**Task 1: Business Case Analysis**

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1. **Describe the objectives of an MLOps deployment architecture**

An MLOps deployment architecture can help Kronkers make the development, deployment, and management of their machine learning models more efficient and reliable. To achieve this, the architecture should focus on multiple key objectives. The first objective is replacing the OneDrive storage with a centralized repository that combines code, data, machine learning models so that different departments at Kronkers, such as Marketing and Procurement, can work together and access and share resources easily. Additionally, a dedicated centralized repository typically offers stronger security measures than OneDrive, which would help protect Kronkers’ sensitive machine learning models and customer data. The second objective is supporting a multi-language environment for Kronkers. Since Kronkers’ analysts use multiple programming languages like Python, R, and Julia, it is important to support these languages to maintain existing workflows and allow analysts to continue using the tools they are most comfortable with. Additionally, as Kronkers continues to grow, supporting a multi-language environment ensures that the MLOps architecture stays flexible and responsive to future changes in technology and business needs. The third objective is enabling continuous updates. Since Kronkers’ analysts manually adjust model parameters for changes in customer demand, continuous updates can streamline this process by using automated pipelines that monitor data changes and trigger model updates automatically. This ensures that the machine learning models stay up to date with the latest trends without requiring manual adjustments from analysts. Automating this process also reduces the chance of human input errors. The fourth objective is transitioning from running models on individual laptops to a centralized API. A centralized API ensures all users interact with models in the same stable environment, avoiding issues like system crashes or resource limitations common with personal devices.

1. **Identify constraints to implementing an MLOps solution**

There are multiple constraints to implementing an MLOps solution at Kronkers. The first constraint is limited technical expertise. With no dedicated roles for maintaining code, models, or deployment, the current staff may lack the skills needed to manage an MLOps framework effectively. The second constraint is limited budget. While there is a small budget for model maintenance, tracking, and quality control, it may not be enough for a full MLOps deployment. The third constraint is skepticism among senior leadership. Some senior leaders at Kronkers question the utility of MLOps, which could hinder organizational buy-in. The fourth constraint is decentralized workflows. Existing machine learning operations at Kronkers are scattered, with storage on OneDrive and models running on local machines, which makes it difficult to combine processes under a single architecture. The fifth constraint is geographic expansion complexities. Since Kronkers is expanding into new regions, it becomes challenging to handle increasing and more complex datasets without an MLOps infrastructure.

1. **Identify all functional and non-functional requirements for the MLOps solution you propose**

Regarding functional requirements, there are multiple of them that must be included in the MLOps solution to meet Kronkers’ needs. The first functional requirement is a centralized repository. This repository manages code, machine learning models, and datasets, replacing OneDrive. It also allows easy access for departments like Marketing and Procurement to collaborate and share resources. The second functional requirement is multi-language support. Since analysts at Kronkers use multiple programming languages, these languages must be supported within the MLOps framework to maintain existing workflows and avoid disruptions. Additionally, multi-language support ensures that Kronkers’ system remains adaptable to future changes in technology. The third functional requirement is automated model updates. Pipelines must be implemented to monitor data changes and automatically update models to reflect shifts in customer demand without the need for manual intervention. Without pipelines, data preprocessing and model training are performed manually, “leading to increased time and effort and a higher risk of errors (Abhishek, 2023, par. 10). The fourth functional requirement is a centralized API for model deployment. A centralized API allows all users to interact with models in a consistent and stable environment. It also avoids issues such as resource limitations or system crashes, which are common when running models on personal devices.

Regarding non-functional requirements, there are multiple of them that must be included in the MLOps solution to meet Kronkers’ needs. The first non-functional requirement is scalability. The MLOps solution must scale dynamically to handle larger datasets and growing user demands as Kronkers expands into new regions. The second non-functional requirement is security. Access control must be implemented to ensure only authorized users can access the company’s models and customer data. The third non-functional requirement is cost-effectiveness. The MLOps solution should provide value within Kronkers’ budget while being cost-effective and sustainable over the long term. The fourth non-functional requirement is flexibility and adaptability. The architecture must be flexible to adapt to new technologies and changing business needs. The fifth non-functional requirement is maintainability. The design must be well-documented to simplify updates and troubleshooting, ensuring all departments at Kronkers can easily follow it. The sixth non-functional requirement is reliability. The Kronkers system must always remain operational and accessible, with minimal downtime to prevent disruptions.

**References**

Abhishek. (2023, March 9). *Why data scientists should adopt machine learning pipelines?* Analytics Vidhya. https://www.analyticsvidhya.com/blog/2023/02/why-data-scientists-should-adopt-machine-learning-pipelines/