CS499 Computer Science Capstone

Milestone Two

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Enhancement One: Software Design/Engineering

Briefly describe the artifact. What is it? When was it created?

Both artifacts chosen for enhancement can demonstrate what I have learned in software design practices, but the artifact I worked on this week was my final project for CS340; a data dashboard that connects to a MongoDB database and displays it in a user-friendly way. It was a project that used a local instance of MongoDB, Python middleware to perform CRUD operations on the database, and dashboard with a map, graphs, and selected data output. I created this artifact originally when I took the course in August 2024.

Justify the inclusion of the artifact in your ePortfolio. Why did you select this item? What specific components of the artifact showcase your skills and abilities in software development? How was the artifact improved?

This artifact was chosen for enhancement because it had a clear path to improvement; the original project was built in a local environment. From a software design and engineering perspective, the obvious enhancement is to reconfigure the artifact to work on the Internet, where anyone can use the dashboard. The design is improved by running the MongoDB database in the cloud, and then refactoring the middleware to connect to the cloud and pull the data. I built an EC2 instance on AWS to host my database, installed MongoDB, set the security parameters, and started the service for remote connection. This shows my proficiency with common design practices and security procedures in MongoDB. The original artifact was written in Jupyter Notebook on an Apporto virtual machine; I refactored the middleware code into a Python virtual environment in VS Code and installed the extensions and library support to run the program on my machine. I rewrote the script to clean it up and make it neater. This demonstrates an ability to

work with multiple coding environments to find a solution to a problem. This artifact will be further developed as part of the database portion of the course; for now, I rewrote the script with the same hardcoded database queries. Those will be reconfigured as a part of that milestone.

Did you meet the course outcomes you planned to meet with this enhancement in Module One? Do you have any updates to your outcome-coverage plans?

This work shows the coverage of the first course outcome (Employ strategies for building collaborative environments that enable diverse audiences to support organizational decision-making in the field of computer science), which will be built upon in further enhancement milestones. Both artifacts that I am working on help bridge the gap between computer scientists and business leaders who need data in a user-friendly form.

This enhancement also demonstrates proficiency in the fourth course outcome (Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices for the purpose of implementing computer solutions that deliver value and accomplish industry-specific goals). Enhancement of this artifact is the most specific example for fulfilling this course outcome; the design pattern of a cloud-based database, middleware to access and update the database, and an end-user dashboard is a standard in data science, and this enhancement shows proficiency with the associated tools.

Setting up the security features of my EC2 instance (by using an RSA key for authentication) and implementing role-based access control on my MongoDB service shows progress toward fulfilling the fifth course outcome (Develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities, mitigate design flaws, and ensure privacy and enhanced security of data and resources). This will

be expanded further with the enhancements of my second artifact and in further work on this one.

Reflect on the process of enhancing and modifying the artifact. What did you learn as you were creating it and improving it? What challenges did you face?

I learned a lot about setting up an EC2 instance on the Amazon Web Service platform. I have had a free-tier account there for some time, but I have only lightly interacted with it. The processes that made MongoDB and our middleware work during CS340 were abstracted away in the virtual machine. Students were provided with the necessary information to connect to services that were already running. My first attempt did not go well; I did not properly secure my database before closing for the night, and when I accessed it the following day, my databases had been replaced with a ReadMe requesting a payment in Bitcoin to release my data. The simplest solution was to simply spin up a new instance since I had not gotten too far into the process.

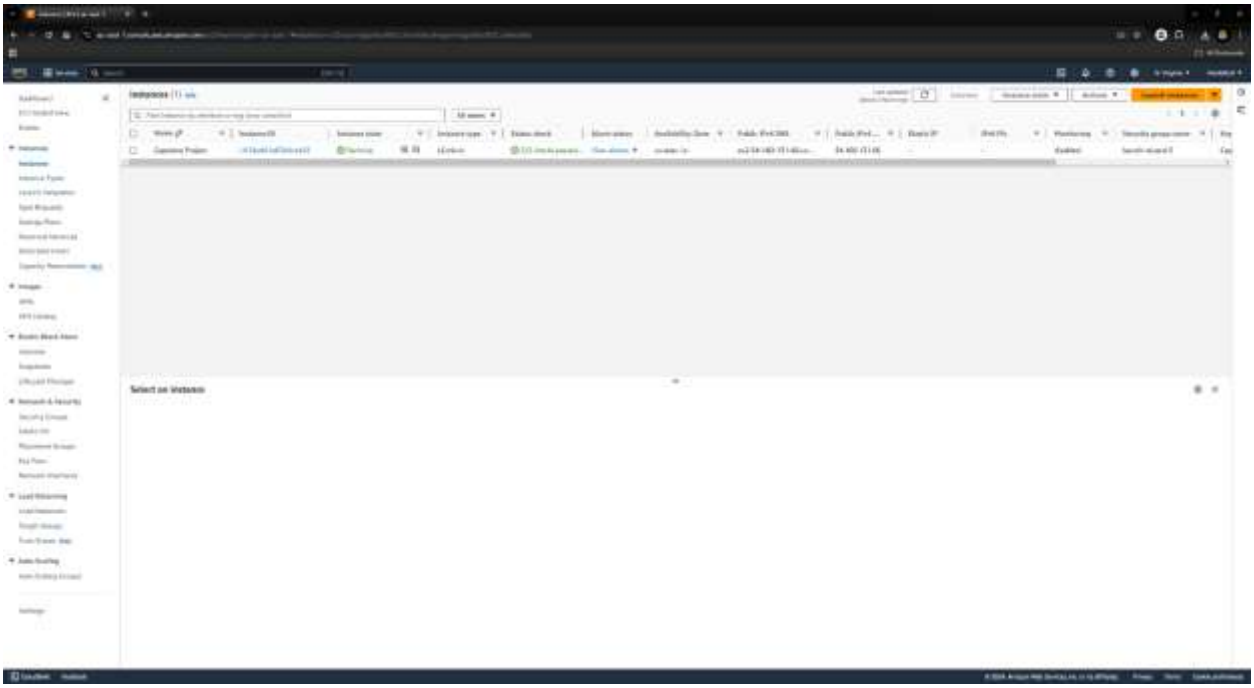
The free tier on AWS includes several options for setup. I began with an instance of Amazon Linux, but I am more familiar with Ubuntu and on my second attempt, I used it instead. I found the setup to be a bit smoother in Ubuntu than Amazon Linux; there were fewer steps and more automated support with the APT package installer than the YUM installer, among other things. Getting MongoDB installed and running also took some learning. Installing it, opening the appropriate ports, and getting it to connect to Powershell on my local machine was a lengthy process with quite a bit of trial and error. I leaned heavily on the MongoDB documentation for assistance with my setup.

My code reconfiguration was not too troublesome, but the bulk of that work will coincide with the upcoming Database enhancement assignment. I refactored the code in VS code in a new

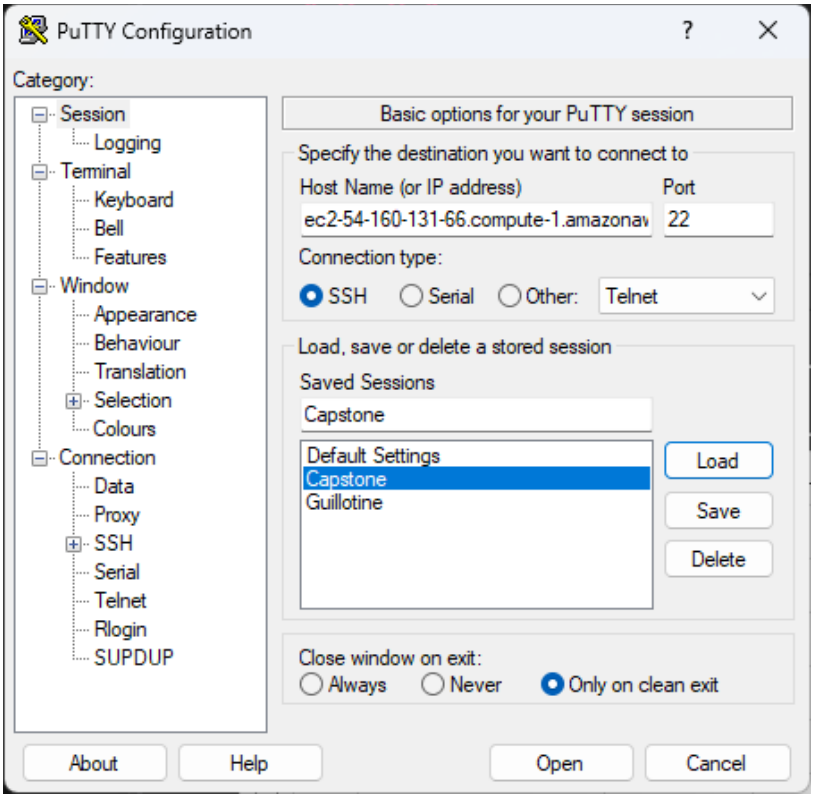
virtual environment and installed the Jupyter extension to run the dashboard script, but most of the code remained unchanged, merely cleaned up. While typing up my code into the new environment (I typed it all out again instead of copying/pasting it so I could clean it up along the way), I made some notes on my Database enhancements that I will be working on for that milestone.

Artifact screenshots:

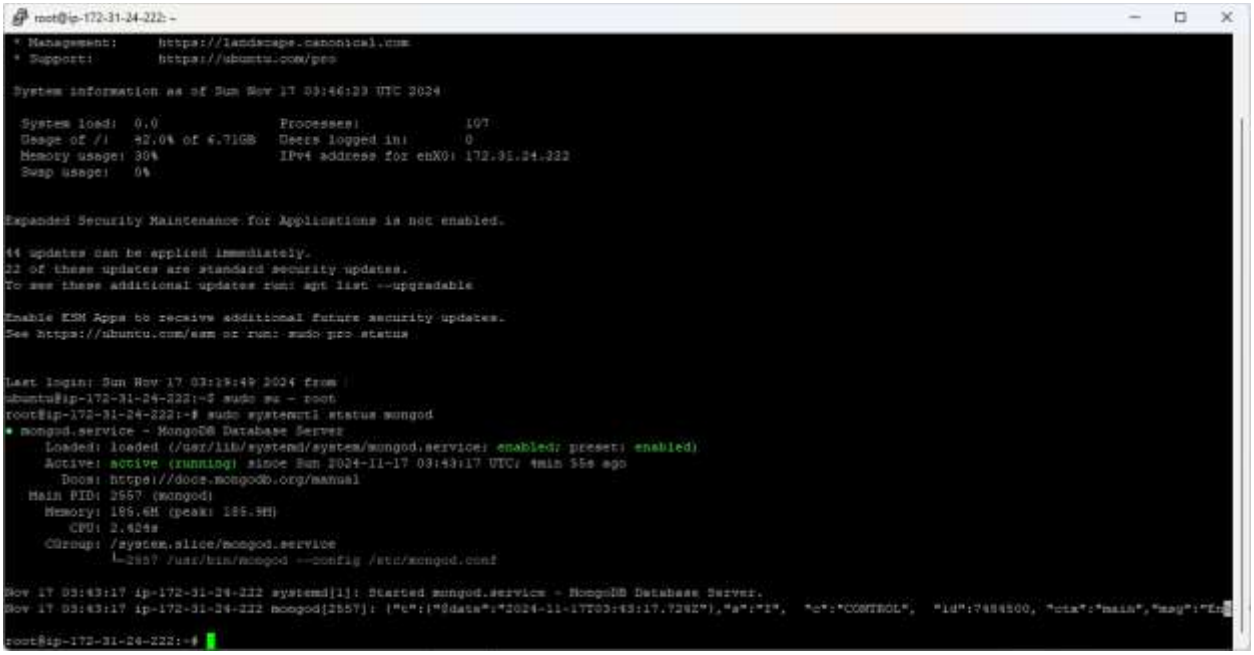
1) Running EC2 instance on AWS:



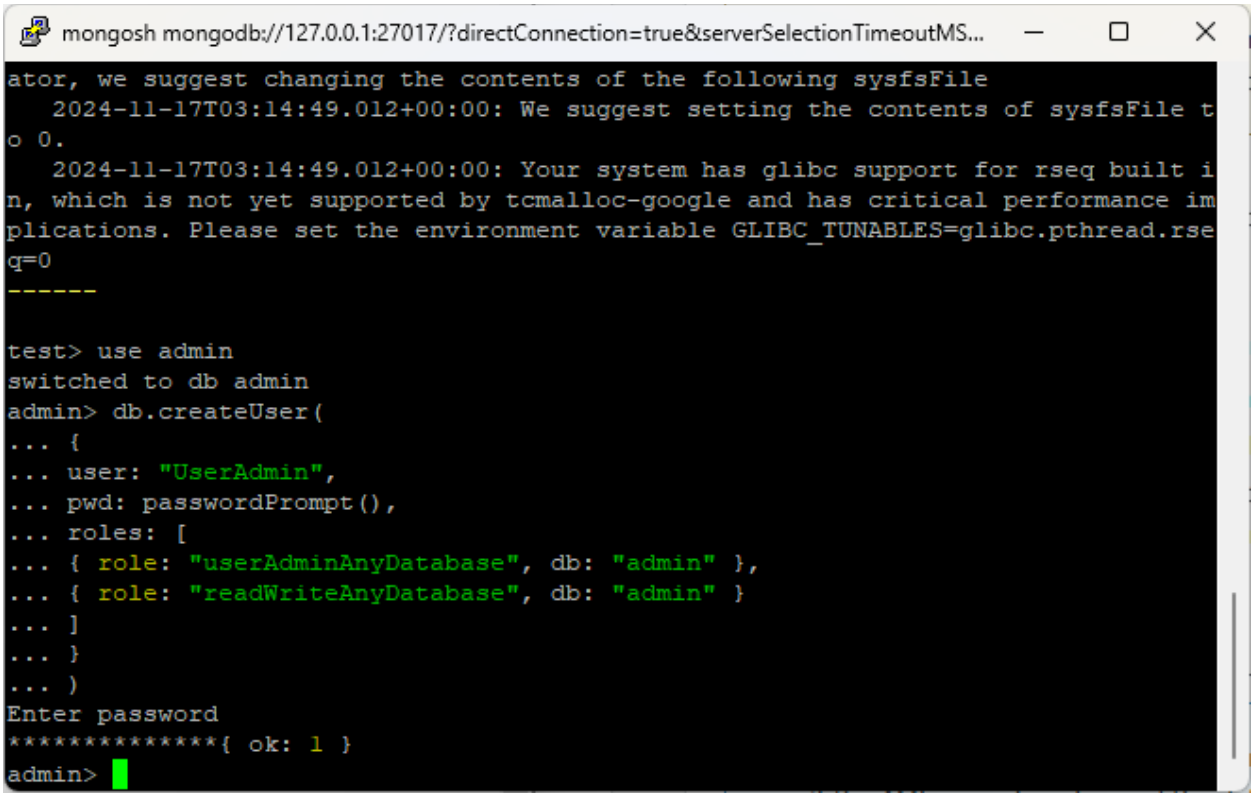
2) PuTTy connection setup:



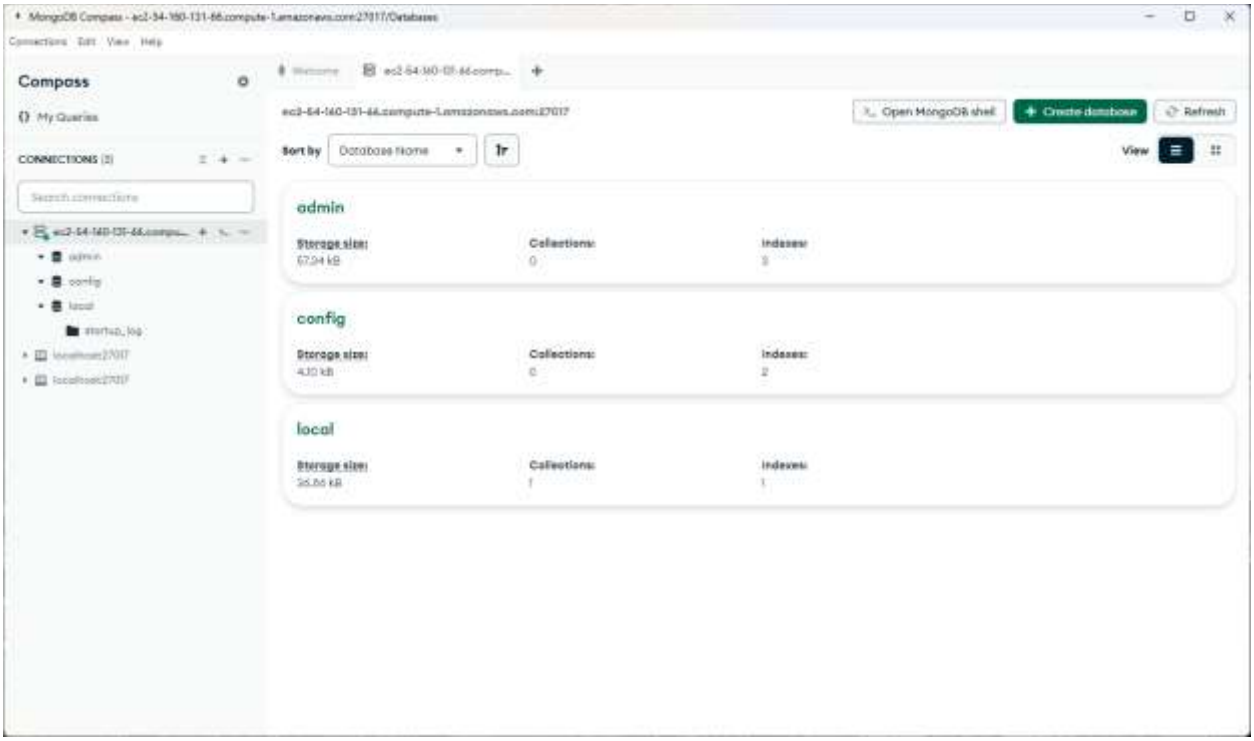
3) Mongo service running:



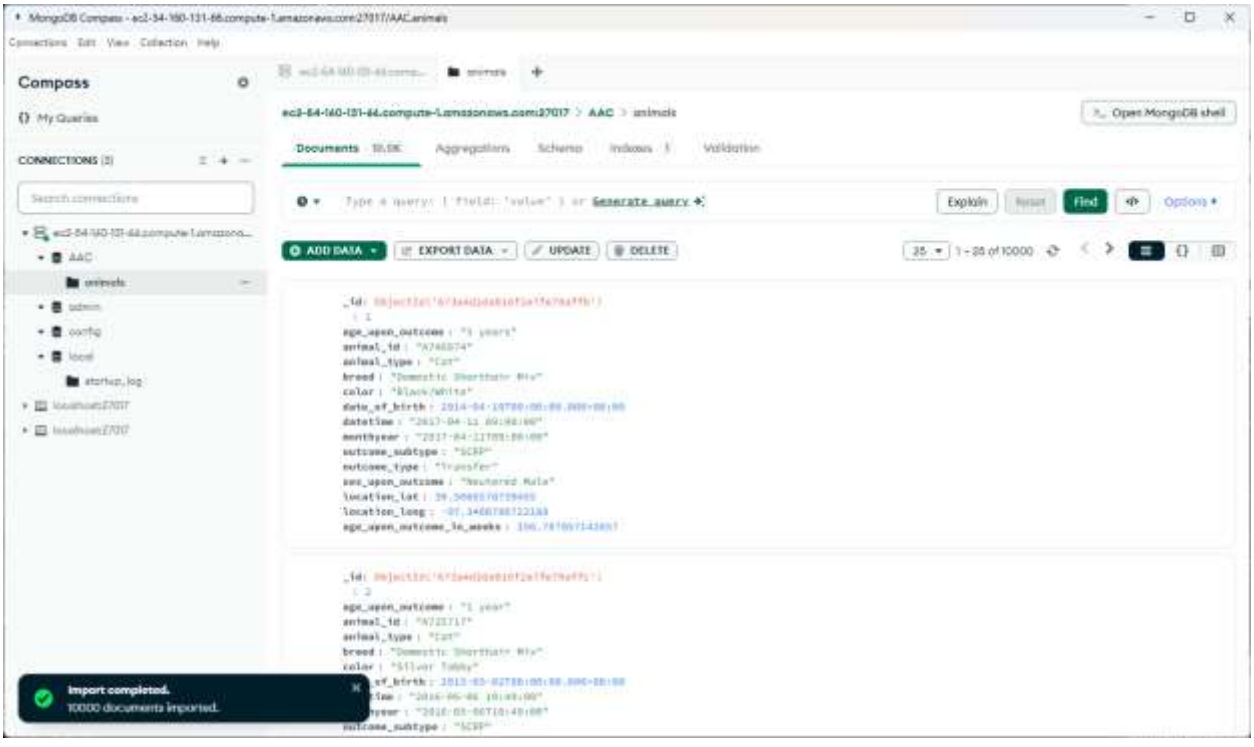
4) Configuring Role-Based Access Control:



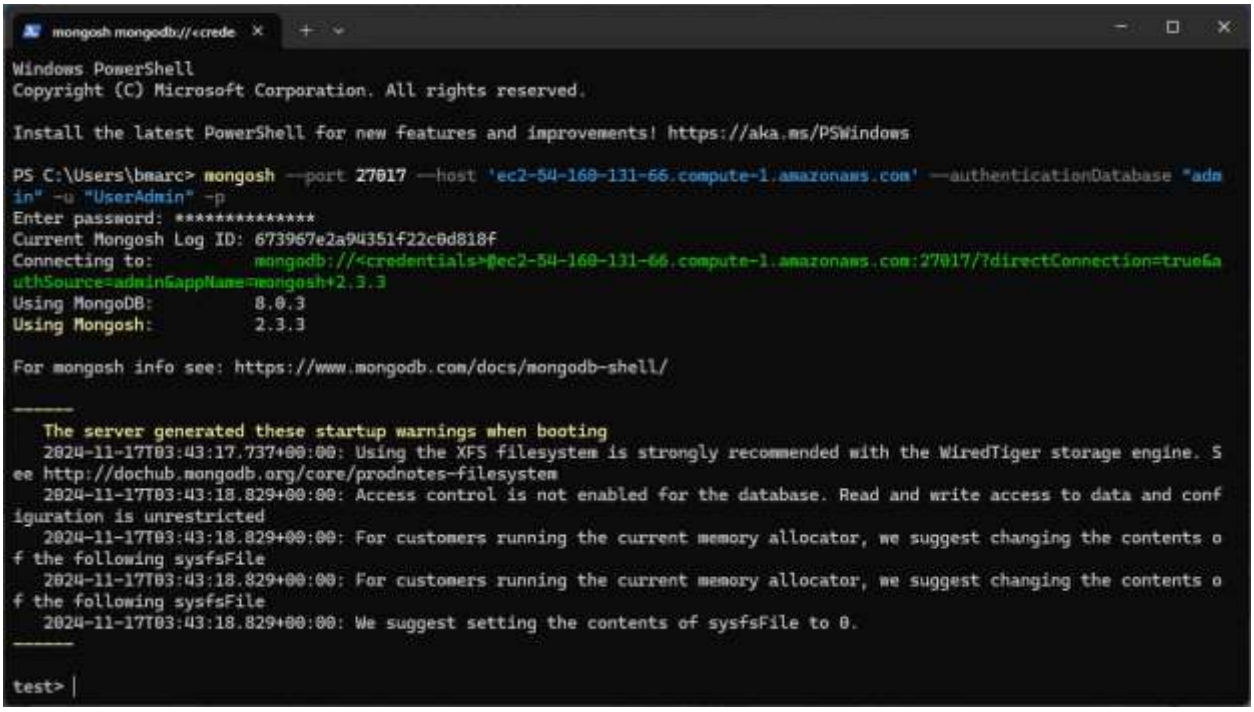
5) MongoDB Compass connected to remote database:



6) Successful database import:



7) Local Powershell connection:



8) Running Dashboard from browser: