Evaluation Form – Technical Background Review

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_____ / 30 Technical Content

- Current state-of-the-art and commercial products
- Underlying technology
- Implementation of the technology
- Overall quality of the technical summary

_____ / 30 Use of Technical Reference Sources

- Appropriate number of sources (at least six)
- Sufficient number of source types (at least four)
- Quality of the sources
- Appropriate citations in body of text
- Reference list in proper format

_____ / 40 Effectiveness of Writing, Organization, and Development of Content

- Introductory paragraph
- Clear flow of information
- Organization
- Grammar, spelling, punctuation
- Style, readability, audience appropriateness, conformance to standards

_____ **/ 100 Total - Technical Review Paper**

I. Introduction

IoT data visualization solutions provide a way to aggregate multiple real-time data points from various sensors and devices in meaningful ways. Sensors have the potential to reasonably send hundreds to thousands of data points per second. Therefore, it is essential for teams of data-driven projects to be able to make sense of huge data sets in analytically and visually to analyze trends and summarize findings to the average consumer. Currently, it is possible to create a robust and completely free visualization suite using a combination of server development, API calls and visualization libraries, such as Matplotlib and Pyplot [1]. However, cloud-based solutions, such as Microsoft's Power BI and the open-source project ThingsBoard provide rapid prototyping and out-of-the-box functionality that benefit smaller teams.

II. Competition in the Data Visualization Space

The top names in data analytical software are Microsoft's Power BI, Tableau and the open-source suite, ThingsBoard, which has been updated last March 5th of this year. [1] [6]

A. Pricing and Feature Structure

The lowest tier of pricing for these products range from Freemium-$10/month/user (Power BI and ThingsBoard) to $70/month (Tableau). These products are geared toward developers and enterprise companies who wish to leverage data analytics on their business data, including customer engagement, revenue streams, and marketing campaigns. Top data analytics and visualization suites leverage artificial intelligence, machine learning, and natural language query processing to allow users to analyze huge sets of data quickly and efficiently. [2] Larger companies, such as Microsoft, integrate their analytics and visualization software with a larger suite of functionalities, including the *IoT Hub*, which allows for real time analysis of IoT data. Competitors, such as Tableau, rely on third-party software to host and stream real-time data. [3] [7][8]

III. Performance and Technology

The technology works using a combination of front-end API to handle data streams and backend data processing, of which the leading companies leverage AI and natural language processing.

A. Relevant Metrics

Unfortunately, most of the actual implementation of machine learning is hidden behind closed source, but measure of performance can instead be analyzed through data limits, data refresh rates, data point throughput and access to advanced dataflows. For example, Microsoft's Power BI enforces a model size limit of 1GB, 100GB, and 400GB with 400,000 to 300,000,000 data points per day on various

pricing tiers, including support for 100+ devices. Alternatively, ThingsBoard's managed cloud server starter package supports up to 30 devices and 10 million to unlimited data points per month. Other non-cloud based solutions, such as Tableau require dedicated physical servers to manage data flows. Performance is completely dependent on the hardware and configuration of the local server. [2][4]

IV. Technology Implementation

For implementing the technology, most user-friendly options provide visualization, data preprocessing and backend management out of the box. For solutions within this category, implementation is based solely on number of supported datapoints and sources and the analytical and visualization tools provided within the software.

A. Back-end Setup

Scalability is practically considered with tiered pricing plans, needing no back-end server optimizations to increase processing, querying, and storage speeds. Non-out-of-the-box solutions require configuration of dedicated servers to handle the processing and storage of data. These could be cloud-based solutions; however, the underlying software are generally built on third party back-end software, such as PostgreSQL and MySQL. [1]

B. Hardware Setup

For both complete suites and standalone visualization software, however, one must setup physical, hardware IoT nodes to communicate with offsite. These nodes—sensors, generally speaking—require setup and some form of internet access to relay information to a processing node. Generally, JavaScript frameworks, such as Node.Js, are utilized to setup message streams (HTTP, SSH, Telnet, etc.) between devices and the data processing server. [8] It is unfeasible for large, distributed IoT networks to utilize a wired connection topology, so wireless data transmission is an essential focus to implement IoT data visualization technology.

V. Conclusion

Cloud-based data visualization tools come fully featured to allow teams to quickly leverage the power of data analytics. Current offerings provide essentially limitless scaling at an affordable price—without the need to manage the backend setup. Price per performance is a key issue and teams should weight the cost benefits of different solutions based on their project needs.

References

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