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Master's Thesis Defense

Comparison of Orchestration Systems for Microservices Applications

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Research Question

Research Focus.

Why It's Important?

Objective.

Problem Statement

- The increasing complexity of managing microservices in modern application architectures requires efficient orchestration tools that simplify deployment, scaling, and management.

Methodology

Approach:
- Quantitative
- Qualitative

Performance Benchmarks:
- Apache AB
- K6
- System Benchmark

Resource Utilization:
- Prometheus
- Grafana

Cost Analysis:
- Azure TCO Calculator
- Azure Pricing Calculator

Qualitative Analysis:
- Results
- Conclusions
- References

Key Results

- Resource Utilization
- Performance Benchmarks
- Cost Analysis
- Qualitative Comparison

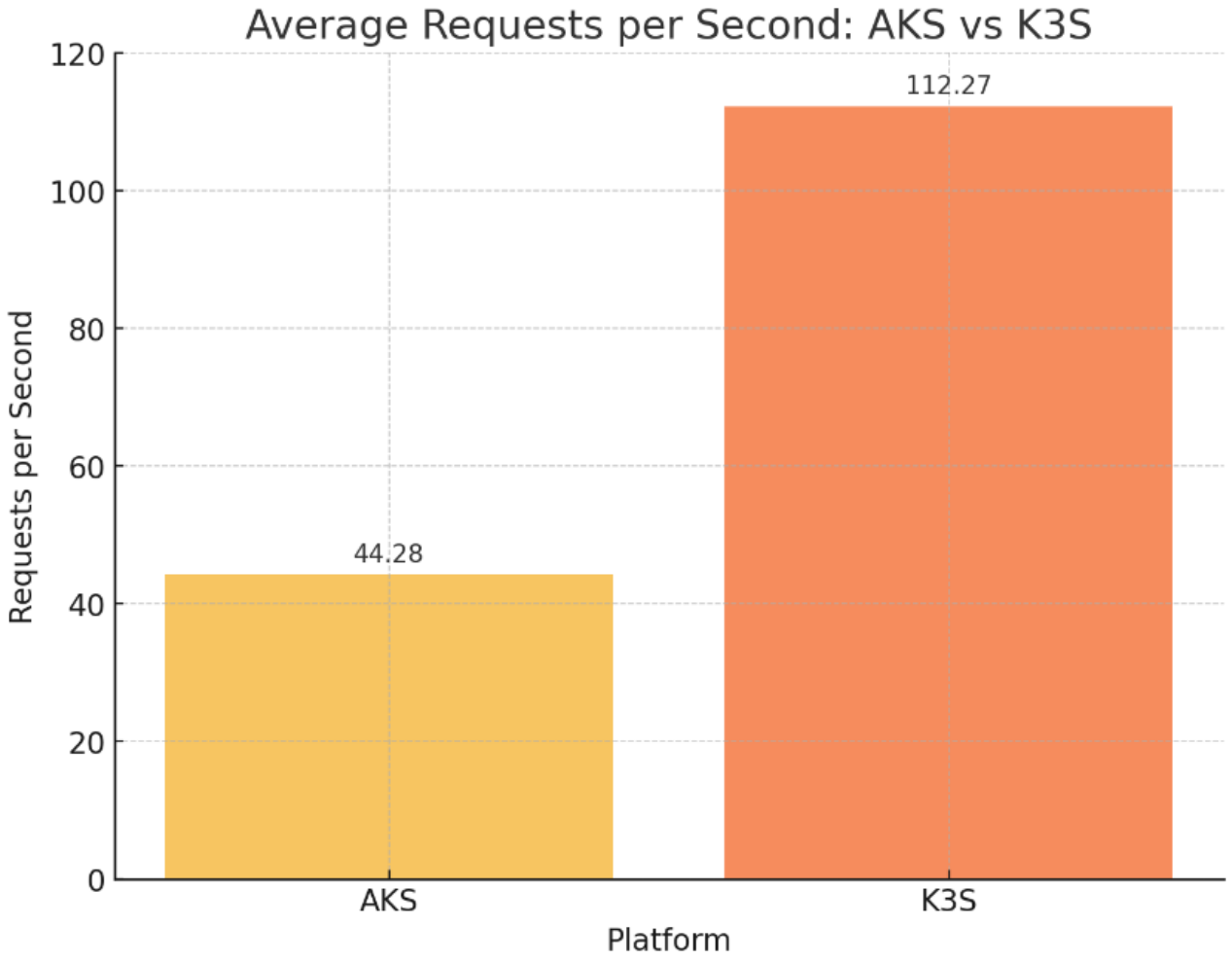
Resource Utilization

Grafana AKS Cluster Resource Utilization

Grafana K3S Cluster Resource Utilization

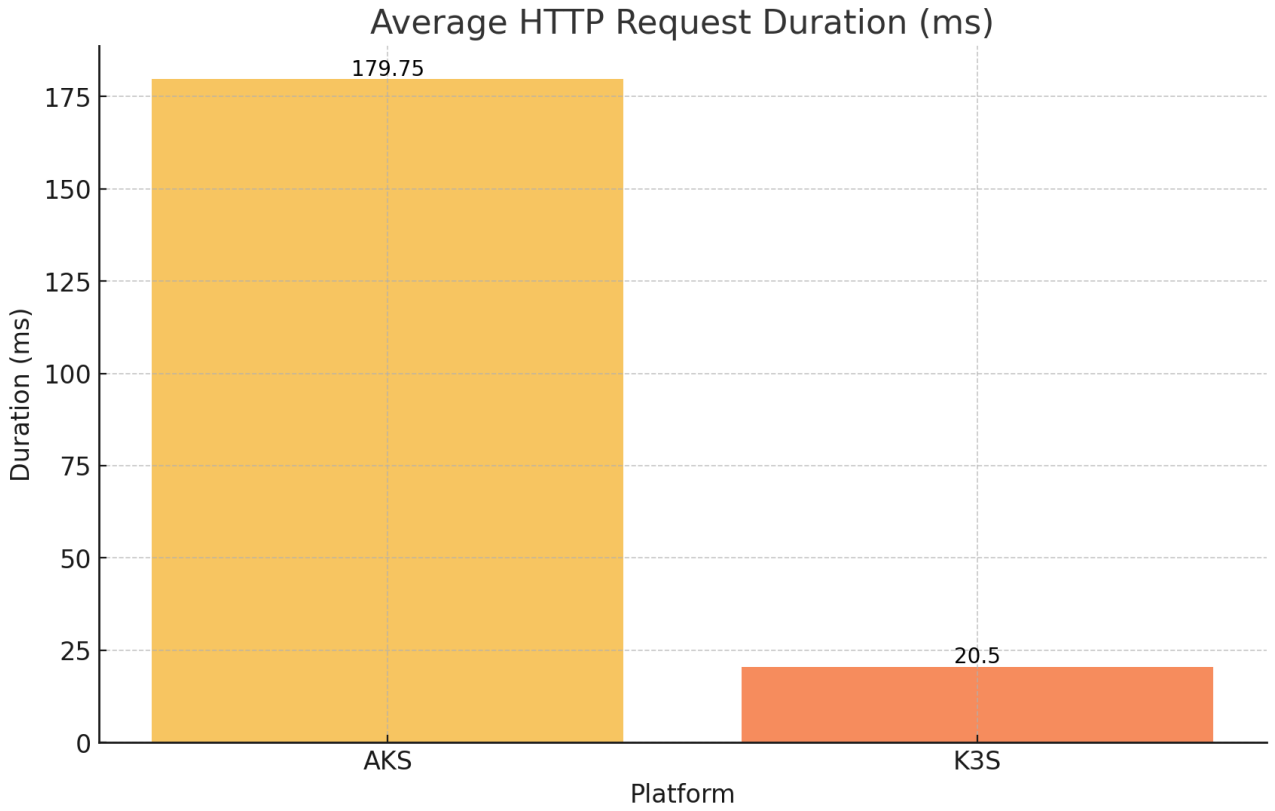
Performance Benchmarks – AB

Higher is better.



Performance Benchmarks – K6

Lower is better.



Performance Benchmarks – System

K3S shows better system performance than AKS.

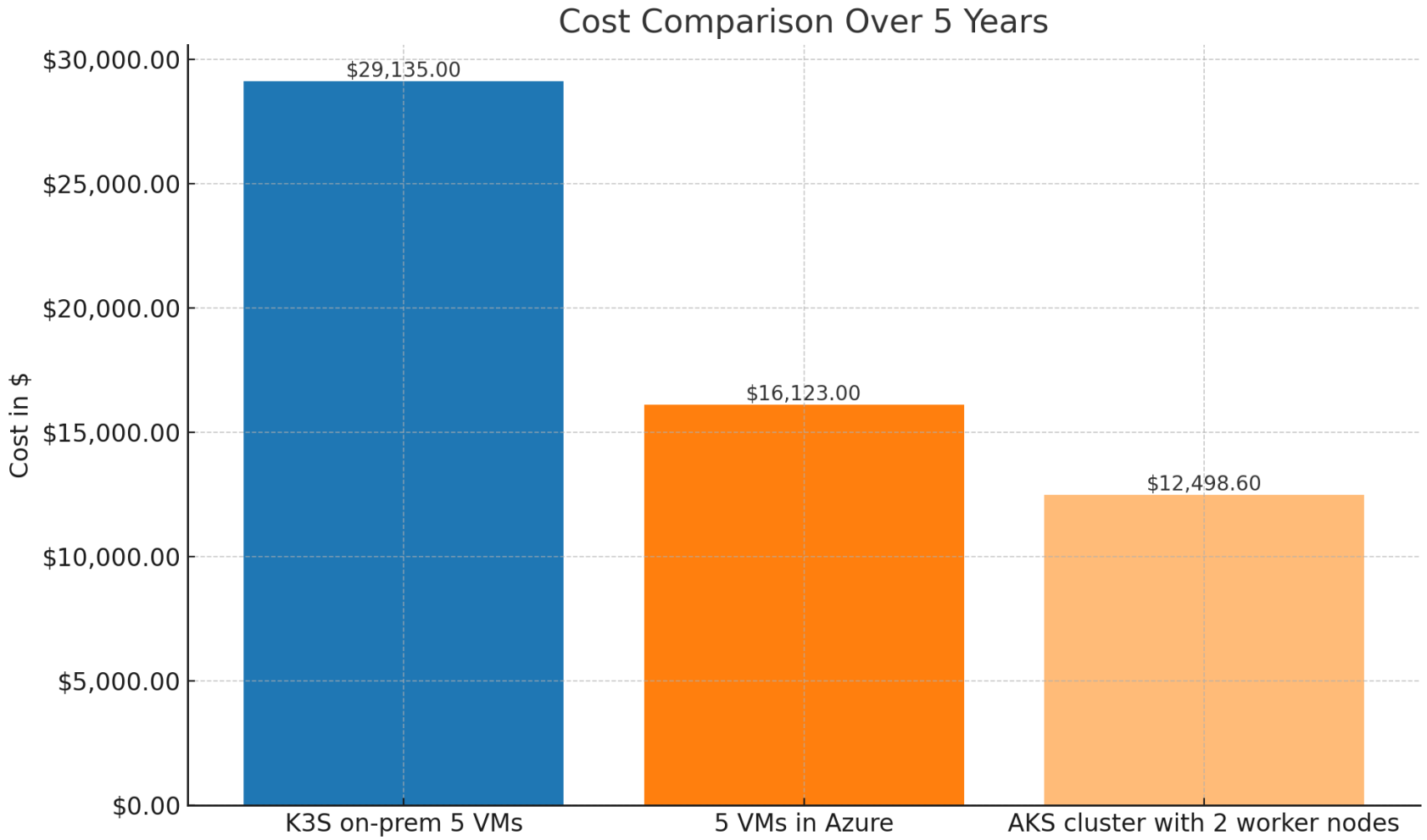
Despite both clusters having the same number of cores and memory.

Difference in:

- CPU architecture
- Hypervisor

The infrastructure was matched as closely as possible.

Cost Analysis



Qualitative Analysis

Criteria	Winner
Performance	K3S
Cost (5-Year Total)	AKS
Implementation and Configuration	AKS
Ease of Deployment and Integrations	Tie – AKS better with Azure integrations
Management Complexity	AKS
Scalability	AKS
Flexibility and Customization	Tie
Security	AKS
Documentation and Community Support	AKS
Overall, Winner	AKS Wins

Conclusion

FIXIT

- If no existing infrastructure:
  - Use AKS for cloud-native efficiency and lower operational overhead.
- If existing on-prem infrastructure:
  - Use K3S for better performance and resource utilization.
  - Also, use K3S for IoT and Edge Devices.

Future Work

COST OPTIMIZATION
(AKS & K3S)

LONG-TERM
PERFORMANCE STUDIES

HYBRID & MULTI-CLOUD
INTEGRATION

SECURITY
ENHANCEMENTS

Thesis Contributions

- Deployment process documentation and GitHub repository
- Detailed performance benchmarks (AB, K6, Sysbench)
- Comprehensive cost analysis methodology (TCO comparison)
- In-depth qualitative comparison
- Clear decision-making framework for orchestration tool selection