. Relational database type are represented with PostgreSQL, NoSQL with MongoDB and NewSQL with CockroachDB. Aspects being measured including response time, throughput, processor and memory usage. Results show that inferentially it is proven that there are significant differences from each type of database to four aspect that being measured. In addition, system with NoSQL database has an advantage in terms of response time and throughput. Whereas NewSQL system superior in term of processor usage and relational system superior in term of memory usage.

Keywords: *microservices, command query responsibility segregation, database, performance*

DAFTAR ISI

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DAFTAR TABEL

DAFTAR LAMPIRAN

DAFTAR ISTILAH DAN SINGKATAN

Rumusan Masalah Penelitian	$\boldsymbol{RQn}$
Apakah terdapat perbedaan yang signifikan dari masing-masing jenis basis data terhadap waktu respons sistem ?	RQ1
Apakah terdapat perbedaan yang signifikan dari masing-masing jenis basis data terhadap *throuhgput* sistem ?	RQ2
Apakah terdapat perbedaan yang signifikan dari masing-masing jenis basis data terhadap penggunaan prosesor sistem ?	RQ3
Apakah terdapat perbedaan yang signifikan dari masing-masing jenis basis data terhadap penggunaan memori sistem ?	RQ4
Bagaimanakah keunggulan dari masing-masing kelompok sistem pada seluruh aspek yang diuji ?	RQ5

Metrik atau Pengukuran	$\boldsymbol{Mn}$
Rerata Waktu Respon	M1
Rerata *Throughput*	M2
Rerata Penggunaan Prosesor	M3
Rerata Penggunaan Memori	M4

Aspek Temuan dan Bahasan	$\boldsymbol{Sn}$
Waktu Respon Sistem	S1
Throughput Sistem	S2
Penggunaan Prosesor Sistem	S3
Penggunaan Memori Sistem	S4
Keunggulan Masing-Masing Kelompok Sistem	S5

***Request*/Sub Skenario**	***Rn***
Gdkkl Products	R1
Get Specific Product	R2
Create Cart	R3
Gdkkl Payment Methods	R4
Make a Payment for Specific Cart	R5

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